

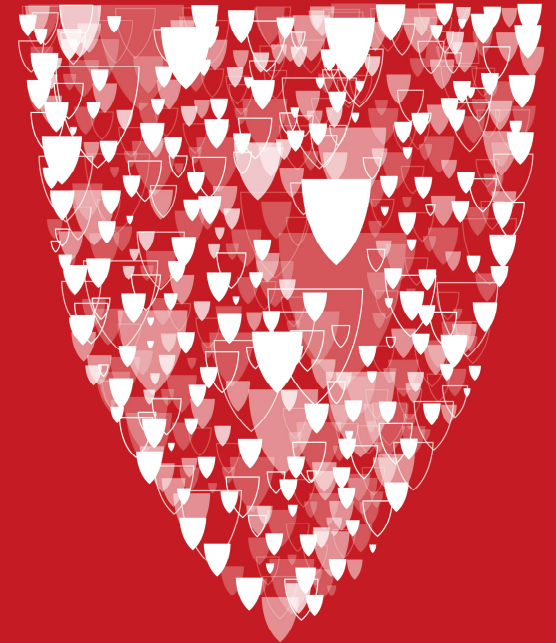
Advancing Evidence-Based Whole Health and Inspiring Stakeholders by Leveraging Electronic Health Records, Patient-Reported Outcomes, and Data Science

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2. Department of Population and Quantitative Health Sciences, Case Western Reserve University School of Medicine
3. Department of Medicine, University of California – Irvine
4. Susan Samueli Integrative Health Institute, University of California – Irvine
5. Osher Center for Integrative Health, Vanderbilt University Medical Center

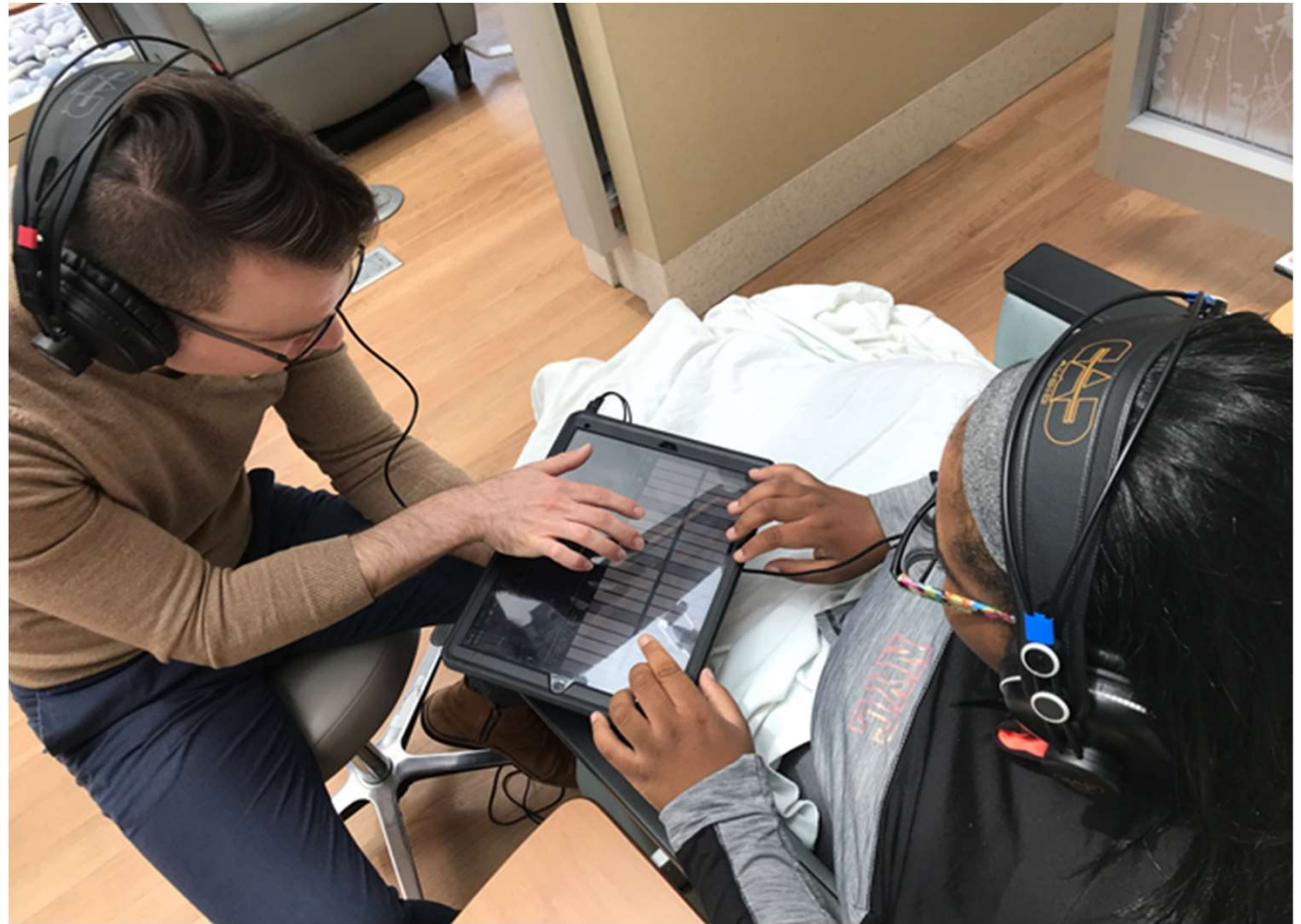


Overview

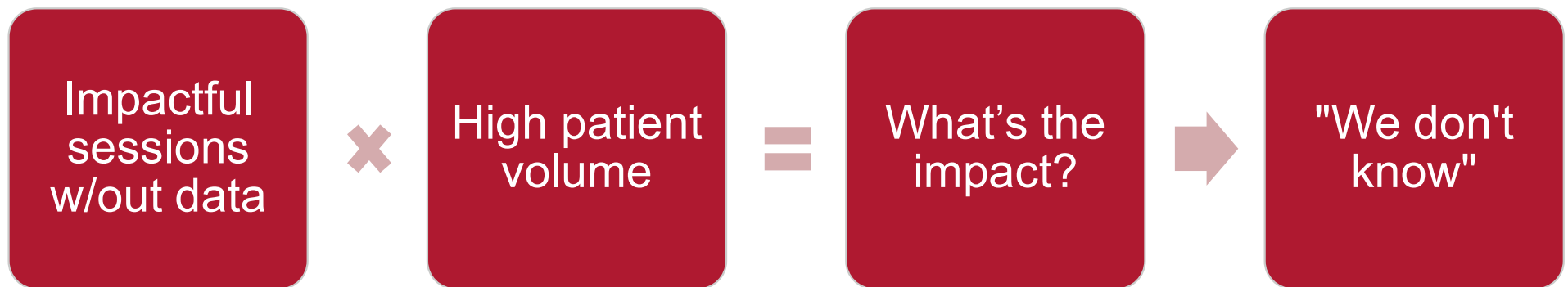
- Value of data across the patient-care continuum.
- Strategies for collecting and extracting data efficiently using
 - Electronic health records
 - REDCap
 - Statistical packages
- Examples from practice-based research
- Future directions



Data at the patient level



What happens if we don't collect data?



