Operationalizing Longitudinal Virtual Care
Speakers

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Presenter Disclosure Information

Ameya Kulkarni, MD
Nothing to disclose

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Sanjeev Bhavnani is a scientific advisor to Analytics 4 Life and Blumio; consultant to Bristol Meyers Squibb and Pfizer; data safety monitoring board chair at Proteus Digital; has received research support from Scripps Clinic and the Qualcomm Foundation, and is member of the innovation advisory boards at the American College of Cardiology, American Society of Echocardiography, and BIOCOM (all non-profit institutions with all positions voluntary).

Erica S. Spatz, MD, MHS, FACC
Nothing to disclose
Making Virtual Care Vital
Sanjeev Bhavnani MD
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Scripps Clinic & Research Foundation
@SanjeevBhavnani
1. Learn about virtual care and digital health transformation

2. Become familiar with the functionalities of a modern remote monitoring virtual care program

3. Real world evidence examples of hypertension and arrhythmia monitoring

4. Leave knowing that virtual care is an integrated model to improve the quality and costs of care
Virtual Care:

“The tools, processes, and procedures allowing organizations to create, manipulate, and manage patients in an individualized approach using new data sets”

Not just devices and technologies …
Moves from device to data to knowledge and aims to answer clinically meaningful questions leading to improved efficiency and outcomes
Why Virtual Transformation?
The Scope of the Problem

- The average North American above the age of 50 has 2-3 chronic medical conditions.
- This population will rise to 100 million by 2030.
- Cost of > 4 trillion dollars per year.
Smart Ring
Smart Computer
Smartphone Exam
Smart Ring
Smartpill
Smart Skin
Smartphone Ultrasound
Smartphone ECG
Smart Necklace
Smartphone Lab Testing
Smart Genome Sequencing
SmartWatch

Health Technology Assessment

Device Usability → User Factors → Clinical Integration

HTA stakeholders: physicians, non-MD, administration, data science, informatics, business development, patient & caregiver
2017 ACC Roadmap for Innovation

1. Concept and Product Development
   - Feature Iteration
   - Hypothesis Generation
   - New Technology Development
   - Surrogate Assessment

2. Evidence Generation
   - Pragmatic Trials
   - Implementation Science

3. Outcomes Measures
   - Clinical Endpoints
   - Patient Reported Outcomes
   - Cost and Cost Effectiveness

4. Guidelines
   - Levels of Evidence
   - Real World Evidence

5. Performance Measures
   - Scalability
   - Patient and Provider Usability
   - Implementation Factors

6. Adoption and Engagement
   - Real World Adherence
   - Registries
   - Technology Transfer
From Technology → Data → Knowledge

Motivating Example: Virtual Care - Remote Patient Monitoring

Patients & Clinics
- Remote Monitoring

Hypertension & Arrhythmia
- Workflow Innovation

Future Directions
- New Clinical Models

CPT 99091
- Activating Your Clinic

Monitoring Clinical Process
- Quality of Care

From Technology → Data → Knowledge

Motivating Example: Virtual Care - Remote Patient Monitoring

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Hypertension & Arrhythmia
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CPT 99091
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Monitoring Clinical Process
- Quality of Care
Remote Monitoring

Workflow Innovation

Quality of Care

CPT 99091

Health Information Transferred Between Patients and Practitioners

Patient Interpretation

Automated Diagnostic Algorithms

Patient Self Measurements

Internet Cloud-based Data Transfer

Healthcare Practitioner

Practitioner Interpretation
These Are Not Our Patients ...
Our Patients are More Like This ...
✓ Clinical workflows
✓ EMR Integration
✓ Clinical Decision Support
✓ Precision Medicine
✓ Population Medicine
✓ Informatics
✓ Regulation
✓ Reimbursement

✓ Device Designs
✓ Apps
✓ Wearables
✓ Wireless Devices
✓ Sensors
✓ Robotics
✓ Implantables
✓ Handheld Imaging
✓ Interoperability

✓ Patient Generated Health Data
✓ Digital Literacy
✓ Digital Engagement
✓ Digital Retention
✓ Social Media
✓ Senior Care
✓ Caregiver Engagement

Remote Monitoring | Workflow Innovation | New Systems
---|---|---
**CPT 99091** | Quality of Care

<table>
<thead>
<tr>
<th>CPT Code</th>
<th>Description</th>
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| 99091 | Collection and interpretation of physiologic data (e.g., ECG, blood pressure, glucose monitoring) digitally stored and/or transmitted by the patient and/or caregiver to the physician or other qualified health care professional, qualified by education, training, licensure/regulation (when applicable) requiring a minimum of 30 minutes of time, **each 30 days**

*This is one of several RPM CPT codes*

Healthy → Worried Well → Chronic

Post Hospital Stay (Acute) → Post Procedure → Long Term Acute Care → Palliative
99091 - Patient Onboarding

Patient Education in Clinic (face to face) → Device Onboarding → MyChart-HealthKit Flowsheet Ordering → CPT 99453 Initial set-up and education on use of equipment → CPT 99091 monthly review

