NODE.Health and Evidence Based Digital Medicine

Ashish Atreja, MD, MPH
Chief Innovation Officer, Medicine
Assistant Professor and Director, Sinai AppLab
Icahn School of Medicine at Mount Sinai, New York, NY
Mount Sinai Health System

Founded in 1852
Not-for-profit Academic Medical Center

7 Hospitals, 1 Medical School, 15 Institutes
3500+ beds, 135 operating rooms
12+ Ambulatory Surgical Centers
200+ community location around New York
36,000 employees

6,200 physicians; 2,000 residents
2.6 million outpatient visits
500 thousand ER visits
170 thousand inpatient visits
This is our Burning Platform

Can Mount Sinai be serious? The answer is a resounding yes. In fact, serious is the most serious.
Mount Sinai’s number one mission is to keep people out of the hospital. We’re focused on population health management, as opposed to the traditional fee-for-service medicine. So instead of treating care that’s isolated and intermittent, patients receive care that’s continuous and coordinated, much of it outside the traditional hospital setting.

Thus far tremendous emphasis on wellness programs designed to help people stop smoking, lose weight and battle obesity, lower blood pressure and reduce the risk of a heart attack. By being as proactive as possible, patients can better maintain their health and avoid disease.

Our Mobile Acute Care Team will treat patients at home who would otherwise require a hospital admission for certain conditions. The care team involves physicians, nurse practitioners, registered nurses, social workers, community paramedics, case managers, physical therapists, occupational therapists, speech therapists, and home health aides.

Meanwhile, Mount Sinai’s Preventable Admission Care Team provides transitional care services to patients at high risk for readmission. After a comprehensive in-home assessment, social workers partner with patients, family caregivers and healthcare providers to identify known risk factors and problems with medication management and provide ongoing support after discharge.

It’s a surprising change in the way that health care is delivered. And with the new system comes a new way to measure success. The number of empty beds.

IF OUR BEDS ARE FILLED, IT MEANS WE’VE FAILED.
Value based healthcare is real!

FOR IMMEDIATE RELEASE
January 26, 2015

Contact: HHS Press Office
202-690-6343

Better, Smarter, Healthier: In historic announcement, HHS sets clear goals and timeline for shifting Medicare reimbursements from volume to value

In a meeting with nearly two dozen leaders representing consumers, insurers, providers, and business leaders, Health and Human Services Secretary Sylvia M. Burwell today announced measurable goals and a timeline to move the Medicare program, and the health care system at large, toward paying providers based on the quality, rather than the quantity of care they give patients.

HHS has set a goal of tying 30 percent of traditional, or fee-for-service, Medicare payments to quality or value through alternative payment models, such as Accountable Care Organizations (ACOs) or bundled payment arrangements by the end of 2016, and tying 50 percent of payments to these models by the end of 2018. HHS also set a goal of tying 85 percent of all traditional Medicare payments to quality or value by 2016 and 90 percent by 2018 through programs such as the Hospital Value Based Purchasing and the Hospital Readmissions Reduction Programs. This is the first time in the history of the Medicare program that HHS has set explicit goals for tying payments to quality.
Health Systems Unprepared for Value Based Care

Value based care has arrived

76% of hospitals face readmissions penalties

50% of unprepared for bundles and MACRA

http://khn.org/
# Mount Sinai Readmission penalties

## Summary P4P Impact

A summary of your hospital's final pay for performance impact is below. These results are based on the finalized adjustments published by CMS for the VBP, Readmissions and HAC programs. You can view more detailed performance information for each program below.

<table>
<thead>
<tr>
<th>Estimated Readmissions Penalty Percentage</th>
<th>Readmissions Percentile Rank</th>
<th>Estimated Readmissions Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.6%</td>
<td>50%</td>
<td>$-1,287,530</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VBP Estimated Net Percent Change</th>
<th>VBP Percentile Rank</th>
<th>Estimated VBP Net Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.03%</td>
<td>50%</td>
<td>$63,472</td>
</tr>
</tbody>
</table>

Advisory Board, Courtesy: Robby Freeman
Poor healthcare apps could cost hospitals $100 million a year, Accenture says

While 66 of the 100 largest hospitals in the United States offer consumers mobile health apps, only 2 percent of patients are using them, new report finds.

By Bill Siwicki | January 06, 2016 | 07:37 PM
Actually, I'm not a doctor... I'm the health-care administrator.

That's okay. I'm not the patient... I'm his attorney.