Expressive Therapies Patient-Reported Outcomes

Please circle the number that best describes how you are feeling NOW:

Wellbeing (how you feel overall)

Worst possible 0 1 2 3 4 5 6 7 8 9 10 Best possible

Coping (ability to deal with difficult situation)

Not well at all 0 1 2 3 4 5 6 7 8 9 10 Very well

Pain

None 0 1 2 3 4 5 6 7 8 9 10 Worst possible

Tiredness (less energy, fatigue)

None 0 1 2 3 4 5 6 7 8 9 10 Worst possible

Anxiety (worry or being nervous)

None 0 1 2 3 4 5 6 7 8 9 10 Worst possible

Depression (feeling sad or blue)

None 0 1 2 3 4 5 6 7 8 9 10 Worst possible

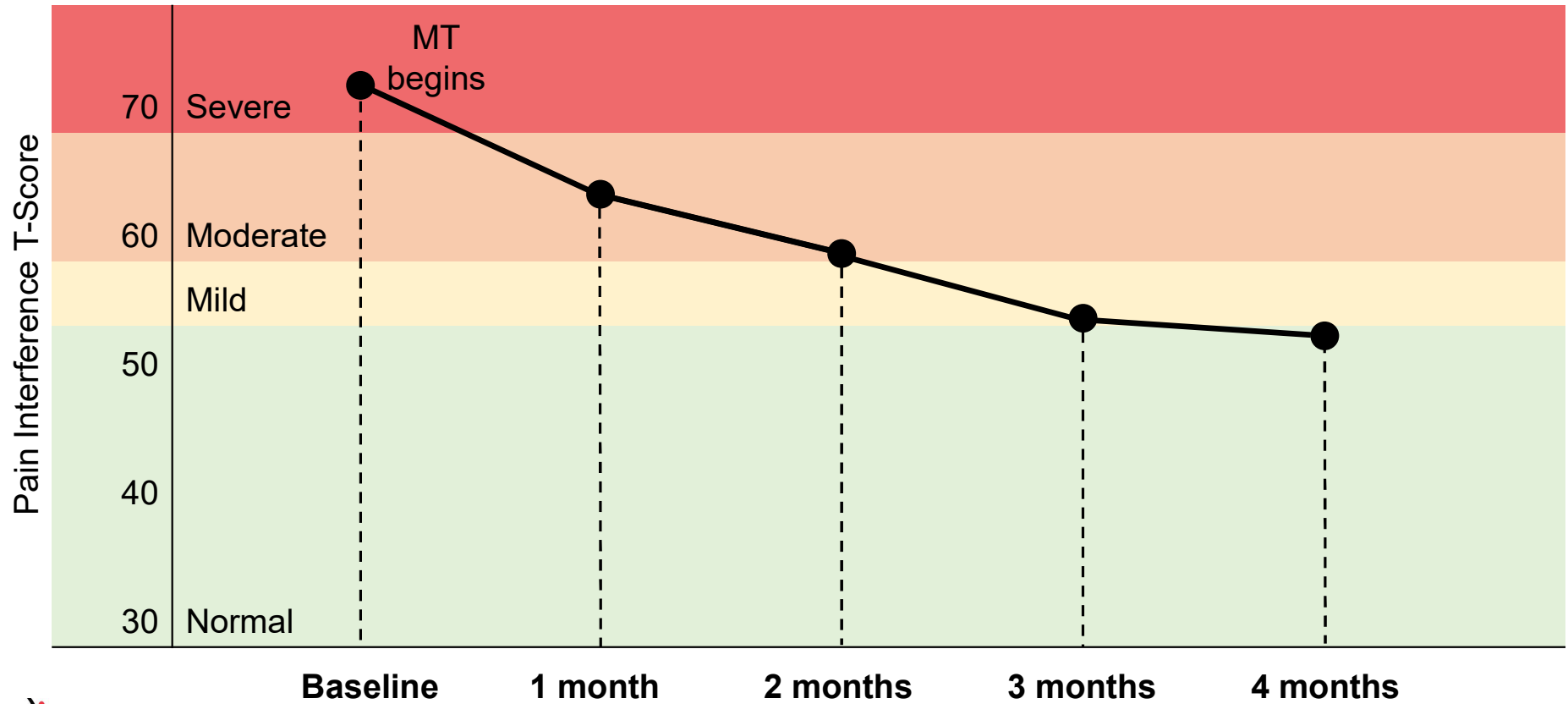
Stress (unpleasant reaction to situation)

