

# The Use of Artificial Intelligence in Clinical Settings: Opportunities, Barriers and Pitfalls

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# Agency for Healthcare Research and Quality

- The Agency for Healthcare Research and Quality is one of the 12 agencies within the US Department of Health and Human Services.
- Conducts health care research examining the access to health care, cost of health care and outcomes of the care received.
- AHRQ has six research focuses:
  - Patient-Centered Research
  - Prevention/Care Management Research
  - Value Research
  - Health Information Technology
  - Patient Safety
  - Crosscutting Activities Related to Quality, Effectiveness, and Efficiency
- Serves the population of the United States
  - Priority Populations
- Public Health
  - Resource Tool
    - Professionals, Policy Makers, Consumers



# Overview

- Opportunity: Achieving the “Triple Aim” of healthcare
- Barriers to Disruptive Technology in Healthcare
  - Professional: IT and medicine—a history of failed expectations
  - Technological
  - FDA Regulations
  - State Licensing and Scope of Practice Laws
- Pitfalls: The “Uberization” of Healthcare?
  - Is the technology safe and effective?
  - Will Medicine Become another Silicon Valley “Winner Takes All” Industry?

# The Triple Aim of Healthcare

- Access—ensure universal access to necessary medical care
- Cost—ensure that medical care is affordable at both the individual and societal level
- Quality—ensure that the care delivered meets standards indicated by evidence based medicine (EBM)
  - In the future EBM might be based on personalized data rather than population based data

# Access: New Physician Wait times up 30% since 2014

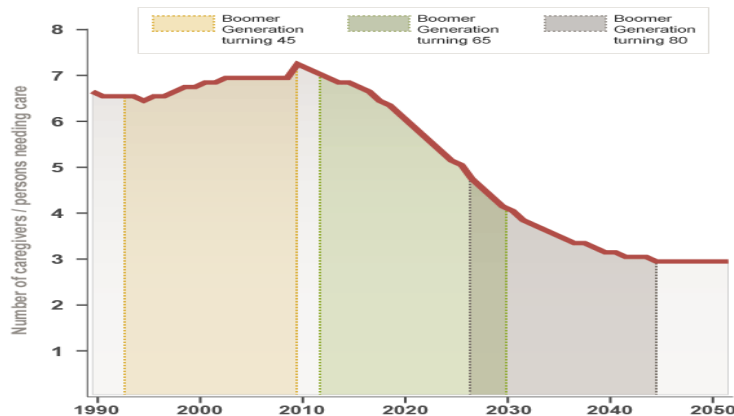
- The average wait time for a physician appointment for the 15 large metro markets surveyed is 24.1 days, up 30% from 2014.
- At 52.4 days, Boston has the highest average new patient physician appointment wait time of the 15 large metro markets surveyed.
  - 109 days to see a family physician
  - 52 days to see a dermatologist
  - 45 days to see an obstetrician/gynecologist
  - 45 days to see a cardiologist
  - 11 days to see an orthopedic surgeon.
- *Merritt Hawkins' 2017 Survey of Physician Appointment Wait Times and Medicare and Medicaid Acceptance Rates:*

# Access: Shortage of Caregivers

## You Take Care of Mom, But Who Will Take Care of You?

Family caregivers provide the majority of long-term services and supports (LTSS). But the supply of family caregivers is unlikely to keep pace with future demand. The Caregiver Support Ratio is defined as the number of potential family caregivers (mostly adult children) aged 45-64 for each person aged 80 and older—those most likely to need LTSS. The caregiver support ratio is used to estimate the availability of family caregivers during the next few decades.

### Caregiver Support Ratio



In **2010**, the caregiver support ratio was **more than 7 potential caregivers** for every person in the high-risk years of 80-plus.

