



Technical Evaluation of Implementing Patient-reported Outcomes Measures into an Electronic Health Record

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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

Clinical Research Informatics

Department of Population Health

- Research focus

PROMs Implementation

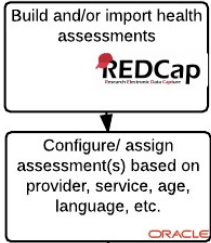
- **Patients** complete assessment via MyChart prior to appointment *or* on tablet in waiting room
- **Staff** rely on system logic to assign PROMs to patients and use Epic-integrated QR code to provision registration tablet
 - Already had paperless registration and tablets for legacy PROMs
- **Providers** 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

CONFIGURE

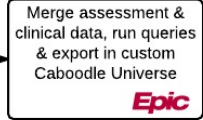
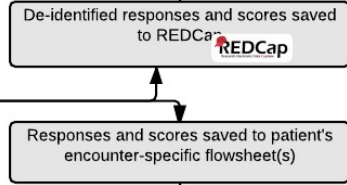
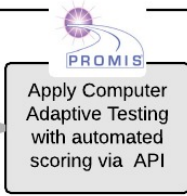
COLLECT

UTILIZE

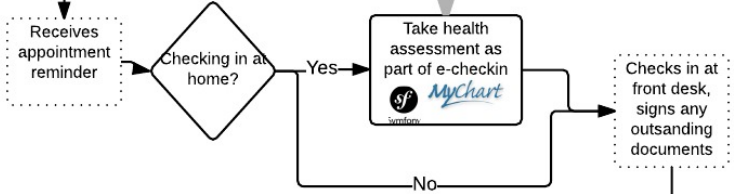
Research & Admin Config



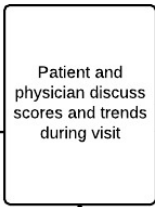
System



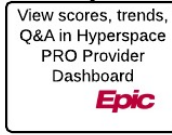
Patient



Front Desk



Provider



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

MyChart, PROMIS
31 y.o., Female, 09/01/1986
MRN, CSN: 10021495, 496686192
Pref Language, Need Interp: **English, No**

Allergies: Unknown: Not on File
PCP: None
Health Maintenance: **Due**

Primary Ins.: None
MyChart: Active

Code Not on file

Recruiting OK?: Yes
Patient Messages: None

Registries: None
My Sticky Note: 📌

PRO DATA

Patient Reported Outcome Measures

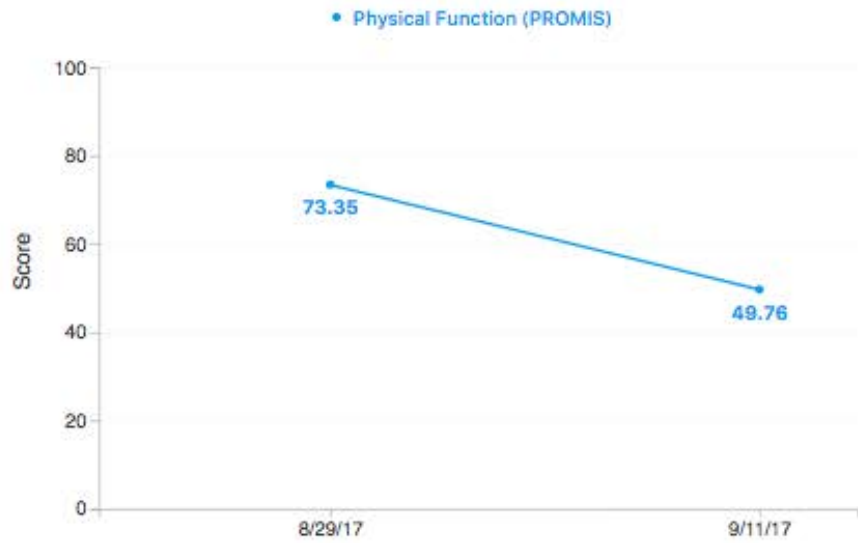
GRAPHS ON THE LEFT
Ideal or improved scores increase in value along Y-axis.

GRAPHS ON THE RIGHT
Ideal or improved scores decrease in value along Y-axis.