None 0 1 2 3 4 5 6 7 8 9 10 Worst possible

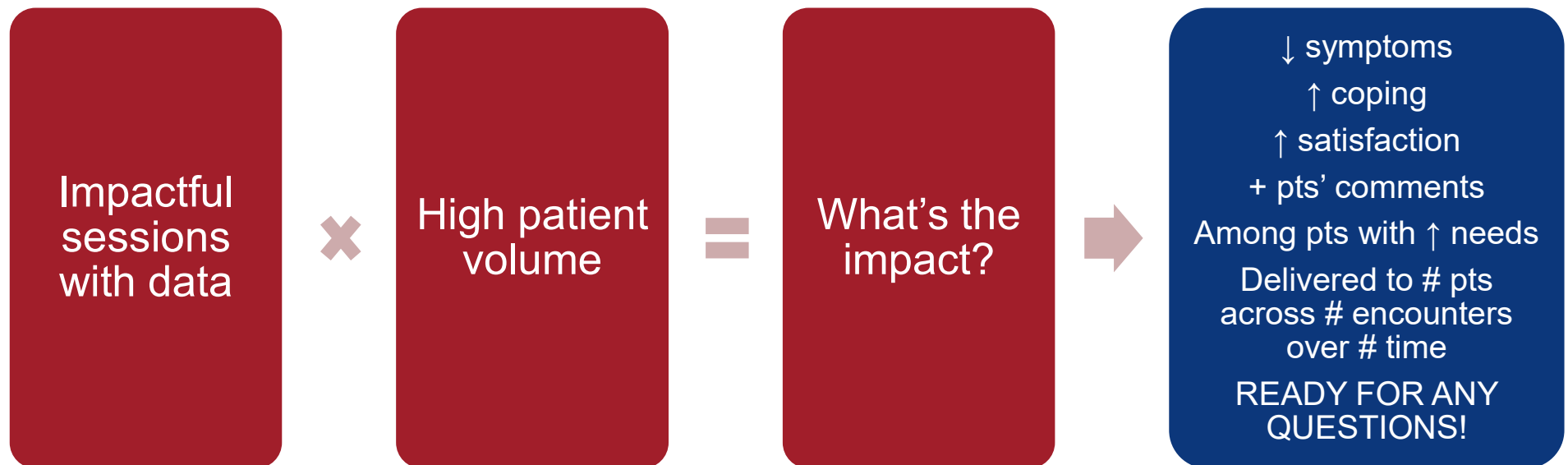


Photo credit – The Plain Dealer

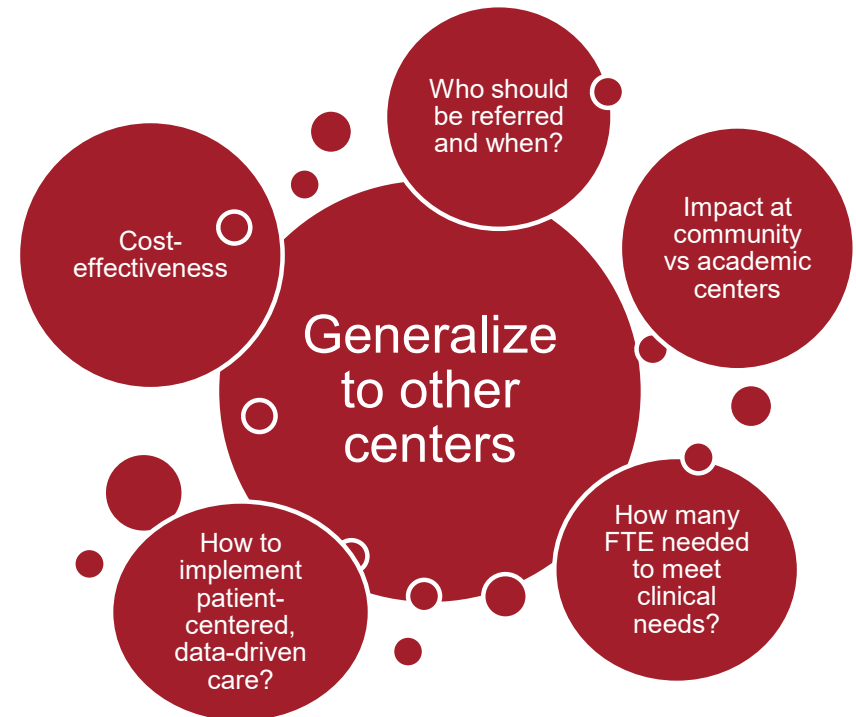
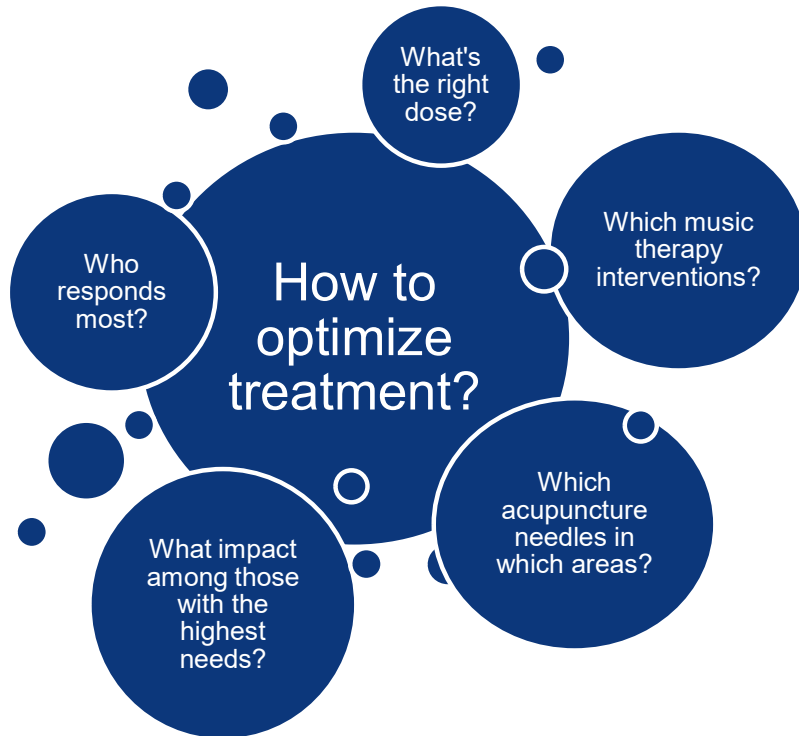
Data at the care team level