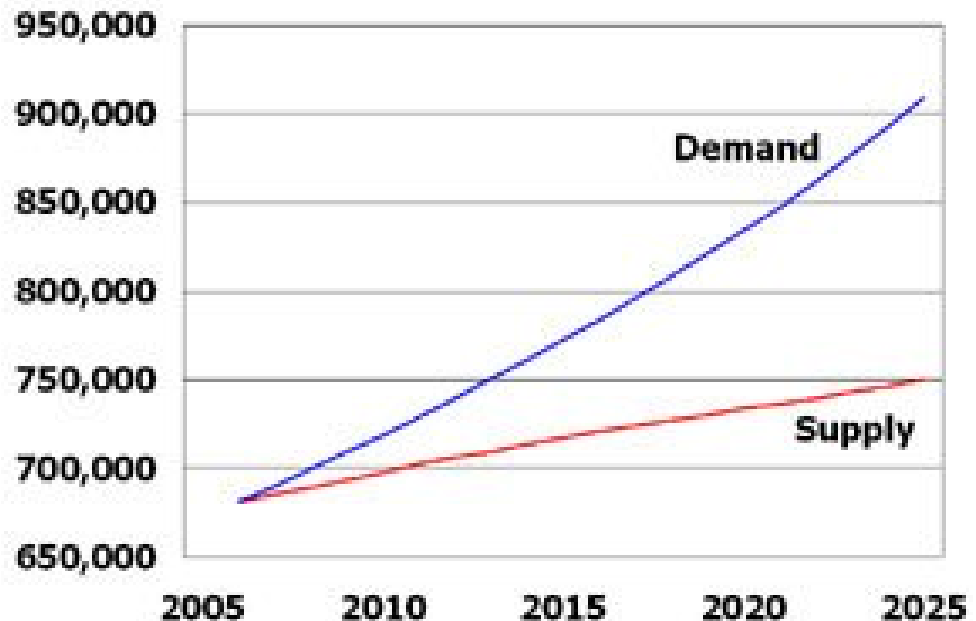


In **2030**, the ratio is projected to decline sharply to **4 to 1**; and it is expected to further fall to less than **3 to 1** in **2050**.

**POLICY ACTION:** Rising demand and shrinking families to provide LTSS call for new solutions to the financing and delivery of LTSS and family support.

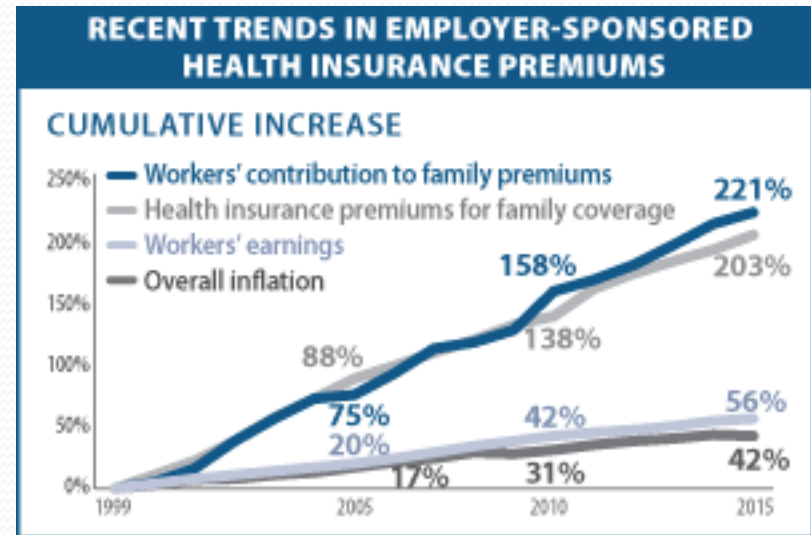
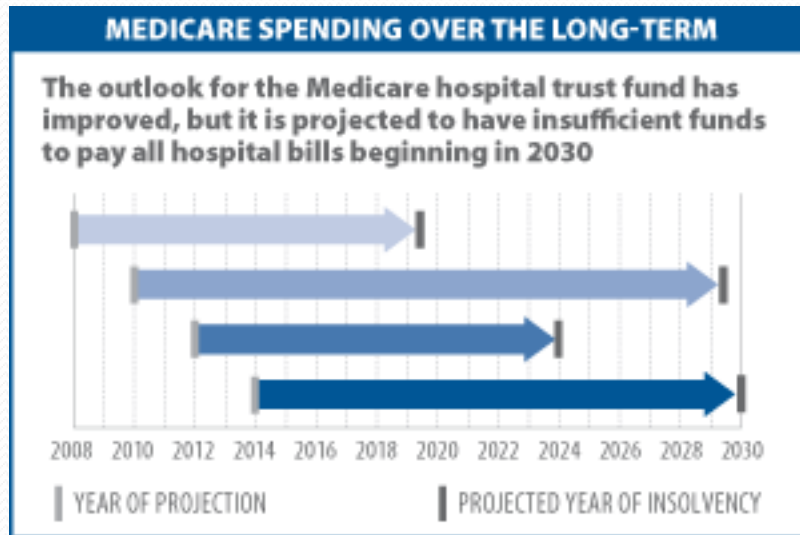
Source: D. Redfoot, L. Feinberg, and A. Houser, *The Aging of the Baby Boom and the Growing Care Gap: A Look at Future Declines in the Availability of Family Caregivers* (Washington, D.C.: AARP Public Policy Institute, August 2013). [www.aarp.org/research/ppi](http://www.aarp.org/research/ppi)