We need tools to address triple whammy!!!
Going beyond the EHRs to find an Answer to Value-Based HealthCare
Computers are like a bicycle for the mind..

I think one of the things that really separates us from the high primates is that we’re tool builders. Humans are one of least efficient species when it comes to using energy to move a kilometer. But, a human on a bicycle, blew the comparison away, completely off the top of the charts- Steve Jobs
Emergence of the new field of Digital Medicine

- 265,000 Mhealth Apps
- Telemedicine
- Linked Wearables
- AI/Machine Learning
- Secure Messaging
- Augmentic/Virtual Reality
- Voice commands/Alexa
- Chat Bots
- Exposome
In RCT, patients using BlueStar saw a greater mean A1c decline than those receiving usual care: 1.2% (1.9% vs 0.7%) over a 12 month period

Quinn, C et al, Diabetes Care, 2011
Telemedicine becomes mainstream: 46 states now have some sort of Parity Law

A significant reduction in emergency department visits (OR = 0.27) and hospitalization (OR = 0.46) was reported with telehealth care in COPD patients

McLean S Br J Gen Pract, 2012
At 6 months, levels of LDL-C were significantly lower in intervention participants (mean difference, −5 mg/dL with reductions in systolic blood pressure (−7.6 mm Hg) and BMI (−1.3), and a significant reduction in smoking (26% vs 44%; relative risk, 0.61 [95% CI, 0.48 to 0.76]; P < .001).

The majority reported the text-message program to be useful (91%), easy to understand (97%), and appropriate in frequency (86%).

Figure Legend:

Enrollment of Participants in the TEXT-ME Randomized Clinical Trial

LDL-C indicates low-density lipoprotein cholesterol.
2016: Year of Wearables / Implantables / digestibles

Patient acceptance and adoption is also growing

Smart watches
Ingestibles
Patches and sensors
Health bands
Smart glasses

mHealth + Telehealth World Congress, 2015
Somatix (Wearables)

**Somatix** is a behavioral medication software platform, utilizing real-time interventions based on data gathered from standard wearables. Its first product, SmokeBeat is addressing the global smoking cessation market; its customers include corporate employers, health insurance companies and clinics.

www.somatixinc.com
From Quantified Self to Quantified Population Health

Angarita et al. Quantified Self
Swan M, Big Data, 2013
Envisioning digital care in year 2020

✓ Virtual care (telemedicine and messaging)
✓ 24/7 tracking (remote monitoring)
✓ Population health (predictive analytics)
✓ Empowerment (SDH, peer networking)
✓ Prescribing Apps (AR/digital therapeutics)

Paul Sonnier, Storyofdigitalhealth.com
How do we get there?
Build Capacity for Digital Transformation
“The Digital Daisy”

Courtesy Bruce Darrow and Digital Medicine Advisory Team
AppLab: Academic Research Organization in Digital Medicine
25 funded Projects, 100 investigators served, Digital Medicine Community created
Remote Monitoring in IBD: HealthPROMISE

# Realtime population health dashboard w/ app data

## Patient Detail

<table>
<thead>
<tr>
<th>Name</th>
<th>UserId</th>
<th>MRN</th>
<th>DOB</th>
<th>Contact #</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milan Patel</td>
<td>mpatel99</td>
<td>0</td>
<td>1/1/1960 12:00:00 AM</td>
<td>2016880785</td>
<td><a href="mailto:mpatel@gmail.com">mpatel@gmail.com</a></td>
</tr>
</tbody>
</table>

