Using a Novel mHealth Platform to Obtain Real-World Data for Post-Market Surveillance: A NEST Demonstration Project

Sanket Dhruva, MD, MHS
Assistant Clinical Professor of Medicine
UCSF School of Medicine
San Francisco VA Healthcare System
Disclosures

• None
Outline

• Evolving regulatory paradigm for medical devices
• Limitations of current mechanisms of real-world evidence generation for devices
• Overview of NEST Demonstration Project
  – Focus on approaches to surmount these limitations
  – Initial results
Evolution of Clinical and Regulatory Research

- Availability of larger, more complex volumes of healthcare data
  + patient-generated data
  + patient-reported data

- FDA is moving towards:
  1. Increasing use of real-world evidence in regulatory decision-making
  2. Life-cycle approach to medical product regulation
Use of Real-World Evidence to Support Regulatory Decision-Making for Medical Devices

Guidance for Industry and Food and Drug Administration Staff

Post-Market Surveillance

• Important to ensure the continued safety and effectiveness of medical devices once they are on the market
  – Passive surveillance
    • Adverse event reporting (MAUDE: Manufacturer and User Facility Device Experience)
  – Active surveillance
    • Post-market studies
    • Medical product registries
Ideal Real World Data Source for Medical Device Surveillance

• Prospectively planned
• Offer continuously updated longitudinal follow-up for a comprehensive set of outcomes
  – Including patient-reported outcome measures and patient-generated data
• Integrate within existing data systems
Challenges for Longitudinal Clinical Data

• Claims Data
  + Ubiquitously available
  – Not collected with the goal of supporting research
  – Complete only if people remain with the same insurer
  – Lack sufficient clinical detail for many outcomes and for risk adjustment
  – Time lag in availability
Challenges for Longitudinal Clinical Data

• Claims Data
  + Ubiquitously available
  – Not collected with the goal of supporting research
  – Complete only if people remain with the same insurer
  – Lack sufficient clinical detail for many outcomes and for risk adjustment
  – Time lag in availability
  – Cannot identify the use of a specific medical device
Challenges for Longitudinal Clinical Data

• Electronic Health Record Data
  + Rich clinical information
    – Not designed to support research
    – Complete only if patients remain in the same health system
    – Rarely include patient-reported outcome measures in a structured format
Challenges for Longitudinal Clinical Data

• Electronic Health Record Data
  + Rich clinical information
  – Not designed to support research
  – Complete only if patients remain in the same health system
  – Rarely include patient-reported outcome measures in a structured format
  – Rarely can identify the specific use of a medical device
Missing Data With Different Health Systems

Pre-Procedure

Device implant or use

Post-procedure
Identifying Medical Devices

• Unique Device Identifier (UDI)
  – Distinct code on device label and packaging
  – Includes both a device identifier and production identifier

• FDA Final Rule for UDI issued in 2012

• However, there has been limited benefit because the UDI is unavailable in administrative claims data and EHRs

Identifying Medical Devices

• Unique Device Identifier (UDI)
  – Distinct code on device label and packaging
  – Includes both a device identifier and production identifier

• FDA Final Rule for UDI issued in 2012

• However, there has been limited benefit because the UDI is unavailable in administrative claims data and EHRs

Demonstration Project

• Opportunity to address the limitations of current paradigms for medical device research in the post-market setting

• Yale / Mayo Clinic Center for Excellence in Regulatory Science and Innovation (CERSI)
  – PIs: Joseph S. Ross, MD, MHS (Yale) and Nilay D. Shah, PhD (Mayo)

• Project support and partnership with FDA and Johnson & Johnson
Project Aim

• To pilot test the feasibility of using a novel mobile health platform to provide real-world data that can be used for post-market surveillance of patients after either bariatric surgery (sleeve gastrectomy or gastric bypass) or catheter-based atrial fibrillation ablation.
Study Logistics

- Total 60 study participants are being enrolled at Yale or Mayo Clinic prior to bariatric surgery or atrial fibrillation ablation
  - 30 at each site
  - 30 for each procedure
- Check-in on first post-procedure day (inpatient)
- Total 8 weeks post-procedure follow-up
- ClinicalTrials.gov identifier: NCT03436082
Inclusion Criteria

• Older than 18 years
• English-speaking
• Has a compatible tablet or smartphone
• Has an email address
• Planned bariatric surgery or atrial fibrillation ablation
Determination of Feasibility

• Describing for the 60 study participants:
  – Enrollment times
  – Patient participation
  – Dropout
  – Obtaining of electronic medical record data
  – Obtaining of pharmacy data
  – Syncing of mobile device data
  – Completion of patient-reported outcome measure questionnaires
  – User satisfaction and burden
Mobile Application: HugoPHR

Aggregates data from 4 different sources:
1. EHRs
2. Pharmacy portals
3. Wearable and sync-able devices
4. Questionnaires / patient-reported outcome measures
Sync For Science Model

People-powered:

People gain access to their electronic health record, pharmacy, and wearable/sync-able device data in the mobile application and asked to sync these with a research database.
Sync For Science Model

People-powered:

- EHR data
- Pharmacy data
- Patient-reported data
- Patient-generated data
Electronic Health Records

• Participants link their portals to the health systems in which they receive care by entering credentials (username and password)
  – Often involves research assistants helping study participants in creating portal accounts

• Hugo PHR currently linked to ~ 600 portals
Electronic Health Records

• Patients with EHRs that are not yet linked can download continuity of care documents (CCDs) and upload them.