## Physician Supply and Demand Projections Through 2025



Source: Dill, Michael J. and Edward S. Salsberg. 2008. *The Complexities of Physician Supply and Demand: Projections Through 2025*. Association of American Medical Colleges: Washington, D.C.

# Increasing Costs



Kaiser Family Foundation, 2016



# Scalability of Training More Medical Experts?





# Alex, What is Unfair? (And...are the Robots Really Taking Over?)



# Triple Aim via AI?

- Improve Quality
  - Demonstrate machine analysis equivalent or superior to highest trained professionals
  - Continual improvement with machine learning processing more transactional data
  - Eliminate human error (diagnosis and treatment)
  - Robust Clinical Decision Support
- Increase Access
  - Autonomize wider range of providers (NPs, PAs, CNAs, etc) to deliver more primary and basic care
  - Patient Self-help (e.g., FDA verified mHealth apps, automated kiosks)
- Lower Costs
  - Cheaply duplicate and automate medical expertise
  - Lower costs with higher mix of non-physicians and automated care

# 1980's—EHRs, Early Clinical Decision Support Programs (CDSPs)

“If the expertise of consultants can be captured in the form of computer programs which provide advice to less-expert physicians or other health-care providers ... The opportunity is there to improve the health-care system by improving each physician's ability to utilize the best ways of analyzing medical problems, as encoded in easily-duplicated and updated computer programs.”

Peter Szolovits, 1982



# Problems with early CDSPs

- Not seamless with patient interaction
- Intrusive interface
- Time consuming
- Require training in a different discipline
  - Early CDSP interaction:
    - Leave patient bedside wash hands
    - Login in to computer in another room
    - Type data into program
    - Wait for program to generate differential diagnosis with 20+ probabilities
    - Wash hands
    - Re-enter patient room several minutes later with no additional confidence regarding diagnosis

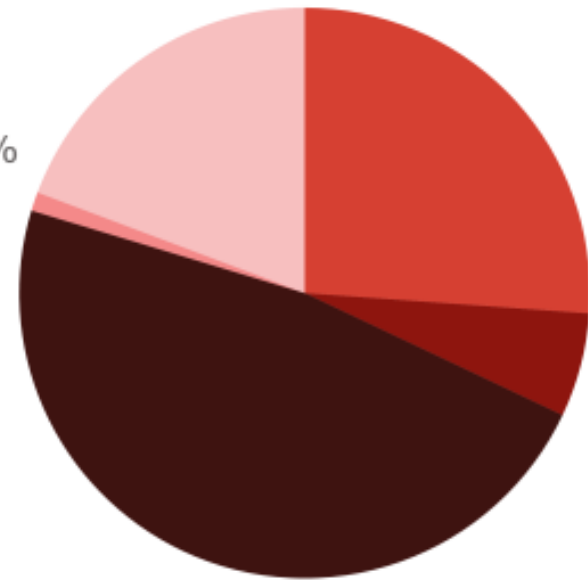


# What about EHR Dissatisfaction?

## EHRs dominate docs' time

Physicians time allocation during office hours

- Direct clinical face time with patient, 26%
- Face time with staff, 6%
- EHR and desk work, 48%
- Administrative tasks, 1%
- Other tasks, 19%



Source: American Medical Association (2016)