## Checklist of Care

<table>
<thead>
<tr>
<th>Checklist</th>
<th>Status</th>
<th>Action Date</th>
<th>Recent QOL Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone Density Test</td>
<td>Met</td>
<td>08-18-2014</td>
<td>Fatigue</td>
</tr>
<tr>
<td>Colonoscopy</td>
<td>Met</td>
<td>09-03-2014</td>
<td>Social</td>
</tr>
<tr>
<td>Hepatitis B Screening</td>
<td>Met</td>
<td>07-29-2014</td>
<td>Leisure</td>
</tr>
<tr>
<td>Injectable Drug Adherence</td>
<td>Met</td>
<td>10-07-2014</td>
<td>Abdomen Pain</td>
</tr>
<tr>
<td>Normal Inflammatory Markers</td>
<td>Met</td>
<td>07-22-2014</td>
<td>Depressed</td>
</tr>
<tr>
<td>Normal Mucosa on Endoscopy</td>
<td>Met</td>
<td>10-03-2014</td>
<td>Gas</td>
</tr>
<tr>
<td>Oral Medication Adherence</td>
<td>Don't Know</td>
<td>07-31-2014</td>
<td>Maintain Weight</td>
</tr>
<tr>
<td>Skin Cancer Protection</td>
<td>Met</td>
<td>09-04-2014</td>
<td>Tense</td>
</tr>
<tr>
<td>Smoking Cessation Advice</td>
<td>Don't Know</td>
<td>07-30-2014</td>
<td>Bowel Issue</td>
</tr>
<tr>
<td>Smoking Screening</td>
<td>Met</td>
<td>08-18-2014</td>
<td>Anger</td>
</tr>
<tr>
<td>Steroid sparing medications</td>
<td>Met</td>
<td>09-05-2014</td>
<td>Stack</td>
</tr>
<tr>
<td>TPMT Testing</td>
<td>Met</td>
<td>09-27-2014</td>
<td></td>
</tr>
<tr>
<td>Tuberculosis Test</td>
<td>Met</td>
<td>08-27-2014</td>
<td></td>
</tr>
<tr>
<td>Vaccination for Flu</td>
<td>Met</td>
<td>11-14-2014</td>
<td></td>
</tr>
<tr>
<td>Vaccination for Pneumonia</td>
<td>Met</td>
<td>07-19-2014</td>
<td></td>
</tr>
</tbody>
</table>

## Recent QOL Score

<table>
<thead>
<tr>
<th>Fatigue</th>
<th>Social</th>
<th>Leisure</th>
<th>Abdomen Pain</th>
<th>Depressed</th>
<th>Gas</th>
<th>Maintain Weight</th>
<th>Tense</th>
<th>Bowel Issue</th>
<th>Anger</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>6</td>
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<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

| Total   | 58.00  | 45.00   | 45.00        | 26.67     | 58.00 |

Registration: ClinicalTrials.gov NCT02322307
Improvement in QOL and Quality Indicators in IBD with HealthPROMISE

Figure 2. Improvement in Percentage of Patients meeting eligible Quality of Care metrics in control (9%) versus Intervention (28%), P<0.01

Fatigue and Tension as major drivers of poor quality of life in more than 75% of IBD patients

Mount Sinai patients with app and UPMC patients with paper based survey
Singular Platform for Digital Transformation

Specialty Specific customized solutions for patient care and research

- Health Education Content, Videos, Webinars
- Survey and Feedback
- Tracking Apps, Websites
- Wearables
- Telemedicine
- Appointment Scheduling
- Social Patient Engagement
- Clinical Trials

https://www.youtube.com/watch?v=1Ax926yrEQc
The Time for Prescribing Apps has Come!!

NPR Marketplace: An App to Prescribe other Healthcare Apps!!
RxUniverse: Usability and Learnability

Figure 5. Adoption, Usability, and Learnability of RxUniverse vs. Industry Standards.

<table>
<thead>
<tr>
<th>System Usability Score Items</th>
<th>Descriptive Scoring for the SUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 I think that I would like to use RxUniverse frequently.</td>
<td>Adjective</td>
</tr>
<tr>
<td>Q2 I found RxUniverse unnecessarily complex.</td>
<td>Worst Imaginable</td>
</tr>
<tr>
<td>Q3 I thought RxUniverse was easy to use.</td>
<td>Awful</td>
</tr>
<tr>
<td>Q4 I think I would need the support of a technical person to be able to use.</td>
<td>Poor</td>
</tr>
<tr>
<td>Q5</td>
<td>Okay</td>
</tr>
<tr>
<td>Q6 I thought there was too much inconsistency in the RxUniverse platform.</td>
<td>Good</td>
</tr>
<tr>
<td>Q7 I would imagine that most people would learn to use RxUniverse very quickly.</td>
<td></td>
</tr>
<tr>
<td>Q8 I found the RxUniverse platform very cumbersome to use.</td>
<td></td>
</tr>
<tr>
<td>Q9 I felt very confident using RxUniverse.</td>
<td></td>
</tr>
</tbody>
</table>
Validated Use-Case

Readmission Reduction

Through the use of the mobile application, HeartHealth, healthcare providers are able to remotely monitor their patients’ blood pressure and weight in the 30 day high risk period post discharge.