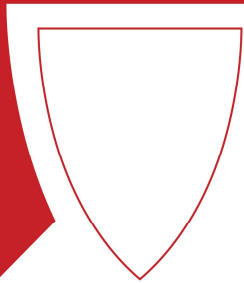


Data at the administrative level



Data at the research level

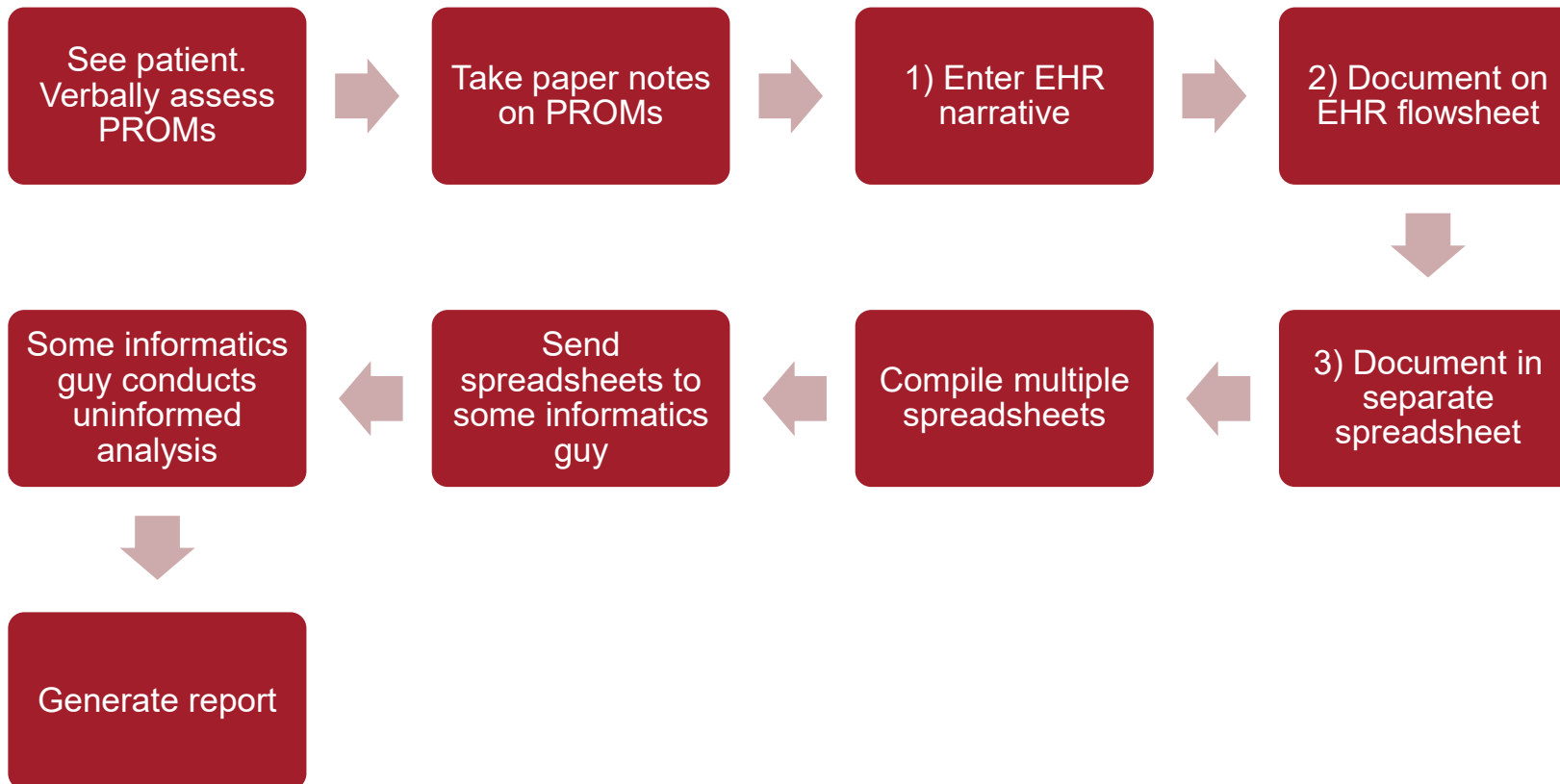




How do we collect data easily?



How not to collect data

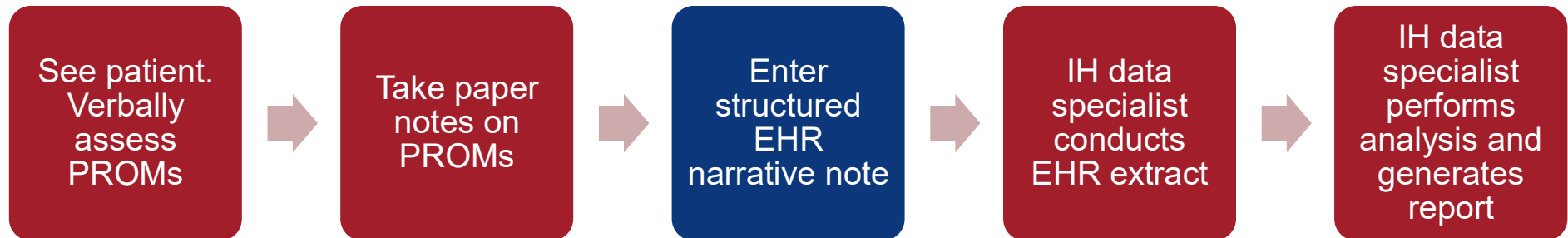


Problems

- Frustrating!
- Triple documentation = waste
- Every hour spent in a spreadsheet is an hour taken from patient care
- Prone to user error
- Uninformed analysis misses impact, nuance, and steps in data cleaning



A better way (inpatient)



Inpatient structured data in the EHR for expressive therapies

- Developed to solve the triple documentation problem (narrative + flowsheets + Excel)
- Created fields based on meaningful data from narrative
- Pilot at academic medical center in 2017 → gradually expanded to community medical centers
- Updated in 2021



EXPRESSIVE THERAPY	
Discipline <input type="radio"/> Art Therapy <input checked="" type="radio"/> Music Therapy	
Referral Type <input type="radio"/> new referral this admission <input type="radio"/> referral from previous admission	
SESSION BASICS	
Session Date <input type="text"/> / <input type="text"/> / <input type="text"/>	Session Begin Time <input type="text"/> : <input type="text"/> : <input type="text"/>
Visit Type <input type="radio"/> new visit <input type="radio"/> follow up visit	Session Type <input type="radio"/> one on one <input type="radio"/> group <input checked="" type="radio"/> group - Behavioral Health

TREATMENT		
Session Goals		
<input type="checkbox"/> agitation reduction	<input type="checkbox"/> anxiety reduction	<input type="checkbox"/> arousal stimulation orientation
<input type="checkbox"/> cognitive functioning improvement	<input type="checkbox"/> coping	<input type="checkbox"/> emotional support
<input type="checkbox"/> end of life support	<input type="checkbox"/> family bonding	<input type="checkbox"/> family/caregiver support
<input type="checkbox"/> fatigue reduction	<input type="checkbox"/> isolation reduction	<input type="checkbox"/> life review
<input type="checkbox"/> locus of control	<input type="checkbox"/> mood modification	<input type="checkbox"/> motor skills improvement
<input type="checkbox"/> nausea reduction	<input type="checkbox"/> normalization	<input type="checkbox"/> pain management
<input type="checkbox"/> physiological functioning improvement	<input type="checkbox"/> procedural support	<input type="checkbox"/> relaxation
<input type="checkbox"/> self-expression	<input type="checkbox"/> socialization	<input type="checkbox"/> speech production
<input type="checkbox"/> spiritual support	<input type="checkbox"/> stress reduction	
Music Therapy Interventions		
<input type="checkbox"/> active music making	<input type="checkbox"/> assessment	<input type="checkbox"/> iso-principle
<input type="checkbox"/> listening/supportive presence	<input type="checkbox"/> live music listening	<input type="checkbox"/> lyric analysis
<input type="checkbox"/> music-assisted life review	<input type="checkbox"/> music-assisted relaxation and imagery (MARI)	<input type="checkbox"/> neurologic techniques
<input type="checkbox"/> recorded music listening	<input type="checkbox"/> song dedication	<input type="checkbox"/> song recording
<input type="checkbox"/> songwriting	<input type="checkbox"/> termination	<input type="checkbox"/> therapeutic instrumental

Expressive Therapy

- EXPRESSIVE THERAPY
- Patient Profile
- Facesheet
- Interpreter Services
- Session
- Pre-Assessment**
- Pain Assessment
- Treatment/Interv...
- Post-Assessment
- Narrative
- Education
- Progress Notes
- Pt Education
- Clinical References
- Patient Instructions
- Order Complete

Pre-Assessment

Time taken: 8/11/2023 1315 Responsible More Show Row Info Show Last Filed Value Show All Choices

Pre-assessment

Unable to Assess Reason

- Cognitive limitation
- Emotional distress
- Outcomes not applicable
- Outcomes not assessed
- Patient declined to answer
- Physical limitation

Pain Score

0 - No pain	1	2	3	4	5 - Mode...	6	7	8
9	10 - Wor...							

