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

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# Disclosures

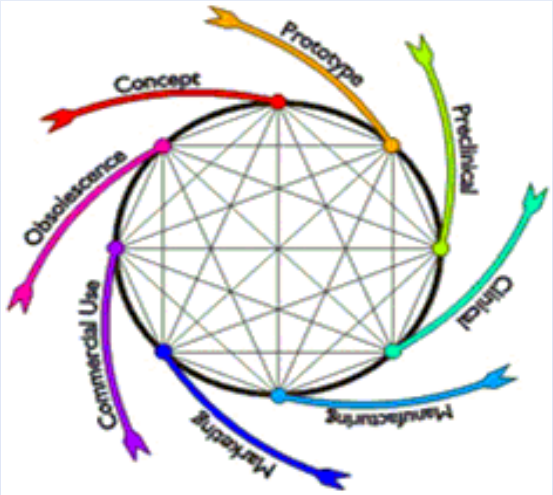
- None

# 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

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# Guidance for Industry and Food and Drug Administration Staff

**Document issued on August 31, 2017.**

# 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

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  - – **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

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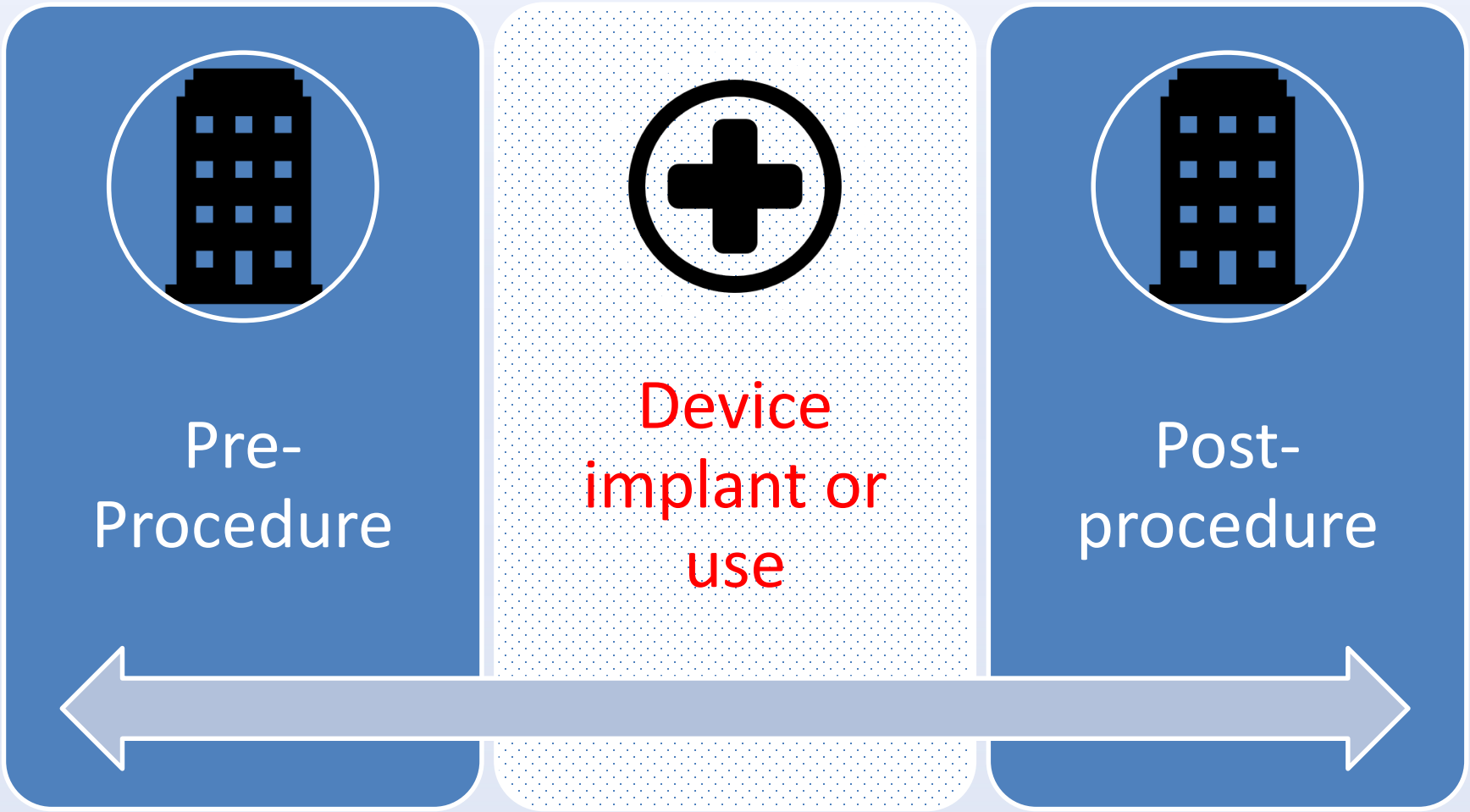
  - – **Rarely can identify the specific use of a medical device**

