Innovation & Digital Health

Jesse M. Ehrenfeld MD MPH FAMIA FASA
Member, Board of Trustees - American Medical Association
Senior Associate Dean – Medical College of Wisconsin
Director – Advancing a Healthier Wisconsin Endowment

DISCLAIMER: The views and opinions expressed in this presentation are those of the author and do not necessarily represent official policy or position of HIMSS.
Conflict of Interest

Jesse M. Ehrenfeld, MD, MPH, FAMIA, FASA

Has no real or apparent conflicts of interest to report.
Agenda

A Little About Me …

- Background & Involvement in Technology Development

American Medical Association

- Priorities & Perspectives on Technology Needs

The Digital Future

- Key Opportunities & Constraints
Learning Objectives

• Describe the role that physicians can play in driving innovation and health technology

• Identify what is required to enable artificial intelligence improvements in care delivery

• Discuss the impact of the COVID-19 pandemic on the adoption of digital health innovations
Background

- Senior Associate Dean, Professor of Anesthesiology, Director of the Advancing a Healthier Wisconsin Endowment at the Medical College of Wisconsin

- Faculty positions at Harvard Medical School (previous), Vanderbilt University (adjunct), Uniformed Services University of Health Sciences (adjunct)

- American Medical Association Board of Trustees (Immediate Past Chair)

- Technical advisor to World Health Organization Digital Health Technical Advisory Group

- Special Advisor to the 20th U.S. Surgeon General

- Combat Veteran, U.S. Navy
May 12, 2019
My Core Research Interests

Primary focus: using technology to drive quality, safety, reliability

- Clinical Decision Support Tools
- AI System Development
- Large Scale Pragmatic Clinical Trials
A Taste of My Previous Funded Research ...

DoD W81XWH-17-C-0252
**Automatic Sensing for Clinical Documentation (ASCD)**
Develop a hands-free documentation system that automatically detects clinical task motion signatures.

DoD (Congressionally Directed Medical Research Programs)
**Veterans Integrated Pain Evaluation Research (VIPER) Study**
Develop pharmacogenomic predictors to improve the safety and efficacy of current opioid treatments.

NIBIB 1R21LM011664-01
**Identification, Extraction & Display of Clinical Data Patterns w/Application to Anesthesia Workflows**
The study goal is to develop data science/Big Data methods to extract meaningful patterns from pt data.

NIH 5U24TR001579-02
**Improving Clinical Trial Education, Recruitment, And Enrollment At CTSA Hubs (I-CERCH)**
Establish a Recruitment Innovation Center for engaging minorities, women & older adults in clinical trials

Robert Wood Johnson Foundation
**Dental Quality of Care, Barriers to Accessing Care, and State & Federal Health Policy Decisions**
Investigates oral health outcomes among sexual & gender minorities using a community engaged approach.

American Medical Association
**Accelerating Change in Medical Education**
The study goal is to develop & evaluate a competency-based assessment program for med students.
Process
Process Reliability

- **Processes** are collections of systems and actions following prescribed procedures for bringing about a result.

- **Reliability** of any processes can be determined using data when process failure criteria are established.

- Results of the analysis can be **graphically displayed**, problems identified, categorized and identified for corrective action.

- The hardest part of any reliability analysis is **getting the data**.
Process Reliability in Healthcare

- Given our intentions, as talented providers, why are clinical processes carried out at such low levels of reliability?

- Don’t show up for work wanting to provide bad care!

- “It’s the system, not the people” – true, but not helpful as we aim to improve our processes

Our Focus Must Shift:

• Often, concentrate on changing small, technical aspects
• These innovations often make little difference
Our Focus Must Shift:

- Often, concentrate on changing small, technical aspects
- These innovations often make little difference
- The next **breakthrough drug** is an **unfailing system**
A Perioperative Systems Design to Improve Intraoperative Glucose Monitoring Is Associated with a Reduction in Surgical Site Infections in a Diabetic Patient Population

Jesse M. Ehrenfeld, M.D., M.P.H., Jonathan P. Wanderer, M.D., M.Phil., Maxim Terekhov, M.S., M.B.A., Brian S. Rothman, M.D., Warren S. Sandberg, M.D., Ph.D.

ABSTRACT

Background: Diabetic patients receiving insulin should have periodic intraoperative glucose measurement. The authors conducted a care redesign effort to improve intraoperative glucose monitoring.

Methods: With approval from Vanderbilt University Human Research Protection Program (Nashville, Tennessee), the authors created an automatic system to identify diabetic patients, detect insulin administration, check for recent glucose measurement, and remind clinicians to check intraoperative glucose. Interrupted time series and propensity score matching were used to quantify pre- and post-intervention impact on outcomes. Chi-square/likelihood ratio tests were used to compare surgical site infections at patient follow-up.