CPT 99453
Initial set-up and education on use of equipment

CPT 99091
Monthly review
99091 – EPIC MyChart Activation

HealthKit
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<thead>
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<th>Systolic</th>
<th>Diastolic</th>
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<td>83</td>
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<tr>
<td>9:28 PM</td>
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<td>10:12 PM</td>
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<tr>
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<td>117</td>
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<td>70</td>
</tr>
<tr>
<td>4:07 PM</td>
<td>115</td>
<td>68</td>
</tr>
<tr>
<td>8:25 PM</td>
<td>115</td>
<td>67</td>
</tr>
</tbody>
</table>

The graph shows the data in chronological order (4/19/2018 - 5/7/2018).
47 YEAR OLD WOMAN
Family history of IHD
Primary prevention

BP 125

The graph shows the data in chronological order (4/19/2018 - 5/1/2019)

All Care Virtual
Patient Engagement
82 YEAR OLD MAN
Hypertension, DM
Ischemic Heart Disease

BP Remote Monitoring

BP 180

BP <140 in 2 weeks

Increase Meds

BP 130

All Care Virtual

The graph shows the data in chronological order (2/25/2019 - 5/2/2019)
85 YEAR OLD WOMAN
Hypertension, HFpEF
Renal Failure

BP 130

BP 160

*Forgot Meds*

BP 125

All Care Virtual

Hospital – Pneumonia and hypertension

Post Hospital Stay (Acute)

The graph shows the data in chronological order (1/3/2019 - 5/2/2019)
69 YEAR OLD MAN
Paroxysmal AF, Ischemic Heart Disease
45 YEAR OLD WOMAN
Palpitation Monitoring

All ECGs normal over 12 months

All Care Virtual
*Did not require MCT, Holter Monitoring Devices*
Collection & interpretation of digitally stored and transmitted patient generated physiologic data

Summary review of physiologic data

Plan

Total time spent in review of patient generated data of 30 minutes

Monitoring vital metrics (BP control, HF symptoms and QoL), costs of care, ongoing patient engagement
Remote Monitoring → Workflow Innovation → New Systems

CPT 99091 → Quality of Care

**Input**

- Heterogeneous biomedical, clinical, or healthcare data

**Output**

- EHR-agnostic visualization

**Integration with Predictive Models**

- Machine Learning
- Risk Algorithms

**Data Processing**

- Electronic Health Record (EHR) Data
- Biomedical Monitor Data
- Wearable Technology Data

**Data Processing Steps**

- Read Data Into Memory
- De-identify Data
- Clinical Phenotypes (diagnoses and procedure codes)
- Medications (normalized using RxNorm and NDC)
- Laboratory Measurements (normalization and quality control)
- Genomic Profiling (genetic and structural variants)
- Wellness Data (wearable devices and technologies)

**Visualization Tools**

- ggplot2
- gridExtra

**Additional Resources**

- Badgeley M. EHDViz: BMJ OPEN 2016
Welcome back, User

EMR Data
- Blood Pressure
- Respiratory Rate
- Heart Rate
- Weight
- Cholesterol
- HDL
- LDL
- Blood glucose

Fitbit Data
- steps
- distance
- active_minutes
- floors
- calories_burned

Personal Logs
- Weight
- Blood Pressure

Data Updated every 60 seconds

CPT 99091

Quality of Care

Remote Monitoring Workflow Innovation New Systems
Remote Monitoring

Workflow Innovation

New Systems

CPT 99091

Quality of Care

[Images of a control room with multiple screens and monitors, including a close-up of a employee working on a computer with another employee standing nearby.]
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• Leave knowing that virtual care is an integrated model to improve the quality and costs of care
Panel Discussion

**Moderator:** Ameya Kulkarni, MD

- Sanjeev P. Bhavnani, MD
- Erica S. Spatz, MD, MHS, FACC
Telemedicine to Enhance Cardiovascular Care

Erica S. Spatz, MD, MHS
Associate Professor, Section of Cardiovascular Medicine
Yale School of Medicine
June 22, 2020
No disclosures.
Telemedicine: Potential to optimize ambulatory care and reduce health disparities

• Improve patient-centered care
• Enhanced disease management
• Elimination of health disparities

*Opportunity to reimagine high-value ambulatory care
Telehealth Overview: Integration across HealthCare

Tele-ICU
Remotely and continuously monitor patients in the ICU, augmenting bedside clinical insight and care. *InSight Tele-ICU*

Tele-Stroke
Enhance and enable stroke diagnosis by virtually connecting patients and bedside providers with board-certified neurologists. *Tele-Stroke*

Acute Care (Hospital) at Home
Manage post-discharge and critically and chronically ill patients from home utilizing audio/visual and peripheral devices. *Tele- and Asynchronous Specialty Consults*

EHR Identification and Virtual Management
Identify patients not meeting guideline directed therapy, or in need of care management or further support for functional ability and return to work.