# Missing Data With Different Health Systems



# 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

Dhruva SS, Ross JS, Schulz WL, Krumholz HM. *Ann Intern Med* 2018.

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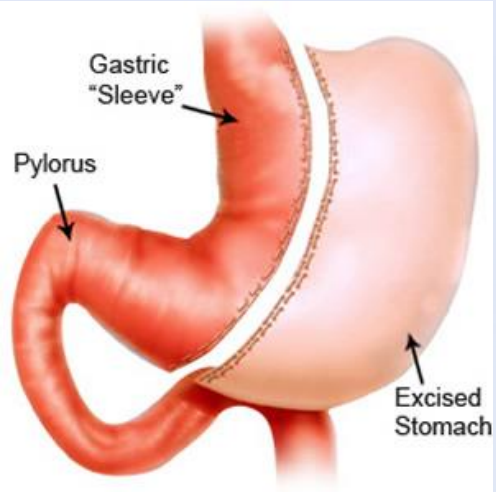
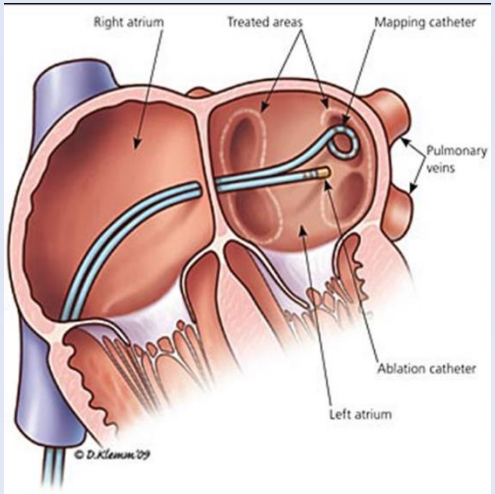
# Demonstration Project