Results: The authors analyzed 15,895 cases (3,994 pre-intervention and 11,901 post-intervention; similar patient characteristics between groups). Intraoperative glucose monitoring rose from 61.6 to 87.3% in cases after intervention ($P = 0.0001$). Recovery room entry hyperglycemia (fraction of initial postoperative glucose readings greater than 250) fell from 11.0 to 7.2% after intervention ($P = 0.0019$), while hypoglycemia (fraction of initial postoperative glucose readings less than 75) was unchanged (0.6 vs. 0.9%; $P = 0.2155$). Eighty-seven percent of patients had follow-up care. After intervention the unadjusted surgical site infection rate fell from 1.5 to 1.0% ($P = 0.0061$), a 55.4% relative risk reduction. Interrupted time series analysis confirmed a statistically significant surgical site infection rate reduction ($P = 0.01$). Propensity score matching to adjust for confounders generated a cohort of 7,604 well-matched patients and confirmed a statistically significant surgical site infection rate reduction ($P = 0.02$).

Conclusions: Anesthesiologists add healthcare value by improving perioperative systems. The authors leveraged the one-time cost of programming to improve reliability of intraoperative glucose management and observed improved glucose monitoring, increased insulin administration, reduced recovery room hyperglycemia, and fewer surgical site infections. Their analysis is limited by its applied quasiexperimental design. (Anesthesiology 2017; 126:431-40)
Calendar Year 2009 & 2010

# Surgical Cases with Diabetic patients: 10,565
   # cases where glucose measured: 2,093 (19.8%)

# Surgical Cases with Diabetic patients where insulin given: 2,224
   # Cases where insulin given, glucose measured: 1,265 (57%)
   # Cases where insulin given, glucose NOT measured: 959 (43%)

Percentage of VUMC Diabetic Patients with Intraoperative GlucoseMeasured

<table>
<thead>
<tr>
<th>Surgical Duration</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>0-1</td>
<td>2.92%</td>
</tr>
<tr>
<td>1-2</td>
<td>13.64%</td>
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<tr>
<td>2-3</td>
<td>29.49%</td>
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<td>4-5</td>
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<td>7-8</td>
<td>88.68%</td>
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<td>8-9</td>
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<td>&gt;9 hrs</td>
<td>97.22%</td>
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</table>

(excludes anesthesia induction & emergence time)
Diabetes Patients Receiving Intraoperative Insulin Who Had Intraoperative Glucose Measured

Surgical Duration (excludes anesthesia induction & emergence time)

Glucose Alert

Your patient meets criteria for intraoperative glucose monitoring. Blood Glucose should be measured at this time.

Last glucose value at 06:46 was: 168.
Insulin infusion of 2 Units/h.
Last insulin bolus value at 06:48 was: 3.

Deferred - case completion within 30 minutes
Will measure in 15 minutes
Will measure now
Glucose Monitoring Over Time
Glucose Monitoring Results

- 15,895 cases included in the analysis (3,994 pre, 11,901 post)
- Rate of intraoperative glucose monitoring rose: 61.6% to 87.3% (p=0.0001)
- Hyperglycemia on entry into the PACU fell from 11.0% to 7.2% (p=0.0019)
- Hypoglycemia on entry into the PACU unchanged (0.6% vs. 0.9% p=0.2155)
- Unadjusted SSI rate fell from 1.5% (n=61) to 1.0% (n=117) p=0.0061
  - 55.4% relative risk reduction
  - Using propensity score matching to adjust for confounders associated with risk of SSI, we generated a cohort of 5,058 well matched patients, and confirmed a statistically significant drop in the SSI rate (p=0.01).
“...these improvements led to the prevention of at least 60 SSIs during the course of our study. Based on previously published cost analyses, this likely represented a substantial direct savings to the healthcare system on the order of $600,000, not taking into consideration the additional revenue likely generated by the additional hospital capacity that was subsequently available due to a reduction in follow-up visits and the treatment of complications.”
Driving National Practice Change

Activate Anesthesia Advisories

BestPractice Advisories (BPAs) are now Intraprocedure-friendly and notify the in-room anesthesiologist when a patient might need an intervention. Advisories can be based on many sorts of anesthesia information, including anesthesia device data.

Help clinicians avoid potential conflicts and track data in the background by adding BPAs to the Intraprocedure activity. The criteria and next actions for Intraprocedure activity advisories are flexible and can accommodate complex criteria and incorporate monitor data and trends. Here are some examples of advisories that you might use:

- The patient is a diabetic patient and hasn’t received a blood glucose test in the past two hours. The notification prompts the clinician to order the test directly from Intraprocedure.
- The patient is suffering from Triple Low (Low BP, Low SIS, and Low MAC). The advisory notifies the clinician and suggests an intervention to help reduce the patient’s mortality risk.
- The Intraprocedure activity automatically performs BPA checks every minute. If any new BPAs are discovered, all active BPAs appear in an advisory window. Clinicians can also manually access the advisory window whenever they want by clicking the advisory list.