Tele- and Asynchronous Specialty Consults
Leverage expert specialty services to triage, assess, and support System and non-System clinicians. *eConsults – outpatient and inpatient*

Video Visits
Urgent care and specialty appointments via audio/visual devices, replacing the need for in-person appointments. *Video Visits*

Condition Management
Coordinate health interventions for high-risk members with CHF, COPD, asthma, diabetes, high-risk maternity and mental health issues. *Condition Management*

Remote Monitoring/Wellness Support
Engage and empower members management of their health through connected medical devices, and mHealth modalities. *Remote Monitoring/Wellness Support*
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Manage post discharge and critically and chronically ill patients from home utilizing audio/visual and peripheral devices.

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Engage and empower members management of their health through connected medical devices, and mHealth modalities.

**EHR Identification and Phenotyping**
Identify patients not meeting guideline directed therapy, or in need of care management or further support for functional ability and return to work.
Hurdles to telemedicine

• Lack of business model: ↓ reimbursement
• IT investment
• Clinician buy-in and training
• Patient capacity – tech access and literacy
• Support staff
COVID: a disaster of Titanic proportions

- Within days/weeks, incumbent to turn this ship
- Defer visits vs convert to telemedicine
## Encounter trends during COVID

### Cardiovascular Medicine

<table>
<thead>
<tr>
<th>Month</th>
<th># Telehealth</th>
<th>In Person</th>
<th>% of Telehealth</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>1246</td>
<td>1869</td>
<td>40.0%</td>
</tr>
<tr>
<td>April</td>
<td>3398</td>
<td>245</td>
<td>93.3%</td>
</tr>
<tr>
<td>May</td>
<td>1956</td>
<td>231</td>
<td>89.4%</td>
</tr>
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</table>

### Yale Medicine

![Video Visit Volume Graph](image-url)
What about for vulnerable populations?
Study of digital uptake in low-income population

AIMS:

• Assess barriers (implementation; attitudes/beliefs) in the uptake of MyChart and a digital health app
• Identify features and adoption supports integral for ensuring success of a digital health intervention
• Assess feasibility and success of a community health worker in supporting digital health uptake

Liu P...Spatz ES, Use of mobile health apps in low-income populations: a prospective study of facilitators and barriers. Accepted for publication: Circ CQO. 2020
Study Design

• Enrolled 80 English- and 50 Spanish-preferred speaking patients
• CHW assisted with MyChart and Hugo (digital health app) downloads, instruction of features and ongoing support in first month
• Bi-weekly surveys sent to participants for 3 months
Implementation barriers

• Phone out of battery
• WiFi connection not strong
• Forgotten passwords – don’t know how to access email
• No storage/memory to download platform
## Beliefs/Attitudes

<table>
<thead>
<tr>
<th>Interested In:</th>
<th>English</th>
<th>Spanish</th>
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<tbody>
<tr>
<td>Owner of health records</td>
<td>&gt;90%</td>
<td>&gt;95%</td>
</tr>
<tr>
<td>View records on phone/device</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Interested in participating in research with their phone</td>
<td>88%</td>
<td>&gt;90%</td>
</tr>
<tr>
<td>Addt’l assistance from community health worker</td>
<td>30%</td>
<td>50%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Concerned about:</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Comfortable sharing data through digital platform</td>
<td>78%</td>
<td>50%</td>
</tr>
<tr>
<td>Concerned about privacy</td>
<td>82%</td>
<td>&gt;90%</td>
</tr>
</tbody>
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## Learnings

<table>
<thead>
<tr>
<th>Feature</th>
<th>Implication</th>
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</thead>
<tbody>
<tr>
<td>Design</td>
<td>Thoughtful design, pilot tests</td>
</tr>
<tr>
<td>Implementation</td>
<td>Address structural needs for digital connectivity; SDOH</td>
</tr>
<tr>
<td>Adoption</td>
<td>Supports (CHWs)</td>
</tr>
<tr>
<td>Value</td>
<td>Patient-reported experiences and outcomes; crossing the digital divide to reduce disparities</td>
</tr>
</tbody>
</table>
Clinical Application

- Cardiology-Pharmacy Blood Pressure Control Program
  - Patients referred to pharmacist for uncontrolled BP
  - Pharmacists assessing CV risk, adherence, implementation barriers
  - Implements remote monitoring of home-blood pressure monitoring
  - Telehealth visits to titrate medications and support lifestyle modifications
Population health-

• Targeting high-risk communities
• Highlighting digital connectivity as a social determinant of health
• Reducing barriers to care
Telemedicine: Opportunity for high-value care

*Business model – reimbursement now at level of in-person visits, but may change in the future

- Improve patient-centered care
- Enhanced disease management
- Elimination of health disparities
Future

- Studies of patient experiences and outcomes
- Identify patients and visit types most appropriate for telemedicine
- Integration of remote monitoring into clinical care
- Re-envision what highly-coordinated, patient-centered ambulatory care looks like 10 years from now