# EHRs Not Efficient?

## Docs pan benefits of technology

They say EHRs add to clerical burden, don't add efficiency

Do EHRs improve patient care? Percent answering no:



Do EHRs improve operational efficiency? Percent answering no:



Do patient portals have efficiency benefits? Percent answering no:



Source: Mayo Clinic/American Medical Association (2016)



# AI Overhyped?



FEB 19, 2017 @ 03:48 PM 142,249 VIEWS  EDITOR'S PICK

## MD Anderson Benches IBM Watson In Setback For Artificial Intelligence In Medicine

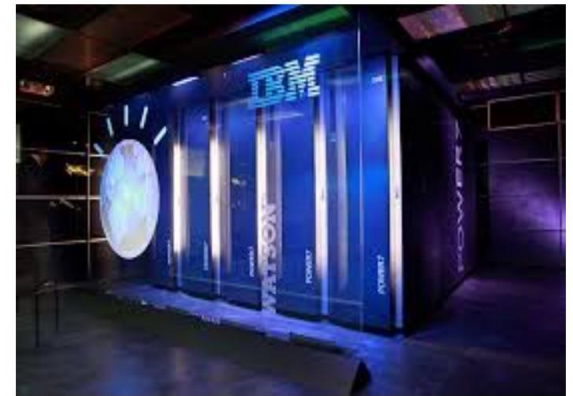


**Matthew Herper**, FORBES STAFF 

*I cover science and medicine, and believe this is biology's century.*

THE UNIVERSITY OF TEXAS

**MD Anderson**  
~~Cancer~~ Center



# Practical Barriers for Advancing AI into Clinical Care

- Lack of shared access to data
  - Privacy, liability concerns
- Lack of annotated datasets
  - Establish “gold standards”
  - Needed for training and validation
- Reproducibility
  - Specialized vocabulary differ between institutions and specialties
- Low clinical adoption
  - Not integrate into workflow
  - “Black box” problem—epistemic uncertainty/trust

# Regulatory Barriers to Smart Machines in Medicine

- Restrictive state licensing and scope of practice laws
- Reimbursement rules—lack of financial incentives
- Political economy concerns—workforce displacement
  - Healthcare providers are currently the largest segment of middle class jobs in the country (U.S. Bureau of Labor Statistics)
  - Wide geographic distribution

# AI in Healthcare: Augmentation and Automation



The Economist (2012)

# AHRQ: Enabling Advances in Medical Natural Language Processing(NLP)

- Create large annotated datasets
  - Open to qualified researchers
  - Assist training and development of application
- Fund better automated de-identification technology
  - Facilitate data access and sharing
- Improved speech recognition (NLP)
  - Reduce transcription errors
  - Reduce administrative burden of EMRs
  - Enhance real-time clinical decision support

# Flexner's Ghost: Or, did I really need to memorize the Krebs Cycle?

- Flexner Report (1910) described Chicago's 14 medical schools as "a disgrace to the State whose laws permit its existence... indescribably foul... the plague spot of the nation."
  - Between 1910 and 1935 the number of medical schools reduced in half
- Post-Flexner Report medical schools emphasized focus on basic sciences
  - Med school: 2 years basic science, 2 years clinical studies
  - Pre-Med: 4 years strong emphasis on basic sciences
- Assessing medical competency
  - Memorization of vast amounts of data
  - Pattern recognition skills