You can also use BPAs simply for documentation and case tracking purposes by configuring the profile so that BPAs below a specified importance threshold won’t trigger the BPA window. These BPAs still appear in the BPA window and advisory list when they’re opened, but the BPAs don’t cause the window to appear when they become active.

Modify a Macro if You Make a Mistake

Remove intraprocedure macros applied erroneously. Clinicians can select parts of the macro to keep and deleting the remaining items. If an anesthesia clinician applies an intraprocedure macro in error, or changes his mind about which macro to use, he can now remove the previously applied macro from the grid. The Select Macro window contains a new tab, Applied Macros, that shows all of the macros that have been applied to the patient. Clicking one of the applied macros opens a summary of it, which includes a button that allows the clinician to remove the entire macro or only parts of it from the grid.
ICU Fluid Selection
<table>
<thead>
<tr>
<th></th>
<th>Na⁺</th>
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<th>Ca²⁺</th>
<th>Mg²⁺</th>
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<tbody>
<tr>
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</table>
Saline vs Balanced Crystalloids

- Saline causes hyperchloremic metabolic acidosis
  - Animal models, randomized trials in surgery and small ICU trials

- Saline causes renal vasoconstriction
  - Healthy volunteers

- Saline may cause acute kidney injury
  - Animal models, observational data among critically ill adults

- Saline may increase mortality
  - Observational studies of critically ill adults, trends in RCTs

Why are we not using balanced crystalloids?
Pragmatic Trial Design

- Cluster-randomized, multiple-crossover trial
- All adults admitted to five ICUs
- Electronic order adviser guided clinicians in fluid selection
- Informatics tools used to capture all data

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Balanced Crystalloids versus Saline in Critically Ill Adults


ABSTRACT

BACKGROUND: Balanced solutions are used for intravenous fluid administration in critically ill adults, but it is not known which results in better clinical outcomes.

METHODS: In a pragmatic, cluster-randomized, multiple-crossover trial conducted in 5 intensivist teams in an acute care setting, we assigned 15,962 adults to receive saline 0.9% vs. balanced crystalloids (Lactated Ringer’s solution or Plasma-Lyte A) according to the randomization of the unit to which they were admitted. The primary outcome was a major adverse kidney event within 30 days—defined as death from any cause, new renal-replacement therapy, or persistent renal dysfunction (defined as an elevation of the creatinine level to ≥2.00 mg/dL). All outcomes were at hospital discharge or 30 days, whichever occurred first.

RESULTS: Among the 7942 patients in the balanced-crystalloid group, 133 (1.7%) had a major adverse kidney event, as compared with 1131 of 7960 patients (14.1%) in the saline group (unadjusted odds ratio, 0.05; 95% confidence interval, 0.04 to 0.06; adjusted odds ratio, 0.05; 95% CI, 0.02 to 0.09). In hospital mortality at 30 days was 10.3% in the balanced-crystalloid group and 11.1% in the saline group (P=0.045). The incidence of new renal-replacement therapy was 2.5% and 3.7%, respectively (P=0.04), and the incidence of persistent renal dysfunction was 6.4% and 6.6%, respectively (P=0.83).

CONCLUSIONS: Among critically ill adults, the use of balanced crystalloids for intravenous fluid administration resulted in a lower rate of the composite outcome of death from any cause, new renal-replacement therapy, or persistent renal dysfunction than the use of saline.
AI Development

Humans + AI = Augmented Intelligence
Kandahar, Afghanistan
Automatic Sensing for Clinical Documentation (ASCD)

- Which clinical activities should the system aim to detect?
- Is it possible to identify activities from accelerometers and video data?
- Is it possible to easily deploy a system in military transport vehicles?

DoD Award #: W81XWH-17-C-0252
Overview

A Little About Me ...