Other Pain Scale

Stress Level (0-10)

Anxiety Level (0-10)

Coping Level (0-10)

Depression Level (0-10)

Fatigue Level (0-10)

Nausea Level (0-10)



Expressive Therapy

- EXPRESSIVE THERAPY
- Patient Profile
- Facesheet
- Interpreter Services
- Session
- Pre-Assessment
- Pain Assessment
- Treatment/Interv...**
- Post-Assessment
- Narrative
- Education
- Progress Notes
- Pt Education
- Clinical References
- Patient Instructions
- Order Complete

Treatment/Intervention

Time taken: 8/11/2023 1315 Responsible More Show Row Info Show Last Filed Value Show All Choices

Treatment

Discipline

- Art Therapy
- Dance/Movement Therapy
- Horticultural Therapy
- Music Therapy**

Areas of Focus

- Agitation reduction
- Anxiety reduction
- Arousal stimulati...
- Cognitive functio...
- Coping
- Emotional support
- End of life support
- Family bonding
- Family/caregiver...
- Fatigue reduction
- Isolation reduction
- Life review
- Locus of control
- Mood modification
- Motor skills impr...
- Nausea reduction
- Normalization
- Pain management**
- Physiological fun...
- Procedural support
- Relaxation
- Self-expression
- Socialization
- Speech production
- Spiritual support
- Stress reduction

Music Therapy Interventions

- Active music engagement
- Assessment
- Contingent singing
- Developmental music play
- Empathic listening/valid...
- Improvisation
- Iso-principle
- Live music listening
- Lyric analysis
- Music-assisted life review
- Music-assisted relaxatio...**
- Music-facilitated relaxati...
- Music instruction
- Music sharing/discussion
- Neurologic techniques
- Paired music stimulation
- Passive musical engag...
- Recorded music listening
- Recording
- Song dedication
- Songwriting/composition
- Termination
- Therapeutic music video



Field notes and patient forms

Expressive Therapy Healing SPACE Assessment

STRESS (unpleasant reaction to situation) How much stress are you having right now? 0 = no stress at all. 10 = worst possible stress.	Patient	Room
PAIN How much pain are you having right now? 0 = no pain at all. 10 = worst possible pain.	Referral Type new previous pain	Begin ____:____
ANXIETY (fear, worry, or nervousness) How much anxiety are you having right now? 0 = no anxiety at all. 10 = worst possible anxiety.	Session Date	End ____:____
COPING (ability to deal with difficult situation) How well are you coping right now? 0 = not coping well at all. 10 = coping very well.	Visit Type new follow up	Delivery in-person
	Session Type 1:1 group behavioral	tele-session
	Family Centered Care	
	# Staff ____	

PRE	EDUCATION	POST
UTA cognitive emotional NA left out declined phys		UTA cognitive no int emotional left out NA declined sleeping phys interrupted
Stress		Stress
Pain		Pain
Anxiety		Anxiety
Coping		Coping
Depression		Depression
FLACC _____	GOALS	FLACC _____
Nausea		Nausea
Tiredness		Tiredness
Wellbeing (0 = best; 10 = worst)	INTERVENTIONS	Wellbeing (0 = best; 10 = worst)
Mood/Affect		Mood/Affect
Verbalized		Verbalized

Expressive Therapies Patient-Reported Outcomes

Please circle the number that best describes how you are feeling NOW:

Wellbeing (how you feel overall)

Worst possible 0 1 2 3 4 5 6 7 8 9 10 Best possible

Coping (ability to deal with difficult situation)

Not well at all 0 1 2 3 4 5 6 7 8 9 10 Very well

Pain

None 0 1 2 3 4 5 6 7 8 9 10 Worst possible

Tiredness (less energy, fatigue)

None 0 1 2 3 4 5 6 7 8 9 10 Worst possible

Anxiety (worry or being nervous)

None 0 1 2 3 4 5 6 7 8 9 10 Worst possible

Depression (feeling sad or blue)

None 0 1 2 3 4 5 6 7 8 9 10 Worst possible

Stress (unpleasant reaction to situation)

None 0 1 2 3 4 5 6 7 8 9 10 Worst possible



Resulted in 4 EMMPIRE studies + NCCIH F31 Fellowship

Journal of Integrative and Complementary Medicine > Ahead of Print > Open Access

Effectiveness of Medical Music Therapy Practice: Integrative Research Using the Electronic Health Record: Rationale, Design, and Population Characteristics

Samuel N. Rodgers-Melnick, Rachael L. Rivard, Seneca Block, and Jeffery A. Dusek

Published Online: 11 Jul 2023 | <https://doi.org/10.1089/jicm.2022.0701>

General Section
Research Paper

OPEN

Published on 27.7.2023 in Vol 10 (2023)

Preprints (earlier versions) of this paper are available at <https://preprints.jmir.org/preprint/46528>, first published February 2023.

Optimizing Patient-Reported Outcome Collection and Documentation in Medical Music Therapy: Process-Improvement Study

Samuel N. Rodgers-Melnick, Seneca Block, Rachael L. Rivard, Jeffery A. Dusek

University Hospitals Researcher Receives NIH Award to Study Real-World Effectiveness of Music Therapy in Medical Care

September 20, 2023
By Carly Belsterling

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Effectiveness of music therapy within community hospitals: an EMMPIRE retrospective study

Samuel N. Rodgers-Melnick^{a,b,*}, Rachael L. Rivard^{a,c}, Seneca Block^{a,b}, Jeffery A. Dusek^{a,b}

Research Article

Clinical Delivery and Effectiveness of Music Therapy in Hematology and Oncology: An EMMPIRE Retrospective Study

Integrative Cancer Therapies
Volume 21: 1-14
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SAGE

Samuel N. Rodgers-Melnick, MPH, MT-BC^{1,2}, Rachael L. Rivard, MPH^{1,3}, Seneca Block, MA, MT-BC^{1,2}, and Jeffery A. Dusek, PhD^{1,2}