- 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

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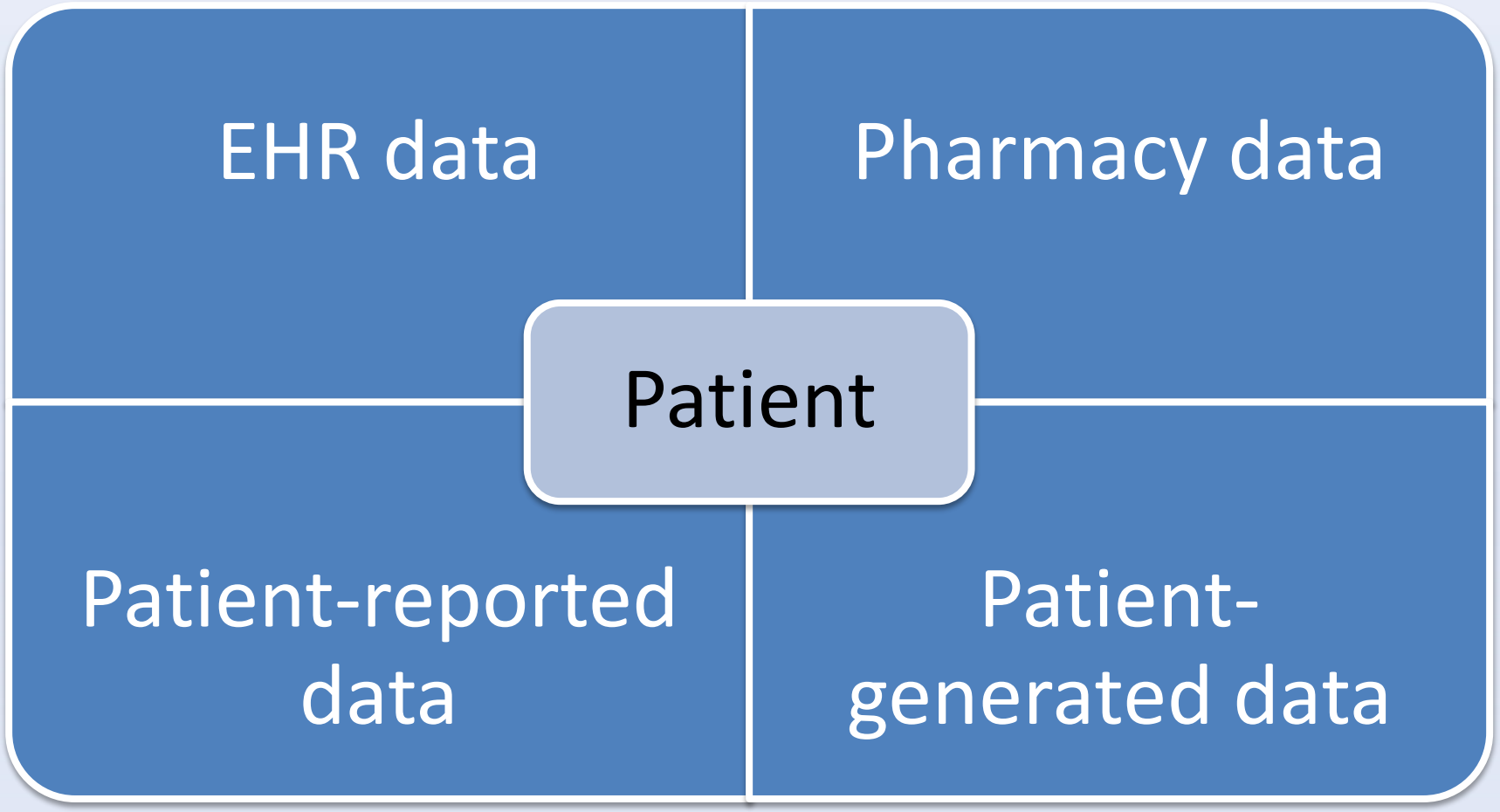