- Clinical background
- Involvement in Technology Development

American Medical Association

- Priorities & Perspectives on Technology Needs

The Digital Future

- Key Opportunities & Constraints
Physicians and the AMA

Policy development and engagement

Nakisa Sadeghi
Member since 2018

Moudi Hubeishy
Member since 2015
AMA = Sum of five parts

House of Delegates (policy) + Members + Practice/Business Tools + Research & Education + Advocacy = AMA

Innovation ecosystem

The American Medical Association promotes the art and science of medicine and the betterment of public health.
AMA Board of Trustees
AMA: The physicians’ powerful ally in patient care

Representing physicians with a unified voice

Removing obstacles that interfere with patient care

Leading the charge to confront public health crises

Driving the future of medicine
New Technology. Now What?
CPT®: The language of medicine today.
The code to its future.
The Life of an Evolving Medical Procedure

- Physician (or QHP) provides service
- Physician (or QHP) submits CPT code to payer
- Payer accesses the coded service performed
  - Determines a valuation and sets a value for the service (often determined by AMA-RUC)
  - Determines and applies payer coverage policy
- Payer pays provider for service, as direct by payment valuation & coverage policy
Fundamentals of CPT®

CPT codes are constantly updated to keep pace with medical innovation

Evidence-based

Types of Codes

- Category I (Commonly Performed)
- Category II (Quality Measures)
- Category III (New/Emerging Svcs/Tech)
- Proprietary Laboratory Analyses (PLA)
- Multianalyte assays with algorithmic analyses (MAAA) administrative codes
The CPT Editorial Panel has the sole authority to create, revise and update codes, descriptions and applicable guidelines for appropriate CPT coding.

CPT® Editorial Panel
17 members* appointed by AMA Board

CPT Advisory Committee Medical Specialties
Payers CMS, AHA, Blue Cross
The Vaccine Coding Caucus (VCC)

The Pathology Coding Caucus (PCC)
Molecular Pathology Advisory Group (MPAG)
The Proprietary Laboratory Analysis Technical Advisory Group (PLA-TAG)
CPT Health Care Professionals Advisory Committee (HCPAC)
Other Workgroups as appointed by the Panel

Clinical expertise from all of medicine

Thousands of volunteers
Hundreds of participants

3 face to face public meetings per year

CPT Panel members do not advocate for their specialty or organization once named to the Panel.

*Editorial Panel
11 appointed physician members 1 AHA physician representative
3 physician payer representatives 2 HCPAC representatives
AMA-Convened Digital Medicine Payment Advisory Group (DMPAG)

Does it work?  Will I get paid?  Will I get sued?  Will it work in my practice?

Innovation  Coding  Coverage  Inter-operability

Regulation  Pricing  Liability  Training

Aggregate evidence base  Address gaps in coding  Propagate widespread coverage

- Remote physiologic monitoring and Internet consultation codes
- Gain broader coverage of remote monitoring services with payers like CMS
- DMPAG created use cases and consolidated evidence from hundreds of studies

15 nationally recognized advisors engages a diverse cross-section of nationally recognized experts Panel and RUC members.
Digital Health Innovation: Health2047

- Silicon Valley-based business development company founded by the AMA in 2017.

- Integrates physician experience and expertise into the design and commercialization of new health care technologies.

- Work focused in four areas:
  - Enable data liquidity
  - Realign systems to better manage chronic care
  - Enhance productivity at all levels
  - Facilitate value-based payments
Connecting physicians and tech innovators

- PIN platform connects the world of medicine to the world of technology and innovation
- More than 15,000 users and 30 organizational collaborators to date

https://innovationmatch.ama-assn.org/
(Some of) AMA’s partners & collaborators

Private Sector
- Optum Health 2.0
- IQVIA
- LexisNexis
- TEDMED

Emerging/Health Tech
- Health 2047
- oNated
- HekaHealth
- Xcertia

Associations/Institutions
- WMA
- Partners Healthcare
- The Sequoia Project
- CDC
- Intermountain Healthcare
- American Heart Association
- MedStar Health
- National Center for Human Factors in Healthcare
- Research America
- HI TRUST
- RAND Corporation

Academic
- NYU School of Medicine
- NYU Langone Medical Center
- Vanderbilt University
- UCSF School of Medicine
- Oregon Health & Science University
- Mayo Clinic
- University of Michigan
- Johns Hopkins Medicine
- Scripps Translational Science Institute
AMA Digital Health Research

Physicians’ Motivations and Requirements for Adopting Digital Health

Adoption and Attitudinal Shifts from 2016 to 2019
Background and Objectives

- In 2016 the AMA conducted a comprehensive study of physician’s motivations and requirements for the adoption of digital health tools.

- In 2019 AMA repeated the study to determine the degree to which adoption has occurred in the past 3 years and identify attitudinal shifts among physicians towards their use and adoption.

- The goals for this research to determine:
  1. Any change in overall interest in digital health tools and the degree to which physicians believe they will help or hinder their patient care
  2. Current familiarity with 7 specific digital health tools and physician enthusiasm, belief in the relevance to their practice, timeline for incorporating or current use
  3. For each tool, the motivators and level of disruption caused or foreseen
  4. The ideal level of involvement physicians would like to have in adoption decisions
  5. An understanding of enthusiasm, current usage and requirements for emerging technologies
**Focus on Digital healthcare**: Broad scope of tools that engage patients for clinical purposes; collect, organize, interpret and use clinical data; and manage outcomes and other measures of care quality.