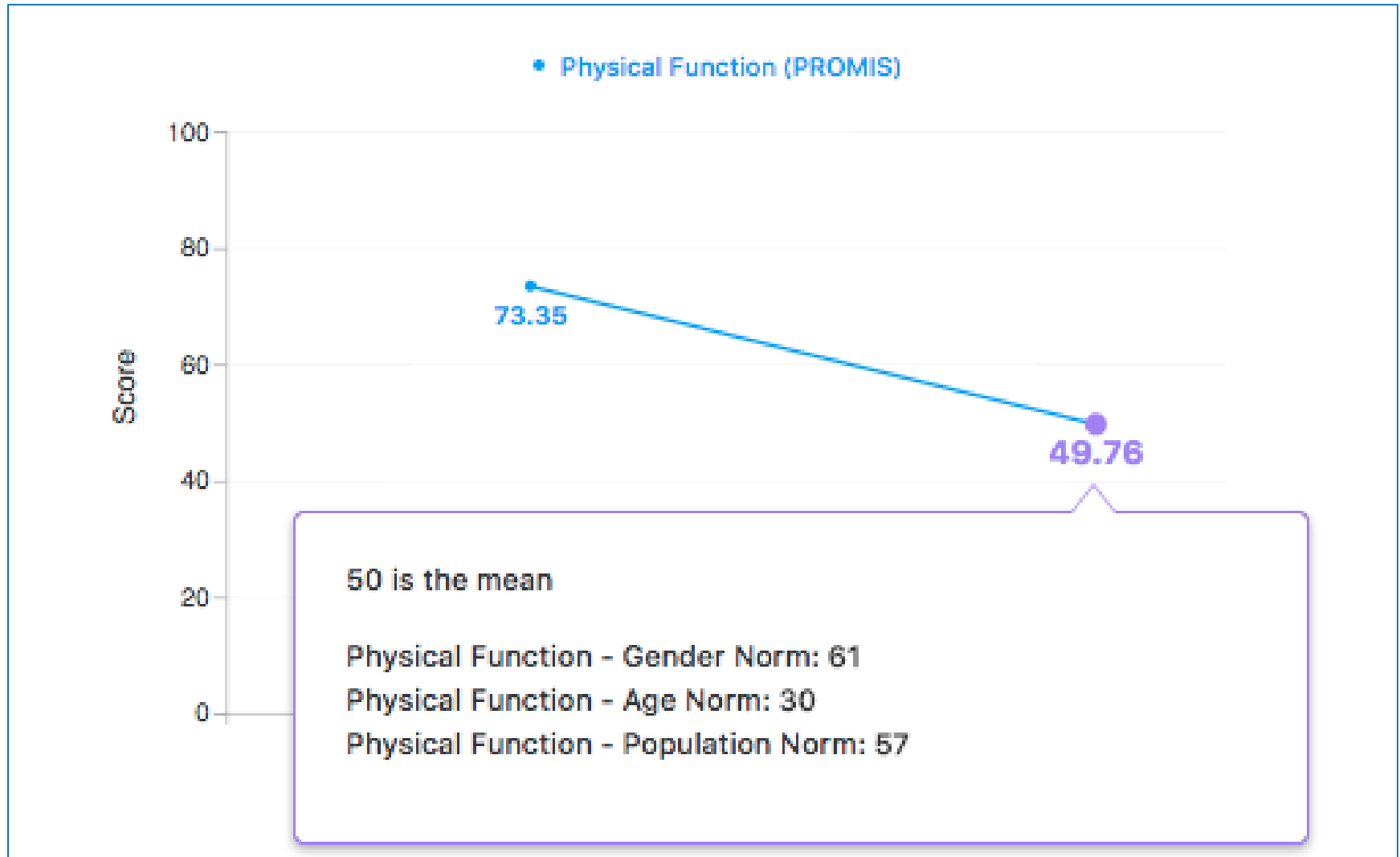
Measure	Score	Date
KOOS Pain (Right Knee)	75	9/11/17
Pain Intensity (PROMIS)	42.62	9/11/17

PHYSICIAN I. 121 Results Canceled/Changed Orders Pt Reminder My Incomplete Notes My Open Charts My Open Encounters Overdue Results Letter Queue Referral Notification Chart Completion My Unsigned Orders 2:16 PM