# Electronic Health Records

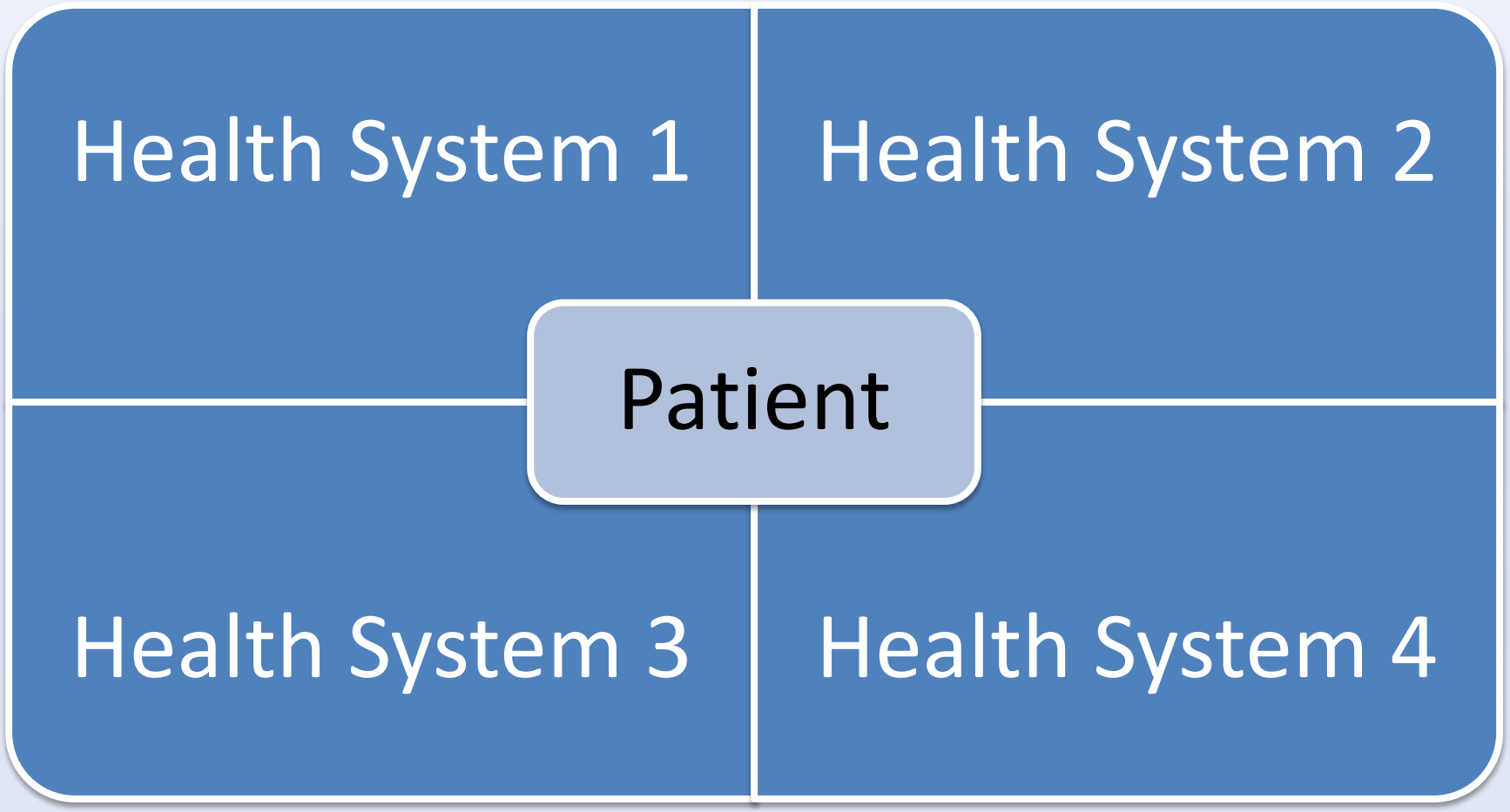
- Participants link their portals to the health systems in which they receive care by entering credentials (username and password)
  - Often involves research assistants helping study participants in creating portal accounts
- Hugo PHR currently linked to ~ 600 portals

# 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

# Electronic Health Records




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

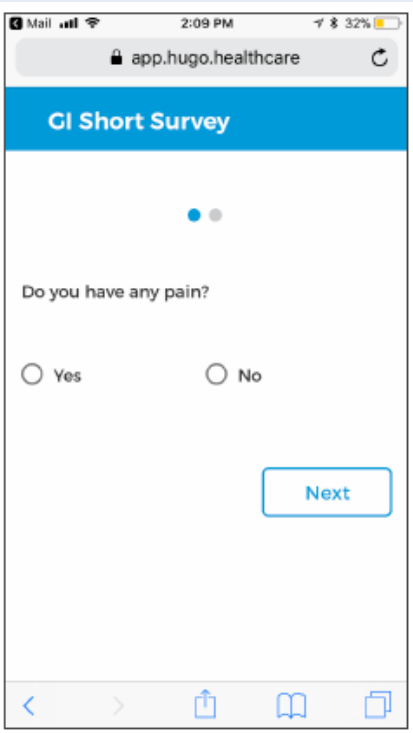
# Patient-Reported Outcome Measures (PROMs)