This includes, but is not limited to, digital solutions involving telemedicine and telehealth, mobile health (mHealth), wearables (Fitbit), remote monitoring, apps and others.

<table>
<thead>
<tr>
<th>7 Specific Tools</th>
<th>Remote monitoring for efficiency</th>
<th>Remote monitoring and management for improved care</th>
<th>Clinical decision support</th>
<th>Patient engagement</th>
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<tbody>
<tr>
<td>Tele-visits/ virtual visits</td>
<td>Point of care/ Workflow enhancement</td>
<td>Consumer access to clinical data</td>
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**Questions**

**Overall Involvement in Digital Health**
- Impact of ability to provide care
- Overall motivators/attractants
- Overall functional requirements

**Specific digital tools**
- Familiarity
- Current use
- Relevance for practice
- Enthusiasm
- Timeline for incorporating into practice
- Ideal level of involvement in Digital Health in general

**Individual tool deep dives**
(Ask for up to two relevant solutions, not currently being used)
- Overall motivators/attractants towards solution
- Rank of top 3 motivators/attractants
- Overall functional requirements of solution adoption
- Rank of top 3 functional requirements
- Level of disruption caused by solution
- Ideal level of involvement with decision to incorporate solutions

WebMD recruited a sample of 1,300 practicing US physicians

Requirements for participation:
- Age 28-65
- Practicing physicians including those focused on research, academia or public health
- Full-owner, part-owner or employee of a practice (not an independent contractor)
- Provide a minimum of 20 hours of direct patient care each week

© 2019 American Medical Association. All rights reserved.
<table>
<thead>
<tr>
<th>Innovation &amp; Digital Health</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Remote monitoring for efficiency</strong></td>
</tr>
<tr>
<td><strong>Remote monitoring and management for improved care</strong></td>
</tr>
<tr>
<td><strong>Clinical decision support</strong></td>
</tr>
<tr>
<td><strong>Patient engagement</strong></td>
</tr>
<tr>
<td><strong>Tele-visits / virtual visits</strong></td>
</tr>
<tr>
<td><strong>Point of care/ workflow enhancement</strong></td>
</tr>
<tr>
<td><strong>Consumer access to clinical data</strong></td>
</tr>
</tbody>
</table>
Physicians’ motivations and requirements for adopting digital health

Shifts from 2016 to 2019
There has been a small but significant increase in the advantage that physicians feel digital health solutions bring to their ability to care for their patients.

- The most notable increases are among PCPs with specialists moving slightly.
- Those that see no advantage are trending downwards and are concentrated in the age 50+ segment.
Use of digital health tools has risen significantly
Tele-visits have seen the greatest growth, doubling in use since 2016.

Q20. Which, if any, of these do you currently incorporate into your practice? Base: Total Physicians (n=1300)

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The average number of digital tools used has increased

Older physicians and those less enthusiastic about technology (there is a lot of overlap) are catching up in their use.
Use by solo practice physicians and partial owners has also increased. These had been lagging behind other physicians in 2016 and are now closer to the average.

Average Number of Tools Physicians Use

<table>
<thead>
<tr>
<th>Ownership</th>
<th>Empl.</th>
<th>Full</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>2.4</td>
<td>2.3</td>
<td>2.4</td>
</tr>
<tr>
<td>2019</td>
<td>2.0</td>
<td>1.8</td>
<td>1.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Practice size</th>
<th>28+</th>
<th>9-27</th>
<th>4-8</th>
<th>1-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>2.6</td>
<td>2.4</td>
<td>2.3</td>
<td>2.2</td>
</tr>
<tr>
<td>2019</td>
<td>2.3</td>
<td>1.9</td>
<td>1.9</td>
<td>1.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>2.1</td>
<td>2.3</td>
<td>2.2</td>
<td>2.6</td>
<td>2.6</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>2019</td>
<td>2.2</td>
<td>2.2</td>
<td>2.1</td>
<td>2.6</td>
<td>2.6</td>
<td>2.2</td>
<td>2.2</td>
</tr>
</tbody>
</table>
While all digital health tools have seen increases in adoption since 2016, remote care tools have seen the biggest moves forward.

Tele-visits/virtual visits and remote monitoring for improved patient care have seen a significant increase in use.

1. Tele-visits/virtual visits: 14% in 2016, 28% in 2019
2. Remote monitoring for efficiency: 12% in 2016, 16% in 2019
4. Clinical decision support: 28% in 2016, 37% in 2019
5. Patient engagement: 26% in 2016, 33% in 2019
6. Point of care/workflow enhancement: 42% in 2016, 47% in 2019
7. Consumer access to clinical data: 53% in 2016, 58% in 2019

Q20. Which, if any, of these do you currently incorporate into your practice? Base: Total Physicians (n=1300)
Remote care tools are also those with the highest likelihood of adoption within the next three years.
Providing remote care is also a driving force for adoption, and the only motivator that has seen upward movement in the past three years.