PRO Data Display



PRO Data Display: Hover detail



Advantages of PROM Assessment Platform over existing tools

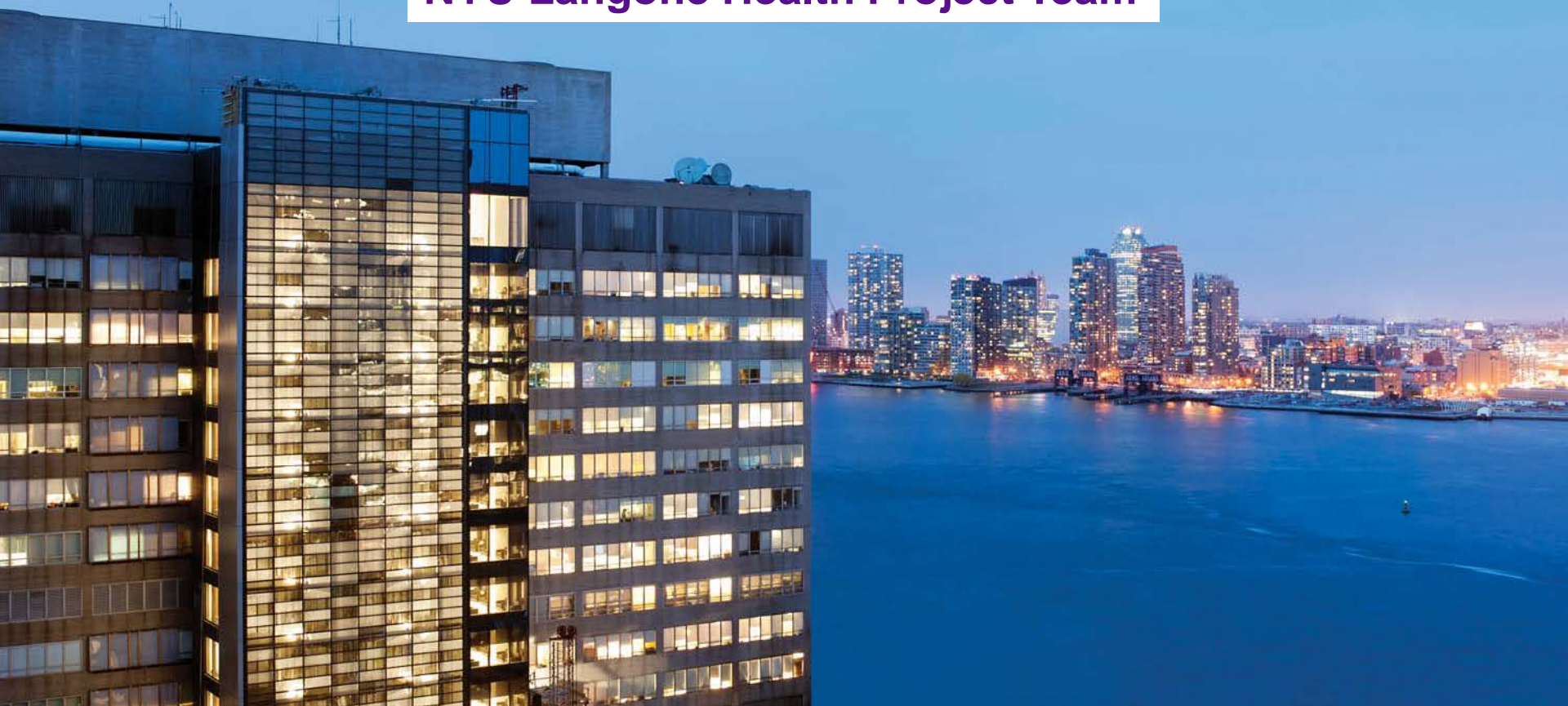
(e.g., MyChart questionnaires, legacy Qualtrics portal)

- 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 Project Team



NYU Langone Health MCIT: Alissa Link, Rachel Lebwohl, Long Zhao, Meredith Blake, Ben Weinstein, Huming Tang, Beбето 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 Symphony layer that optimizes the patient experience of completing the assessment on any device

Front Stage Interactions	Back Stage Interactions
<p>1. Staff click a button in the Epic registration module that opens a QR code in the side bar</p>	<p>1a. Button creates a hyperlink with encrypted MRN + CSN, which is passed to Symphony 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</p>
<p>2. Staff scan the QR code with the tablet app and loads the patient's assessment</p>	<p>2a. Symphony web app retrieves questions and answer choices using REDCap and PROMIS APIs 2b. Oracle database stores REDCap Record ID, plus MRN and CSN</p>
<p>3. Patient completes assessment via tablet</p>	<p>3a. Symphony 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</p>
<p>4. Provider views scores in Hyperspace via Synopsis Report</p>	<p>4. Synopsis Report pulls longitudinal data from a given flowsheet row/ template</p>