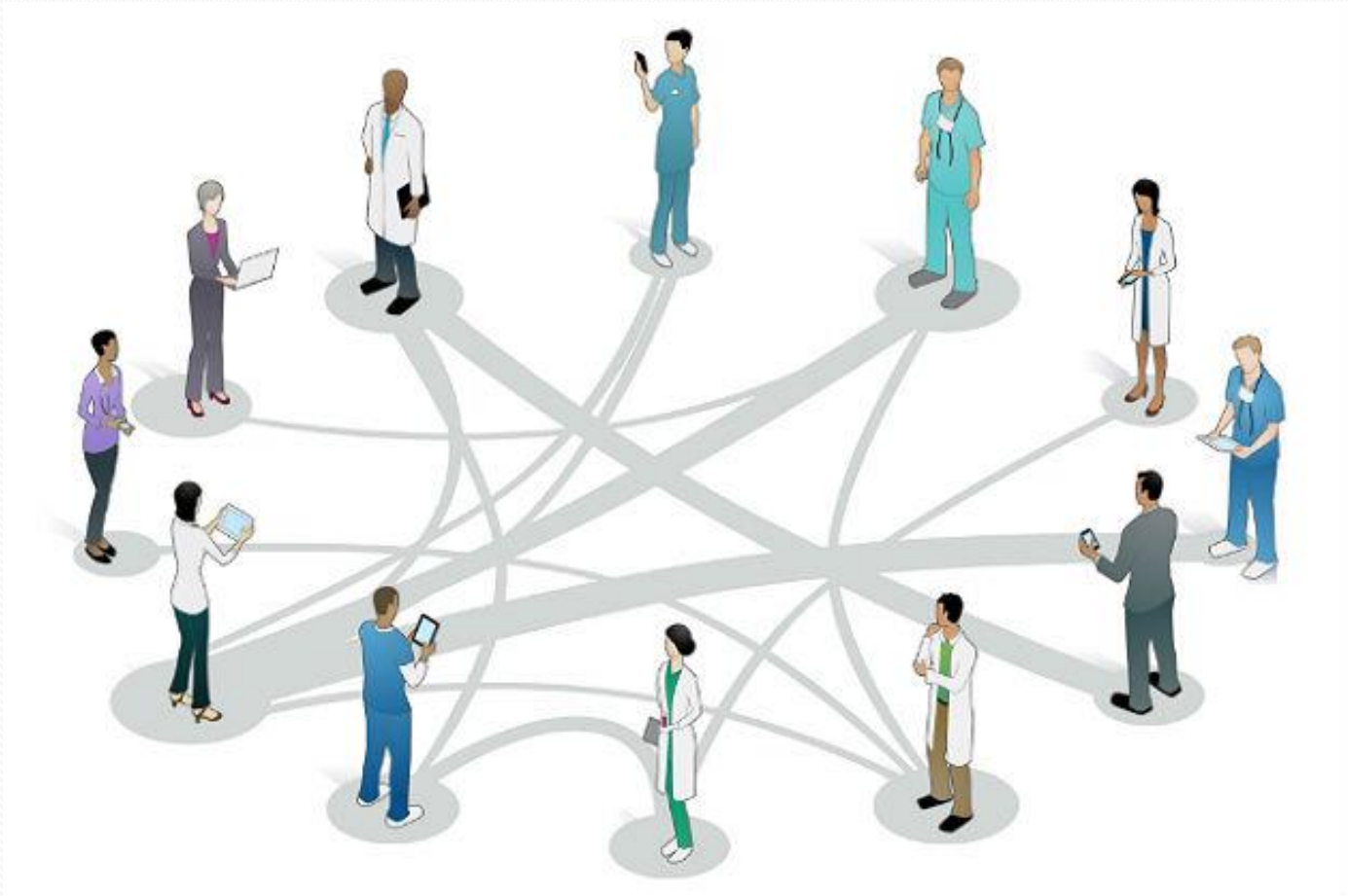
# Innovation in Medical Training

- Managing a team of providers across the care spectrum
  - Augmented NPs, PAs, nutritionists, community health workers
  - Smart machines in patient's home/body
- New training and curriculum
  - Management and leadership skills
  - Emphasizing empathy and care
  - Communication skills
  - Training alongside different providers and AI
  - Data science comprehension
- Rethink accreditation and competency standards
  - Less emphasis on memorization and pattern recognition
  - Focus on successful management of care process (providers and technology)

# Legal Proposal: Leverage AI to Achieve Triple Aim, But Keep Humans in Loop

- Implement evidence-based scope of practice and licensing laws
  - Allow for expanded scope-of-practice for augmented providers
  - Accreditation and licensing standards assess competency with smart machines
- Regulations to require keeping humans in the loop
  - Reimbursement—CMS and Medicaid
  - FDA medical device regulations
  - State licensing and scope of practice laws
- Automation for tasks that do not require medical and residency training
  - Prevention and wellness screenings
  - Triage alerts can trigger referral to human provider

# The Future of Medical Innovation: Augmentation and Collaboration





# QUESTIONS?