<table>
<thead>
<tr>
<th>Feature</th>
<th>2016</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allows me to provide care to my patients remotely</td>
<td>26</td>
<td>31</td>
</tr>
<tr>
<td>Improves resource allocation for staff</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>Allows me to see more patients</td>
<td>27</td>
<td>26</td>
</tr>
<tr>
<td>Demonstrates awareness of the latest technologies</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>Provides a new stream of revenue</td>
<td>25</td>
<td>22</td>
</tr>
<tr>
<td>Differentiates my practice from others</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Patients demand it</td>
<td>13</td>
<td>14</td>
</tr>
</tbody>
</table>

Q17. When thinking about incorporating digital health solutions into your practice, how important would each factor be? Base: Total Physicians (n=1300)
When asked what digital health tools they are most enthusiastic about, remote tools are the two that gained traction since 2016.

Q2: Which, if any, of the solutions below are you enthusiastic about? (Base: Total Physicians (n=1300))
Multi-Specialty Groups are currently the heaviest users of remote digital health tools.

Other groups that showed relatively heavier usage of remote digital health tools are hospitals, physicians under 50, and PCP’s.
Improved efficiency and increased patient safety remain the top motivators for physicians to use digital health tools.

Patient adherence, convenience, and helping address physician burnout have increased in importance as reasons for attraction.

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improves efficiency</strong></td>
<td>48</td>
<td>51</td>
</tr>
<tr>
<td><strong>Increases safety</strong></td>
<td>47</td>
<td>46</td>
</tr>
<tr>
<td><strong>Improves diagnosticability</strong></td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td><strong>Burnout</strong></td>
<td>39</td>
<td>40</td>
</tr>
<tr>
<td><strong>Patient Adherence</strong></td>
<td>36</td>
<td>39</td>
</tr>
<tr>
<td><strong>Convenience</strong></td>
<td>32</td>
<td>36</td>
</tr>
<tr>
<td><strong>Relationship</strong></td>
<td>38</td>
<td>35</td>
</tr>
</tbody>
</table>

Q17. When thinking about incorporating digital health solutions into your practice, how important would each factor be? Base: Total Physicians (n=1300)

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There has been a significant shift in the importance of remote care.

Q17. When thinking about incorporating digital health solutions into your practice, how important would each factor be? Base: Total Physicians (n=1300)
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Two elements that attract physicians to digital health tools have shifted in importance

“Allows me to provide care remotely” and “Helps reduce stress/burn-out” have moved into the quadrants for drivers, now closely hovering along the line between key motivators and secondary drivers. The movements are small but meaningful.
Requirements for adopting digital health tools have remained unchanged.

Integration with EHR and being as good as traditional care are the two key requirements.
The importance of digital health tools being covered by standard malpractice insurance has increased significantly as a requirement.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>2016</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covered by my malpractice ins.</td>
<td>52</td>
<td>57</td>
</tr>
<tr>
<td>Data privacy/security assured by EHR vendor</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Well integrated with EHR</td>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>Data privacy assured by my practice/hosp.</td>
<td>47</td>
<td>49</td>
</tr>
<tr>
<td>Reimbursed for time spent using</td>
<td>43</td>
<td>45</td>
</tr>
<tr>
<td>Supported by EHR vendor</td>
<td>40</td>
<td>41</td>
</tr>
</tbody>
</table>
Demonstration of safety and efficacy in peer reviewed publications has also increased in importance.
The degree of responsibility that physicians desire to have in the adoption of digital health solutions in their practice has not changed.

Physicians want to be part of the decision-making process; owners expect to be responsible.
Current or planned future use of digital health tools is also slightly up; most growth is in tele-visits/virtual visits and remote monitoring for improved care.
Emerging Technologies
Awareness of augmented intelligence technologies is high, though adoption remains in single digits for almost all tools.

Q39. When would you expect to start incorporating this into your own practice?
Intentions to adopt augmented intelligence tools within the next three years are very high even if current use is low.

One-third of physicians plan to adopt most of these technologies within the next year.