- 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

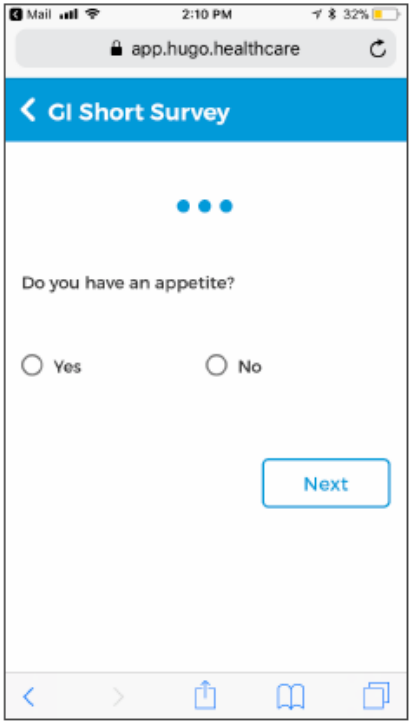
# Quick PROMs

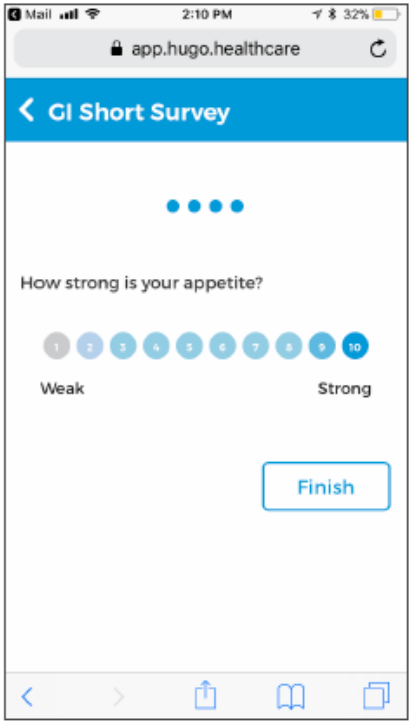
- Bariatric surgery patients
  - Appetite & pain
- Atrial fibrillation ablation patients
  - Palpitations & pain

# Quick PROMs Screenshots







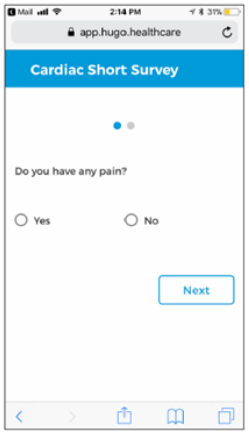
# Longer PROMs

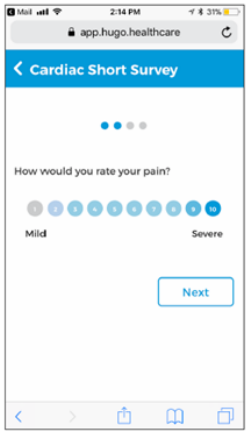
- Bariatric surgery patients
  - PROMIS questions related to global health, gastroesophageal reflux, nausea/vomiting, diarrhea, constipation, and sleep
- Atrial fibrillation ablation patients
  - Cardiff Cardiac Ablation (C-CAP) 1  pre-procedure
  - Cardiff Cardiac Ablation (C-CAP) 2  post-procedure
  - PROMIS questions related to global health, dyspnea, and fatigue

White J, Withers KL, Lencioni M, et al. *Qual Life Res* 2016.

## 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
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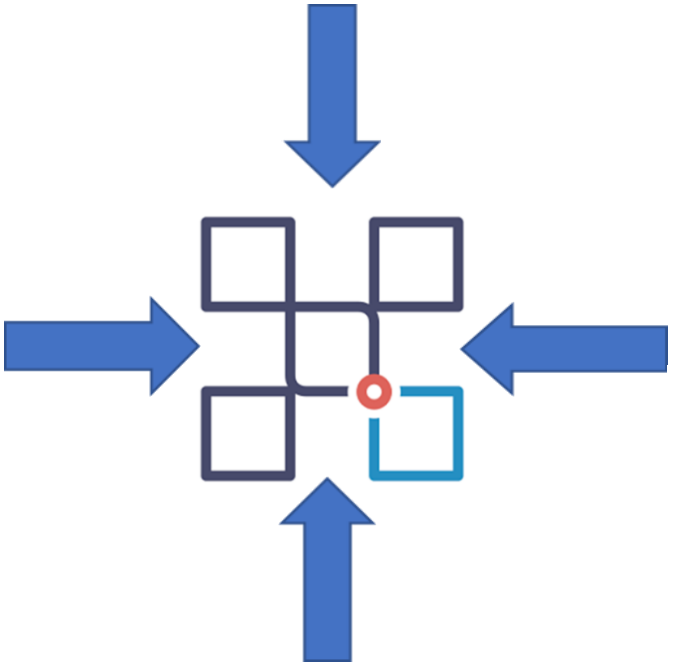




## Syncable Devices

- 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

# 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?