- **Patient Satisfaction**: Increased positive health outcomes due to high patient satisfaction with the platform
- **Readmission Rate Reduction**: 10% readmission rate compared to the national rates of >20% readmission within 30 days of discharge
- **Activated Patients**: Who continue to use the mobile apps and smart devices to track BP and weight

URL: http://www.iproc.org/2017/1/e24 | DOI: 10.2196/iproc.8459
Enterprise-wide SDoH Assessment
Real Time Patient Experience Survey and Service Recovery (MIPS)

Patient Satisfaction Survey

Please select the number of stars on a scale of 1-5, with 1 being the worst, and 5 being the best, please rate the following:

1. How well your doctor communicated your medical plan with you.

2. How well your nurse communicated your medical plan with you.

3. How well the staff explained the purpose and side effects of new medications.

4. How well the staff is preparing you for leaving the hospital (discharge).

5. How would you rate your experience in the hospital thus far?
CLINICAL DECISION AID: BLADDER CANCER RISK TOOL (OCM)
Peri-procedural Support for Bundles

Dear Ashish Atreja,
Colonoscopy on 8/6/2017 at 06:00:00

———
DAY BEFORE COLONOSCOPY
Your colonoscopy is tomorrow. You must now modify your diet and begin drinking the Miralax mixture in a timely manner.

———
DAY OF COLONOSCOPY
Your colonoscopy is today. Make sure to complete drinking your Miralax mixture in a timely manner.
For more details: http://bit.ly/2jckAl
Exponential ROI

One Stop Shop for Multiple Transformation Use-Cases

EHR Integrated Platform
Curated by Academic Centers

Transforming Organizations within 90 days

Increased Patient and Provider Engagement
Improved Patient Outcomes

Ongoing Use-cases
- Providing PHR access to populations at scale
- Behavioral health apps
- Pre and Post Surgery Engagement
- Transitions of Care
- Remote Monitoring of 5 high cost diseases
- Employee Engagement and Wellness
- Assess Social Determinants
- Readmission Reduction
- Patient Reported Outcomes

ROI through
- Leveraging investments made (PHR)
- Improving peri-op throughput
- Remote monitoring and CCM Codes
- Patient experience survey and Real time service recovery
- Reducing readmission penalties
- MACRA-Increased score- QI activities
- CIN and Pop Health (Top 5 diseases)
- At-risk contracts and ACO
BOTTLENECK: Creating Evidence for Digital Medicine

mHealth Lacks Evidence: Takes “scatter shot” approach

--World Bank

Tsai et al. PLOS Medicine. Scaling up mHealth: Where is the evidence?
Digital Health Investment fueled by Innovation Economy

**TOTAL FUNDING**
2011-H1 2017

**TOTAL VENTURE FUNDING**

<table>
<thead>
<tr>
<th>Year</th>
<th>Funding</th>
<th>Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>$1.1B</td>
<td>81</td>
</tr>
<tr>
<td>2012</td>
<td>$1.5B</td>
<td>133</td>
</tr>
<tr>
<td>2013</td>
<td>$2.1B</td>
<td>186</td>
</tr>
<tr>
<td>2014</td>
<td>$4.4B</td>
<td>268</td>
</tr>
<tr>
<td>2015</td>
<td>$4.6B</td>
<td>275</td>
</tr>
<tr>
<td>2016</td>
<td>$4.3B</td>
<td>304</td>
</tr>
<tr>
<td>H1 2017</td>
<td>$3.5B</td>
<td>188</td>
</tr>
</tbody>
</table>

**AVERAGE DEAL SIZE**

- 2011: $12.4M
- 2012: $10.7M
- 2013: $10.7M
- 2014: $14.8M
- 2015: $14.8M
- 2016: $13.7M
- H1 2017: $18.7M
Problem of Plenty
The ‘Burden of Proof’

From $4.5 Billion To Nothing: Forbes Revises Estimated Net Worth Of Theranos Founder Elizabeth Holmes

Future generations of startup founders should ensure they are working with venture capital firms that have ample experience in health care. These investors will understand that it takes time to build a successful and long-lasting company.”
- Christina Farr, Fast Company
Scripps Wired for Health study results show no clinical or economic benefit from digital health monitoring

By Jonah Comstock | January 19, 2016

A prospective randomized trial examining health care utilization in individuals using multiple smartphone-enabled biosensors

The results are in for the Scripps Translational Science Institute’s Wired For Health study, and there’s no sugar-coating it: they’re disappointing for those working in digital health. The six-month randomized control trial found no short-term benefit in health costs or outcomes for patients monitoring their health with connected devices.