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

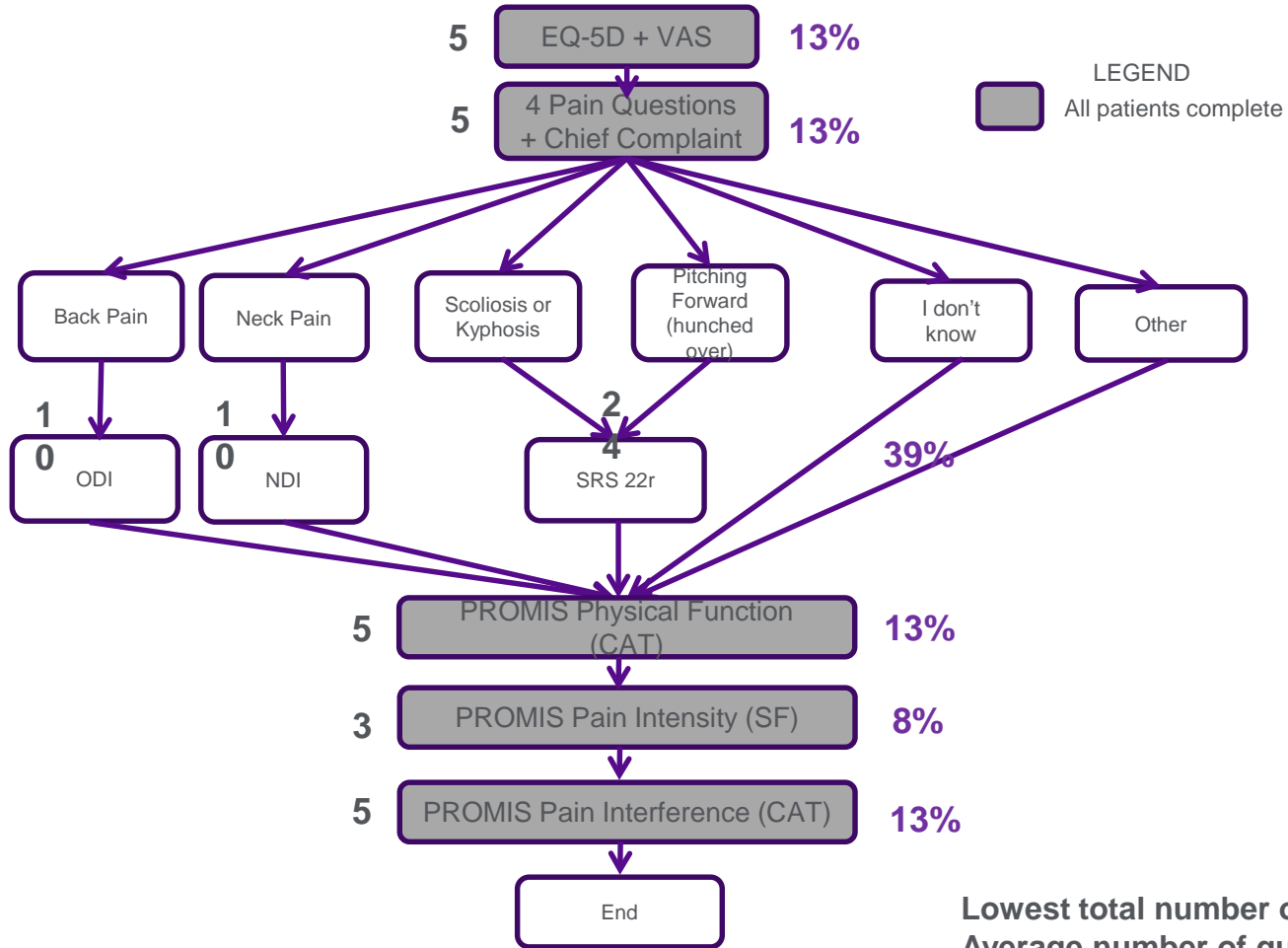
- EQ-5D
- HOOS Jr -hip
- KOOS Jr -knee
- IKDC -knee
- Marx Activity Scale - knee
- ASES -Shoulder
- Mayo Elbow -elbow
- Quick Dash -hand/wrist
- PROMIS PF Upper Extremity (CAT)
- PROMIS PF Mobility (CAT)