• A comprehensive picture can only be obtained if patients link/upload data from different health systems.
  – This will become easier through implementation of FHIR (Fast Healthcare Interoperability Resources) and Blue Button 2.0.
Patients with EHRs that are not yet linked can download continuity of care documents (CCDs) and upload them. A comprehensive picture can only be obtained if patients link/upload data from different health systems. This will become easier through implementation of FHIR (Fast Healthcare Interoperability Resources) and Blue Button 2.0.
Electronic Health Record Data

• Data made available through Continuity of Care Documents

• Differs for each health system, for example:
  – Encounters
  – Medications
  – Lab and imaging results
  – Procedures
  – Clinician notes

• Data pulled from portals to our researcher database on a weekly basis
EHR Data for Our Study

- Co-morbidities
- Duration of hospitalization and complications
- Encounters with a health system for 8 weeks post-procedure
Pharmacy Data

• Participants link their Walgreens and/or CVS portals
  – As with EHR data, this often involves research assistants helping participants create a pharmacy portal

• Data obtained:
  – Active prescription names
  – Dosages
  – Days supply or # dispensed
  – Prescriber information
Patient-Generated Data

• Fitbit to all study participants
  – Activity, heart rate, and sleep data

• Nokia Body digital weight scale to bariatric surgery patients

• AliveCor Kardia Mobile (mobile 1-lead ECG) to atrial fibrillation ablation patients

• Study participants asked to sync these devices once weekly
Patient-Reported Outcome Measures (PROMs)

• Emails sent to study participants with a secure link that can be opened on any device
• Quick PROMs every Monday and Thursday post-procedure for total 10 instances
  – Track post-procedural patient recovery
• Longer PROMs at 1, 4, and 8 weeks related to symptoms specific to each procedure
• Goal: assess if patients respond, if they respond after 1 or 2 reminders, and thoroughness of response
Quick PROMs

• Bariatric surgery patients
  – Appetite & pain

• Atrial fibrillation ablation patients
  – Palpitations & pain
Quick PROMs Screenshots

CI Short Survey

Do you have any pain?
- Yes
- No

Next

How would you rate your pain?
- 1 2 3 4 5 6 7 8 9 10
- Mild
- Severe

Next

Do you have an appetite?
- Yes
- No

Next

How strong is your appetite?
- 1 2 3 4 5 6 7 8 9 10
- Weak
- Strong

Finish
Longer PROMs

• Bariatric surgery patients
  – PROMIS questions related to global health, gastroesophageal reflux, nausea/vomiting, diarrhea, constipation, and sleep

• Atrial fibrillation ablation patients
  – Cardiff Cardiac Ablation (C-CAP) 1 pre-procedure
  – Cardiff Cardiac Ablation (C-CAP) 2 post-procedure
  – PROMIS questions related to global health, dyspnea, and fatigue

Syncable Devices
• Activity, including ambulation, and heart rate (Fitbit)
• Weight (Nokia Body Scale)
• Single Lead ECG (Kardia Mobile)

Electronic Health Records
• Encounters
• Vital signs
• Lab results
• Test results
• Diagnoses
• Medications
• Procedures
• Notes

Patient Reported Outcome Measures (PROMs)
• Short questionnaire sent every Monday and Thursday a total of 10 times immediately post-procedure
• Longer questionnaires collected at baseline, 1, 4, and 8 weeks post-procedure

Pharmacy Records
• Active prescription names
• Formulations and dosages
• Days supply or # dispensed
• Prescriber
Close Out Survey

• How was your overall experience using this technology (open-ended)?

• How was the experience of answering questions (open-ended)?
Progress To Date

• Significant enthusiasm from specialists and support from their staff

• Significant satisfaction from study participants, who generally find the process easy

• Mean total enrollment time: 1 hour 11 minutes (Range: 40 mins to 3 hours)

• 53 patients enrolled
  – 30 bariatric surgery (15 Yale, 15 Mayo)
  – 23 atrial fibrillation ablation (10 Yale, 13 Mayo)

• 44 patients completed entire 8-week study (26 bariatric surgery, 18 ablation)
Linking EHR and Pharmacy Portals

• 34 of 53 patients with primary care based at Yale or Mayo
  – 11 patients have linked additional portals from other health systems
  – Total 12 portals linked to the study

• 20 of 53 patients with connected CVS or Walgreens pharmacy accounts
  – Other patients using smaller local pharmacies, mail order pharmacies, Yale Health, or grocery stores
PROM Metrics
(as of 6/25/18)

- 329 “quick” PROMs sent out, 247 completed
- 34 “regular” 1-week PROMs sent, 25 completed
- 16 “regular” 4-week PROMs sent, 10 completed
- 11 “regular” 8-week PROMs sent, 9 completed
- All but 2 patients have responded to at least 1 follow-up PROM
- 10 of 19 cardiac study participants have synced their Kardia Mobile devices on a weekly basis
  - 3 patients have additional syncs, though not consistently weekly
Next Steps

• Complete enrollment and follow-up

• Commence analyses
  – Aggregating data across the various sources
  – Verifying with Yale and Mayo Clinic EHR:
    • Encounter date, encounter type, and primary diagnosis
    • Any missing visits or diagnoses and medications

• Share final summary-level results with study participants
Thank You!

• Questions?