Goal: Enhance electronic platform for PROMs collection at academic medical center

- Used formal human-computer interaction (HCI) techniques in academic medical center IT operations
- Ensure PROMs are usable, efficient, and acceptable to clinicians and patients
  - Legacy instruments in orthopedics already being used (Qualtrics, not integrated into EHR): HOOS, KOOS, ODI, etc
- Include PROMIS computer adaptive instruments (CAT)
- Allow for data pulls for research
- Provide real-time PROMs integration into EHR
Interdisciplinary project team

NYU Langone Health MCIT Digital Solutions Team
- Implementation team – technical and user experience design

Orthopedic Surgery
- Champions: Department of Orthopedic Surgery
  - Wanted Computer Adaptive question bank to save patient time
  - Wanted real-time access to scores in EHR

MCIT Digital Solutions Team

PROMs implementation team

Population Health

Clinical Research Informatics
- Facilitate project across clinical departments, research, IT

Department of Population Health
- Research focus
PROMs Implementation

- **Patients** complete assessment via MyChart prior to appointment or on tablet in waiting room
- **Staff** rely on system logic to assign PROMs to patients and use Epic-integrated QR code to provision registration tablet
  - Already had paperless registration and tablets for legacy PROMs
- **Providers** view scores, PROM Q&As, interpretation in Hyperspace in real time
- **Patients** view scores in MyChart in real time
- REDCap used for administering PROMs and de-identified data storage
- **Researchers** obtain data pulls of PROMs plus clinical data from Epic Caboodle
PROMIS API & REDCap API integrated in NYU PROMs Application

- All assessments configured in REDCap
- If CAT assessment, instrument name is compared against PROMIS API
  - If a match, CAT instrument is executed over PROMIS API
- Final responses and scores are validated against REDCap metadata
- Answers given to matching instruments are imported into Oracle database, saved to REDCap and Epic
  - Data in REDCap remain de-identified for research purposes
  - Data in Epic saved in flowsheets accessible in Hyperspace
  - Oracle database maintains patient identifier linkages to MRN and encounter-ID (CSN)
Advantages of setting up PROM Assessments in REDCap + Epic

- Leverage the REDCap Shared Library to import instruments, including PROMIS CAT measures
- Once a particular instrument has been mapped to a flowsheet, that instrument can be added to any number of assessments/questionnaire batteries
- Translated versions of instruments can be mapped to the English flowsheet rows for provider use of data
PRO data integrated into Epic flowsheets

• Data stored in flowsheets become part of EHR (real time)

• Flowsheet data can be retrieved by providers using note templates or via Synopsis Reports

• Flowsheet data are available in Caboodle and other Epic data warehouse for research (day-long delay)
Assigning PROM Assessments

• Assessments can be assigned by:
  • Provider, Service line
  • Visit Type
  • Location (coming soon)

• Assessment assignments can be further refined by:
  • Age
    • Parent/caregiver Proxy (age 5-12)
    • Pediatric (age 13-17)
  • Language
Daily reports assess compliance

• Staff training of utmost importance to get check-in process and assessments completed
• Staff can document reason for non-completion by patient, included in daily report
• Daily email report of total patients, assessments completed, partially completed, completion time, and by mechanism (i.e., tablet, home)
Focus on optimizing user experience (UX)

- Interviews with Epic “super users” at NYU Langone Health
- Workgroup with orthopedic surgery faculty to ascertain preferences for data visualization
- Used rapid-cycle design, full team meetings bi-weekly
- Incorporated user feedback throughout all stages of development (usability testing) including prototypes
  - Patients, Staff (Front desk staff, Medical Assistants)
  - Providers, Researchers
Physician data access

• Data visualization is large focus
• Fewest “clicks” as possible to view
• Context for PROMs scores given
  • National norm, age norm, gender norm
  • Patient over time
PRO Data Dashboard in Epic

Patient Reported Outcome Measures

Graphs on the Left:
Ideal or improved scores increase in value along Y-axis.

- KOOS Pain (Right Knee)
- MDHQ - Pain
- KOOS Symptoms (Right Knee)

Graphs on the Right:
Ideal or improved scores decrease in value along Y-axis.

- Pain Intensity (PROMIS)
PRO Data Display

- Physical Function (PROMIS)
  - Score: 73.36  
  - Date: 8/29/17
  - Score: 49.76  
  - Date: 9/11/17

- Pain Interference (PROMIS)
  - Score: 60.34  
  - Date: 9/11/17

- EQSD
  - Score: 0.6  
  - Date: 8/31/17
  - Score: 0.71  
  - Date: 9/5/17
  - Score: 0.6  
  - Date: 9/11/17

- Quick DASH (Right)
  - Score: 25  
  - Date: 9/5/17
PRO Data Display: Hover detail

- **Physical Function (PROMIS)**

  - Score
  - 73.35
  - 49.76

- **50 is the mean**
- **Physical Function - Gender Norm:** 61
- **Physical Function - Age Norm:** 30
- **Physical Function - Population Norm:** 57
Advantages of PROM Assessment Platform over existing tools (e.g., MyChart questionnaires, legacy Qualtrics portal)