Health Assessment Instruments II

Rheumatology

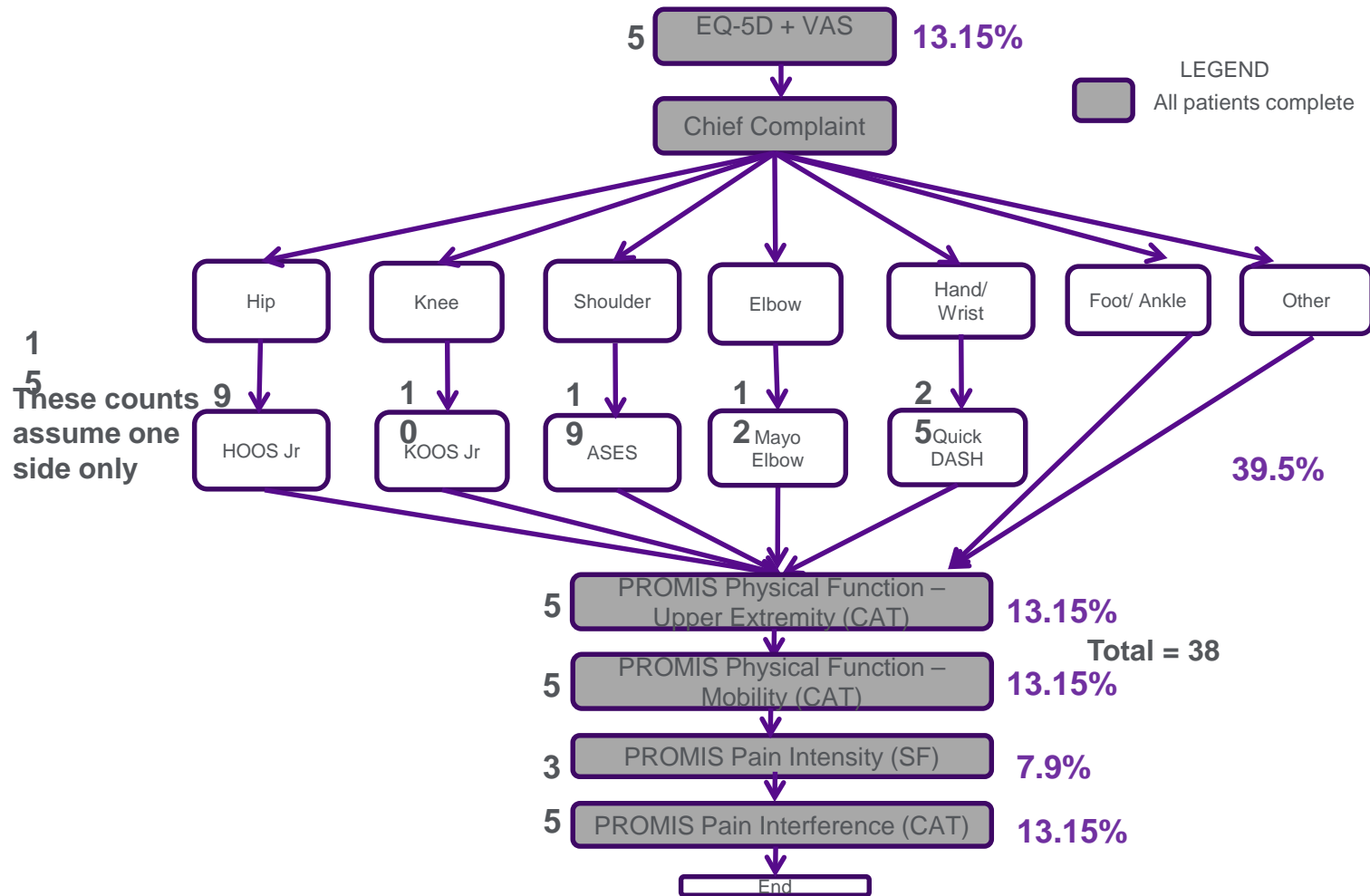
- EQ-5D
- MDHAQ
- HOOS - hip
- KOOS - knee
- ASES -Shoulder/elbow
- Mayo Elbow -elbow
- Quick Dash -hand/wrist
- BASDAI - (Ankylosing Spondylitis, Psoriatic Arthritis)
- LupusQoL
- PSAID12 -(Psoriatic Arthritis)
- PROMIS Physical Function (CAT)