Acupuncture Treatment



Responsible Create Note

Show Row Info Show Last Filed Value Show All Choices

Acupuncture Physical Exam



Pain with Palpation/Tightness



Range of Motion



Orthopedic Tests



Visual Inspection



Tongue Color

- Black Blue Dark purple Dusky Orange edges Pale body Pale edges Pink Red body Red edges Red tip
- Other (specify)



Tongue Shape

- Crevice in back Curved edges Deviated Flabby Indented tip Large Long pointed Midline cracks Puffy
- Scalloped edges Thin Yin cracks Other (specify)



Tongue Coating

- Dirty Dry Greasy No coating Peeled Peeled in spots Thick white Thick yellow Thin white Thin yellow
- Other (specify)



Message Therapy Treatment



Responsible Create Note

Show Row Info Show Last Filed Value Show All Choices

Message Treatment

Denies Allergy

Patient denies allergy to topical lubricant

Patient Position

Bed Chair Prone Seated Side... Supine

Positioning Assistance

Did not need assistance Needs assistance with positioning Pillow(s)/bolster under knees while supine Pillow(s)/bolster under anles while prone
 Pillow(s)/bolster for positioning during si... Other (specify)

Massage Technique

Acupressure Cranio-sacral therapy Fascial release Lymphatic drainage Mobilization Myofascial release Nurturing touch
 Positional release Post-isometric mus... Relaxation massage Soft tissue mobiliza... Stretching Superficial fascial r... Therapeutic massage
 Other (specify)

Area/Body Region

Pressure Scale

0 1 2 3 4 5

Massage Intervention Length (min)

Action Note

Response Note

Restore

Close

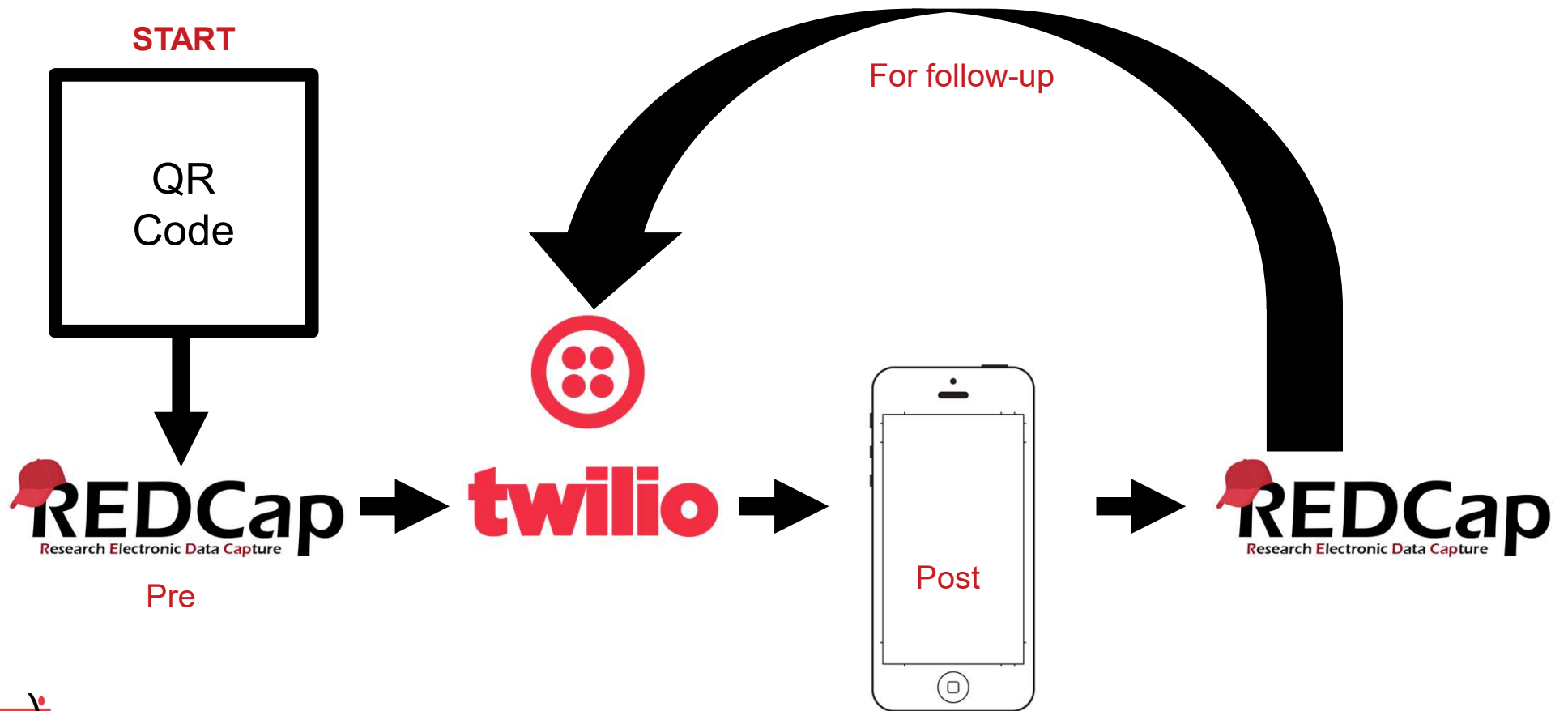
Cancel

Previous


Next



REDCap and Twilio data collection



REDCap data collection for staff services



AAA

Pre-Session Questions

Please complete the questions below. Your responses help us understand more about how you are feeling today.

Thank you!

I am a

reset

UH email

* must provide value

Firstname.Lastname@UHhospitals.org

Waiver and Release

I, the undersigned, desire to participate in and/or receive services from University Hospitals Connor Whole Health, which includes Ayurveda, Acupuncture, Hypnotherapy, Life Coaching, Massage Therapy, Myo- fascial Release Therapy, Meditation and Mindfulness, Nutrition, Reflexology, Reiki, Yoga and Tai Chi (individually and collectively, the "Program"). By signing this Waiver and Release, I acknowledge, understand, and agree to the following:

1. I represent to UH that to the best of my knowledge I am physically capable of participating in and/or receiving services from the Program and that I have consulted my personal physician before making such representation.
2. I am participating in and/or receiving services from the Program upon the express agreement and understanding that I do hereby for myself, my heirs, executors, assigns and administrators waive and release UH, its parent, subsidiaries, employees, and agents from any and all claims, costs, damages, liabilities, expenses, or judgments, including attorney fees and court

Session name

reset

Session location

If virtual session, select VIRTUAL.

Type in the box to find your location.

Rate your overall stress level right now.