- Real-time Epic integration with improved features for staff and providers
- Improved user experience
- Improved reporting
- Data for research (incl randomized order of assessments)
- Customizability
Future Plans

• Rollout to other divisions and clinical departments
• **Governance** rules across enterprise
• Include surgical history context in provider dashboard
• Assign assessments in MyChart as planned series
  e.g., 3 month follow-up, 6 month, etc.
• Enhance branching logic to assign assessment based on answer to a previous question
• Provide more languages for assessments
  • Chinese, Arabic, Russian
NYU Langone Health MCIT: Alissa Link, Rachel Lebwohl, Long Zhao, Meredith Blake, Ben Weinstein, Huming Tang, Bebeto Jefry, Sony Sebastian, Anokh Vijayakumaran, Tom Thliveris

Dept of Population Health +/- Clinical Informatics: Heather T. Gold, Devin Mann, Michael Cantor

Dept of Orthopedic Surgery: Raj Karia, Joseph Zuckerman, Thomas Errico, James Slover, Aaron Buckland
Detail slides
Setting up PROM Assessments in REDCap + Epic

1. Use REDCap Online Designer and/or data dictionary to build and configure questionnaires
2. Download REDCap data dictionary and share CSV file with Epic analysts
3. Epic analysts build flowsheet templates and flowsheet rows that correspond with each data element (e.g., individual questions, summary scores)
4. Epic flowsheet template ID and flowsheet row ID are saved back to the REDCap data dictionary in the Field Annotation column
5. PROMs are collected and saved in REDCap, with a Symfony layer that optimizes the patient experience of completing the assessment on any device
<table>
<thead>
<tr>
<th>Front Stage Interactions</th>
<th>Back Stage Interactions</th>
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| 1. Staff click a button in the Epic registration module that opens a QR code in the side bar | 1a. Button creates a hyperlink with encrypted MRN + CSN, which is passed to Symfony web app and decrypted  
1b. Epic web service calls look up provider name, department, visit type, age and language based on MRN + CSN, and assign correct assessment |
| 2. Staff scan the QR code with the tablet app and loads the patient’s assessment         | 2a. Symfony web app retrieves questions and answer choices using REDCap and PROMIS APIs  
2b. Oracle database stores REDCap Record ID, plus MRN and CSN                              |
| 3. Patient completes assessment via tablet                                              | 3a. Symfony web app writes data to REDCap  
3b. Based on REDCap / flowsheet mapping, data are written to flowsheets via web service upon completion of each instrument  
3c. After PROMIS instruments are scored, age and gender are used to look up percentile scores, which are saved to both REDCap and Epic |
Health Assessment Instruments I

**Spine**
- EQ-5D
- ODI - back pain
- NDI - neck pain
- SRS22 - scoliosis
- PROMIS Physical Function (CAT)

**Total Joint**
- EQ-5D
- HOOS Jr -hip
- KOOS Jr -knee
- ASES -Shoulder
- Mayo Elbow -elbow
- Quick Dash -hand/wrist
- PROMIS PF Upper Extremity (CAT)
- PROMIS PF Mobility (CAT)

**All**
- PROMIS Pain Intensity (SF)
- PROMIS Pain Interference (CAT)

**Sports**
- EQ-5D
- HOOS Jr -hip
- KOOS Jr -knee
- IKDC -knee
- Marx Activity Scale - knee
- ASES -Shoulder
- Mayo Elbow -elbow
- Quick Dash -hand/wrist
- PROMIS PF Upper Extremity (CAT)
- PROMIS PF Mobility (CAT)
Health Assessment Instruments II

Rheumatology

• EQ-5D
• MDHAQ
• HOOS - hip
• KOOS - knee
• ASES -Shoulder/elbow
• Mayo Elbow -elbow
• Quick Dash -hand/wrist
• BASDAI - (Ankylosing Spondylitis, Psoriatic Arthritis)
• LupusQoL
• PSAID12 -(Psoriatic Arthritis)
• PROMIS Physical Function (CAT)
Spine Assessment Flow

- **EQ-5D + VAS**
- **4 Pain Questions + Chief Complaint**
- **Scoliosis or Kyphosis**
- **Back Pain**
- **Neck Pain**
- **I don't know**
- **Other**

Legend:
- All patients complete

1. **Back Pain**
   - 1 ODI
   - 0 NDI

2. **Scoliosis or Kyphosis**

3. **Pitching Forward (hunched over)**

4. **SRS 22r**

5. **PROMIS Physical Function (CAT)**

6. **PROMIS Pain Intensity (SF)**

7. **PROMIS Pain Interference (CAT)**

End

- Lowest total number of questions = 33
- Average number of questions = 38
- Highest total number of questions = 47
Sports Assessment Flow

Chief Complaint

- Hip
  - HOOS Jr
- Knee
  - KOOS Jr
  - IKDC
  - Marx Activity
- Shoulder
  - ASES
- Elbow
  - Mayo Elbow
- Hand/Wrist
  - 2
- Foot/Ankle
  - 2
- Other

EQ-5D + VAS

PROMIS Physical Function – Upper Extremity (CAT)

PROMIS Physical Function – Mobility (CAT)

PROMIS Pain Intensity (SF)

PROMIS Pain Interference (CAT)

Total = 43

End