Spine Assessment Flow

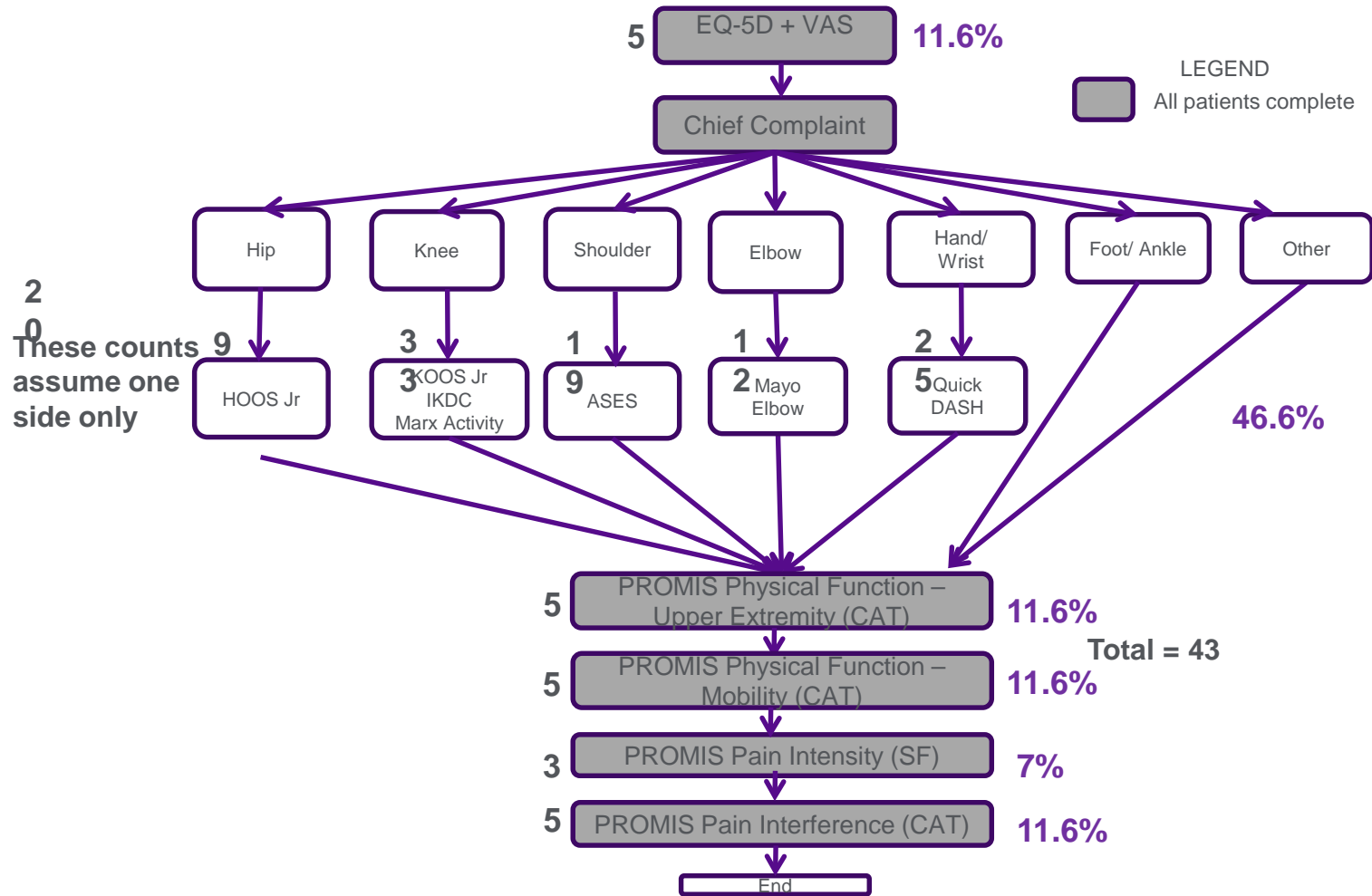


Lowest total number of questions = 33
Average number of questions = 38
Highest total number of questions = 47

Total Joint Assessment Flow



Sports Assessment Flow



CMC Rheumatology Patient Reported Outcomes (PRO) Workflow

30