None Worst possible

Tap the slider above to set a response

reset

How well do you feel you are coping with work challenges right now?

Not well at all Very well

Tap the slider above to set a response

reset

Rate your overall level of wellbeing right now.

Worst possible Best possible

Tap the slider above to set a response

reset

By the end of the session today, how much % improvement in your wellbeing do you expect will occur?

None Maximum improvement

Tap the slider above to set a response

reset

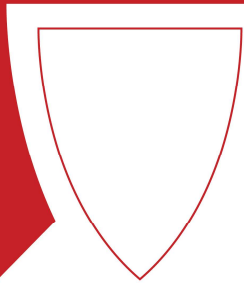
May we ask you follow up questions regarding your Acupuncture session?

reset



Other REDCap features

- Autoscoring PROMIS instruments with T-Scores
- Branching logic
 - If this response, then that question
- Calculated fields
 - $a + b = c$
- Generate text documentation from patients' responses for easy transfer to EHR
- Calculated text: generate a name from an email
 - Tony.Stark@UHhospitals.org → first_name = Tony, last_name = Stark
- Easily flag identifiers and control data access
- Easy export to statistical packages



Integrative Health and Medicine (IHM) Intake



Intake data elements

1. **Expectations** for treatment experience at the IHM outpatient clinic
2. **Chief health concerns** and their respective start date, frequency, and severity
3. **Prior experience seeing IHM** practitioners and practicing IHM modalities
4. **Social history** (i.e., who lives in household, and children's ages)
5. **Food insecurity** (i.e., Hunger Vital Sign)
6. **Exercise** history in the past 6 months
7. **Use of alcohol, tobacco, and recreational drugs**
8. **Nutrition** (e.g., water intake, dietary restrictions, and daily fruit and vegetable intake)
9. **Medications**, supplements, and opiate use
10. **Review of systems** with questions for each domain (e.g., digestion, mental health, sleep)
11. **Pain** (e.g., frequency, duration, location, intensity, description).



Outpatient Intake

Attached to a message from **Christine Kaiser, LAc, DACM** received **10/4/2023**

How many times over the past 6 months have you practiced the following for a minimum of 20 minutes?

Biofeedback

<input checked="" type="radio"/> Never	<input type="radio"/> Fewer than once per week	<input type="radio"/> 1-2x per week	<input type="radio"/> 3-4x per week	<input type="radio"/> 5 or more times per week
--	--	-------------------------------------	-------------------------------------	--

Breathing exercises

<input type="radio"/> Never	<input type="radio"/> Fewer than once per week	<input checked="" type="radio"/> 1-2x per week	<input type="radio"/> 3-4x per week	<input type="radio"/> 5 or more times per week
-----------------------------	--	--	-------------------------------------	--

Guided Imagery

<input type="radio"/> Never	<input checked="" type="radio"/> Fewer than once per week	<input type="radio"/> 1-2x per week	<input type="radio"/> 3-4x per week	<input type="radio"/> 5 or more times per week
-----------------------------	---	-------------------------------------	-------------------------------------	--

Hypnosis

<input type="radio"/> Never	<input type="radio"/> Fewer than once per week	<input type="radio"/> 1-2x per week	<input type="radio"/> 3-4x per week	<input type="radio"/> 5 or more times per week
-----------------------------	--	-------------------------------------	-------------------------------------	--

Mindfulness / Meditation

<input type="radio"/> Never	<input type="radio"/> Fewer than once per week	<input type="radio"/> 1-2x per week	<input type="radio"/> 3-4x per week	<input type="radio"/> 5 or more times per week
-----------------------------	--	-------------------------------------	-------------------------------------	--

Progressive relaxation

<input type="radio"/> Never	<input type="radio"/> Fewer than once per week	<input type="radio"/> 1-2x per week	<input type="radio"/> 3-4x per week	<input type="radio"/> 5 or more times per week
-----------------------------	--	-------------------------------------	-------------------------------------	--



Outpatient Intake

Attached to a message from **Christine Kaiser, LAc, DACM** received 10/4/2023

Nutrition

How many glasses of plain water do you drink per day?

No water 1 per day 2 per day 3 per day 4 per day 5 per day 6 per day 7 per day 8 per day 9 per day
 10 or more per day

How many caffeinated beverages do you drink per day?

No caffeine 1 per day 2 per day 3 per day 4 per day 5 per day 6 per day 7 per day 8 per day
 9 per day 10 or more per day

Please describe any dietary restrictions or practices that you follow. For example: vegan, vegetarian, Kosher

Please list any food intolerances you have. For example: lactose intolerance, gluten intolerance



Menu



Visits



Message Center



Test Results



Medications

Outpatient Intake

Attached to a message from **Christine Kaiser, LAc, DACM** received **10/4/2023**

Symptom Summary

For the following areas, select those for which you have received treatment or experienced symptoms in the past 5 years. We will ask you more about the areas you select in later questions.

Select all that apply.

Appetite Body temperature Brain (e.g., nervous system, memory, headache, lightheadedness)

Breathing (e.g., asthma, cough) Digestion Ears Eyes Heart Immunity Mental health Nose

Reproductive Health Skin **Sleep** Sweating Teeth Throat Urinary No symptoms

[Continue](#)[Back](#)[Finish later](#)[Cancel](#)

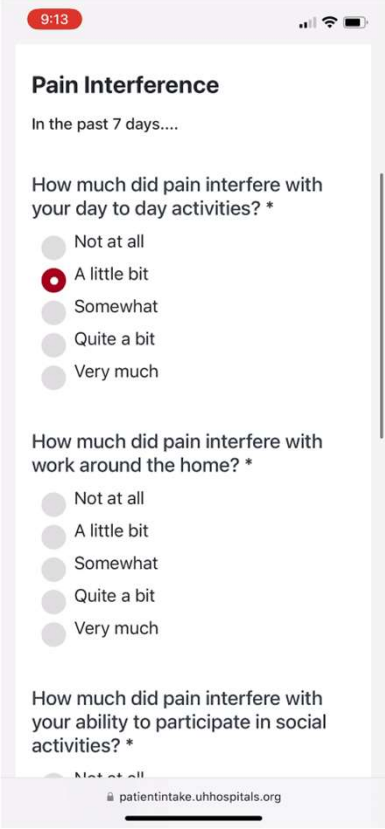
PROMs

PROMIS-29

- Physical function (4 items)
- Anxiety (4 items)
- Depression (4 items)
- Fatigue (4 items)
- Sleep disturbance (4 items)
- Ability to participate in social roles and activities (4 items)
- Pain interference (4 items) and intensity (1 item)

Perceived Stress Scale 4

Oswestry Disability Index (If seeing chiropractic)



9:13

Pain Interference

In the past 7 days....