<table>
<thead>
<tr>
<th>Technology</th>
<th>% Physicains Adoption Timeline for Advanced Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Intelligence for health administration</td>
<td>11 within 2-3 years, 36 within year, 11 using</td>
</tr>
<tr>
<td>Augmented Intelligence for clinical applications</td>
<td>36 within 2-3 years, 37 within year, 3 using</td>
</tr>
<tr>
<td>Augmented Intelligence for business operations</td>
<td>31 within 2-3 years, 36 within year, 2 using</td>
</tr>
<tr>
<td>Precision &amp; Personalized Medicine</td>
<td>33 within 2-3 years, 31 within year, 4 using</td>
</tr>
<tr>
<td>Augmented Intelligence for population health</td>
<td>31 within 2-3 years, 30 within year, 5 using</td>
</tr>
<tr>
<td>Augmented Intelligence for research and development</td>
<td>35 within 2-3 years, 30 within year, 10 using</td>
</tr>
<tr>
<td>Blockchain, and other similar data solutions</td>
<td>21 within 2-3 years, 22 within year, 11 using</td>
</tr>
</tbody>
</table>
Physicians are most interested in these emerging technologies to help them serve chronic care patients.

Indicators of % Physicians Want New Technology to Serve:

- **Total**:
  - Chronic care patients: 44%
  - Millennial population: 34%
  - Patients in low resource environments: 13%
  - Aging population (85+): 7%

- **Male**:
  - Chronic care patients: 43%
  - Millennial population: 37%
  - Patients in low resource environments: 10%
  - Aging population (85+): 8%

- **Female**:
  - Chronic care patients: 45%
  - Millennial population: 28%
  - Patients in low resource environments: 19%
  - Aging population (85+): 6%

- **PCPs**:
  - Chronic care patients: 47%
  - Millennial population: 31%
  - Patients in low resource environments: 13%
  - Aging population (85+): 6%

- **Specialists**:
  - Chronic care patients: 40%
  - Millennial population: 37%
  - Patients in low resource environments: 13%
  - Aging population (85+): 8%
Summary: Changes from 2016

1. There has been an increase in the number of physicians that see a definite advantage in digital tools
   - Growth in those that see an advantage is among PCPs.
   - Those that see no advantage are trending downwards and are concentrated in the age 50+ segment.

2. Adoption of digital tools has grown significantly among all physicians regardless of gender, specialty or age.
   - Use of all seven tools has increased.
   - Increased efficiency and patient safety are key drivers.
   - Tools need to be covered by standard malpractice insurance and data privacy concerns have increased.

3. Adoption of remote care tools such as tele-visits and remote monitoring had the most movement
   - Providing remote care to patients has increased significantly as a driver of adoption of digital tools.
   - Use of these tools is still at roughly one quarter of physicians, but this is nearly doubled from 2016.
   - Likelihood of adoption has increased significantly.

4. Awareness of most of the emerging technologies such as artificial or augmented intelligence is fairly high.
   - Current adoption of these technologies is however very low.
   - Intentions to adopt these emerging technologies is quite high and aggressive timelines are planned.
Overview

A Little About Me ...

- Clinical background
- Involvement in Technology Development

American Medical Association

- Priorities & Perspectives on Technology Needs

The Digital Future

- Key Opportunities & Constraints
What creates health?

Cochlear Implants

Transmitter
Microphone and speech processor

Speech processor, microphone and transmitter

Receiver and stimulator

Electrodes

Cochlea

Cochlear implant
Disruption of health care has already begun...

Retail and direct-to-consumer (DTC) growth:

- Increase in physicians going to work for new models
- Increase in patient use of new models
  - Millions have lost employer-provided healthcare coverage making $40 doctor visits at care clinics increasingly tempting

Patients and physicians want virtual care to continue:

- 68% of clinician respondents are motivated to increase telehealth; 75% of clinicians indicated that telehealth enabled them to provide quality care (COVID-19 Coalition Telehealth Impact Survey)
- Patient satisfaction score for telehealth is 860/1000 – highest of all healthcare, insurance and financial services (JD Power)

Record digital health investments in 2020:

- $20 billion globally
- Similar investments expected in 2021 focused on interoperability, mental health and personalized care (Rock Health)

AI, genomics, precision medicine, health at home...
New care delivery models already at work

Melting margins and hospital closures

'Tumultuous' year for hospitals results in 55% drop in median operating margin, Kaufman Hall finds

Negative operating margins likely for 39% of hospitals this year: Kaufman Hall

Even under an optimistic pandemic recovery scenario, 39 percent of hospitals may have negative operating margins this year, according to a new report from healthcare consulting firm Kaufman Hall.

In a pessimistic scenario, nearly half of U.S. hospitals may have negative operating margins, according to the report. Prior to the pandemic, 25 percent of hospitals had a negative operating margin.
The National Health Care Challenge
Global

The National Health Care Challenge
No ordinary trends....