“It was a bit disappointing, but remember, this was the first multisensor trial that’s ever been reported, so in that respect it was a pioneering effort,” study author and STSI Director Dr. Eric Topol told MobiHealthNews. “And you know, it was very difficult because we had these three different sensors, glucose, blood pressure, and heart rhythm, and a lot of patients had all three problems or two of them, and had to have a dashboard created. There are a lot of logistical challenges there.”

https://peerj.com/articles/1554/
WHY POKÉMON GO IS SECRETLY THE WORLD’S NEWEST FITNESS PHENOMENON

Legions of eager Pokémon masters are suddenly realizing what FitBit wearers have long known: Walking around all day is actually one hell of a workout.

BY MICHAEL RODIO

Tess Koman
@tessie_the_mess

True Life: I Abandoned My Fitness Tracker in Favor of Catching Pokemon All Over the City and I'm in the Best Shape of My Life

12:25 PM - 10 Jul 2016

115

268
INNOVATION
Digital Technologies

RIGOR
Evidence-based Medicine

Evidence-Based Digital Medicine (EBDM)
NODE Health: Guiding Principles

1. Share information about ongoing innovation and single site trials
2. Standardize existing governance, regulatory and best practices
3. Support multi-site digital medicine trials and implementations
NODE Health Foundation

Diagram showing the interconnections between Hospital System & Patients, Startup, Grant Agency, Industry, Pharma, Payer, VC and Angel.
Launched Feb 2016
Consortium Members
Eco-System Members and Partners
The Network of Digital Medicine Evidence PULSE
Your Recommended Dose of Peer-Reviewed
#DigMedEvidence Issue No. 4, 2016

Sharing Evidence

Peer Reviewed EBDM Newsletter

Curated by thought leaders

Initiatives, reviews, key publications

7000+ members

#digmedevidence

Evidence PULSE is curated and critiqued by thought leaders in academic medicine. Our mission is to make #DigMedEvidence universally available to all academic and industry partners.

Know someone who should be getting Evidence Pulse? -> Sign them up!

Join NODE

Initiatives

The White House's Million Person Precision Medicine Project

TWEET New York Times

"This exciting initiative could change the conversation at home and in the clinic about what "healthy" actually means for the individual. Genetic information can be associated with the real life phenotypes and lifestyles at immense scale, so we can get a sense not just of what genes are there but perhaps how and when genes get switched on or off. This could be the key to modern medicine's Renaissance." -Mike Hoaglin, MD, Duke University Health System, @medmike

Telehealth: Mapping The Evidence For Patient Outcomes From Systematic Reviews

TWEET Agency For Healthcare Research and Quality
JOURNAL Partnership
Digital Medicine Conference 2017

From Innovation to Transformation - Forging the pathway to Evidence-Driven Digital Medicine
2018 Focus Areas

I. Meaningfully Engaging Underserved Population

I. Successful transformation examples from payers and health systems

I. Enabling clinical trials and evidence generation

Click here
Collaborators

**Executive Sponsors:** Bruce Sands, Barbara Murphy, Bruce Darrow, Kumar Chatani

**INTERNAL Collaborators**
HealthPROMISE: IBD Center
IBD Home: Laurie Keefer
Heart Health: Sean Pinney, Robbie Freeman
Hepcure: Ponni Perumalswami, Jeff Weiss
HP Survey: Roxanna Mehran
HealthFlo: Beth Raucher, Andrew Dunn, Julie
HP Allergy: Scott Sicherer
Bladder Cancer: Matt Galsky
Health Hypnosis: Guy Montgomery
Patient Satisfaction: Mona Krouss
eMotivate: Sarah Miller
Bifurcate: Annapoorna Kini
Procedure Bundle: David Greenspan, Brett Bernstein
Care Management: Lisa
Clinical Operations: Abbie Schwartz

**EXTERNAL Collaborators**
Gett- New York State: Mark Thompson
Canada PACE sites: Neeraj Narula
Mc Gill University: Waqqas Afeef
Baystate Health: Rohit Singhania
Yale: Yoeheni Solad
UPMC: Eva Szigethy
Northwestern-Stephen Hanauer

**TEAMS**
DOM: Office of Innovation: Noel Rijo
Mount Sinai Innovation Champions
Clinical Informatics: Bruce Darrow
ehealth Team: Sudipto Srivastava
Big Data Team: Robbie Freeman
Telemedicine: Niyum, Sudipto, Nick Genes
MSIP: Scott Friedman, Erik Lium
CTSA: Janice Gabrilove, Carol Horowitz
Digital Medicine is Digital Medicine

How technology gave Stephen Hawking a voice

Are you ready to create success story, TODAY?
ashish.atreja@mssm.edu & info@nodehealth.org