National specialty shortages
Geographic mismatches

Aging of Baby Boom living longer
Growing demand on safety net  Growing demand for caregivers and physicians

Relative birth rates in US and globally
Fewer funding safety net  Shrinking ratio of physicians to patients  Shrinking number of caregivers

Physician burnout
Overwhelmed with data
Overall technology without emphasis on user-centered design and IoT reality
Healthcare Delivery Model Challenge (continued)

US Labor Productivity (Output Per Worker Hour)

Productivity in healthcare
(2000 = 100%)

Productivity in all other industries (2000=100%)

http://data.bls.gov/pdq/SurveyOutputServlet

Courtesy of
Michael Abramoff, MD, PhD
New technology—solution or added complexity?

Average ambulatory elderly fills 9-13 prescriptions/year

Proliferation of digital solutions (with/without AI) for *individual* chronic conditions
Making health care technology an asset, NOT a burden

Promoting innovation to tackle the biggest problems in health care by...

- Bringing the physician perspective to the front-end of health care technology development, and
- Building a powerful network to drive the future of health technology

The goal: Returning physicians’ time and attention to their patients, the work of paramount value to physicians and to the health care system.
AI as a solution?
Hype v. Reality

Visibility

Time

Peak of Inflated Expectations

Plateau of Productivity

Slope of Enlightenment

Trough of Disillusionment

Technology Trigger
AI health care applications – Validated Solutions Needed

**COMMON FOCUS**

Patient Engagement and Support

Health Promotion and Disease Prevention

Disease Screening and Diagnosis

Disease Treatment and Management

**ADDITIONAL AREAS OF NEED**

Research and Development

Healthcare Administration / Business Operations

Care Delivery Support

Population Health
What is AI?

What are the applications in health care?
What AI System(s) are you talking about?

What are the intended uses?

What are the conditions of deployment?

Stakeholders need to specify intended uses, AI systems utilized, and conditions of deployment represent different risk profiles and may impacts costs as well. . .
Why “Augmented Intelligence”? 
Technology vs Human or Technology + Human?

“The way here is not to think technology versus human, but to ask how they come together where the sum can be greater than the parts for an equitable, inclusive, human and humane care and practice in medicine.”

-- Dr. Abraham Verghese
Stanford University
Augmented = Assistive
Augmented = Autonomous
The AI policy progression

2016
Obama Administration
OSTP Meetings
and White Papers

2017
Congressional Hearings, FDA
Precertification Program Proposal

2018
Trump Administration
Summit & Executive Order

2019
Trump Administration
Executive Order

AI Policy Discussions

AMA House of Delegates
Annual 2018
Reports & Policy Adopted

AMA House of Delegates
Annual 2019
Reports & Policy Adopted
Augmented intelligence in health care

As a leader in medical education, our American Medical Association (AMA) has an important role to play in the evolution of augmented intelligence in health care. This is not just an opportunity to innovate, but a responsibility to ensure that the potential of this technology is realized in a way that benefits patients and physicians alike.

Payment and regulation

Executive summary

Effective patient care and health care delivery depend on the ability to leverage data and the technology to improve outcomes. The AMA has a key role in ensuring that the payment and regulatory landscape supports the use of augmented intelligence in health care, ensuring that patients receive the best care possible.

Medical education, professional development, and credentialing

Introduction

The use of augmented intelligence in health care is rapidly changing the way we deliver care. The AMA is committed to ensuring that medical education and professional development are at the forefront of these changes, preparing the next generation of physicians to effectively integrate these technologies into their practices.
What do physicians need to know to adopt new technologies?

Nancy Church, MD
Member since 1986
Lessons Learned

Electronic Health Records ➔ Genetic/Genomics ➔ Digital Health

- Innovation
- Payment
- Infrastructure
- Regulation
- Liability
- Training / Prof. Dev.
The innovation pathway to clinical integration... AI considerations

- Does it work?
- Will I get paid?
- Will I get sued?
- Will it work in my practice?

- Innovation
- Coding
- Coverage
- Infrastructure

- Regulation/Quality Assurance
- Pricing
- Liability/Privacy/Security/Med-Mal & Developer Liability
- Education/Training/Iterative Learning Models

Equity
Data
Ethics
Medical Device Regulatory Policy Priorities
Our AMA promotes:

All that advances the quadruple aim and equity

Sohayla Rostami, DO
Member since 2014
Our AMA promotes:

Opportunities to integrate the perspective of practicing physicians into the development, design, validation, and implementation of health care AI.
Liability

Liability and incentives should be aligned so that individuals or entities best positioned to know the AI system risks and best positioned to avert or mitigate harm do so through design, development, validation, and implementation.
Engage health care stakeholders and standards setting bodies

- Support Gap Analysis of Existing Standards and Policies
- Identify Health Care Applications and Relative Benefits and Risks
- Support and Accelerate Common Terms and Definitions
Questions

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- www.linkedin.com/in/doctorjesse