How much did pain interfere with your day to day activities? *

- Not at all
- A little bit
- Somewhat
- Quite a bit
- Very much

How much did pain interfere with work around the home? *

- Not at all
- A little bit
- Somewhat
- Quite a bit
- Very much

How much did pain interfere with your ability to participate in social activities? *

- Not at all

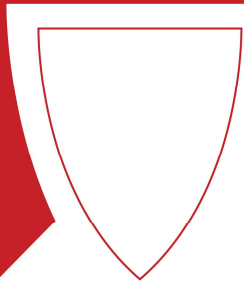
patientintake.uhhospitals.org

Capturing PROMs in MyChart

The screenshot shows the MyChart interface for University Hospitals. The header includes the University Hospitals logo and the MyChart by Epic logo. Below the header is a navigation bar with icons for Menu, Visits, Message Center, Test Results, and UH Home. The main content area displays a "PROMIS-29 Profile" form. The form is titled "PROMIS-29 Profile" and is attached to a message from David Vincent, DC, received on 8/11/2023. The form asks the user to rate their pain interference with various activities over the past 7 days. The rating scale ranges from "Not at all" to "Very much" with five radio button options.

	Not at all	A little bit	Somewhat	Quite a bit	Very much
How much did pain interfere with your day to day activities?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much did pain interfere with work around the home?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much did pain interfere with your ability to participate in social activities?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How much did pain interfere with your household chores?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>





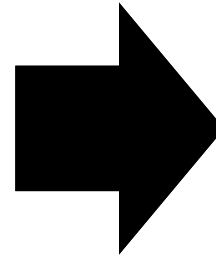
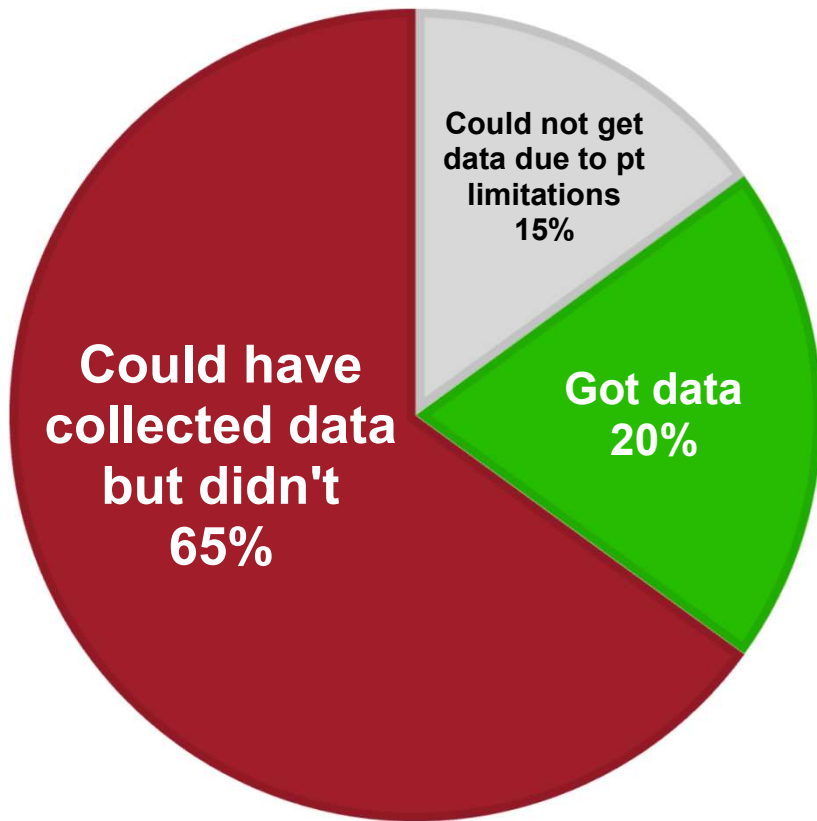
Our job as providers when collecting data



Patient-reported outcome collection myths and barriers

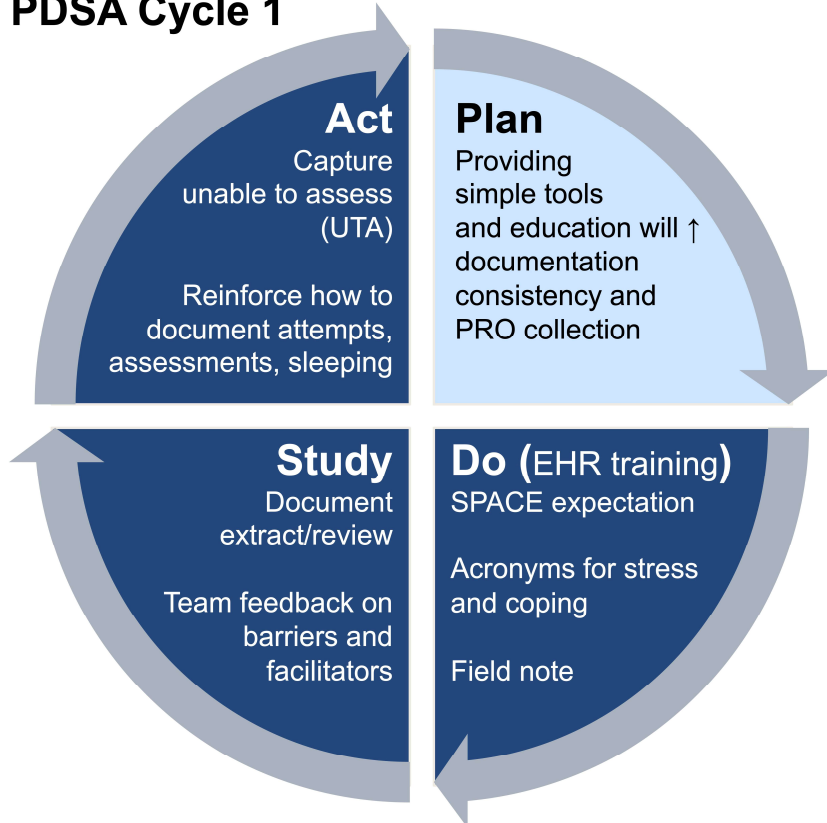
- “Asking about post-session pain will bring the pain back.”
- “Sometimes the pain doesn’t change at all.”
- “Won’t their scores be biased because I’m asking the question?”
- “I can remember this one session when...
 - the patient was confused by the question.”
 - the patient asked why I was asking them about this.”
 - the patient rated worsening pain after the session.”
 - the patient was frustrated by the question.”

Asking numeric questions doesn’t fit with my therapeutic style.

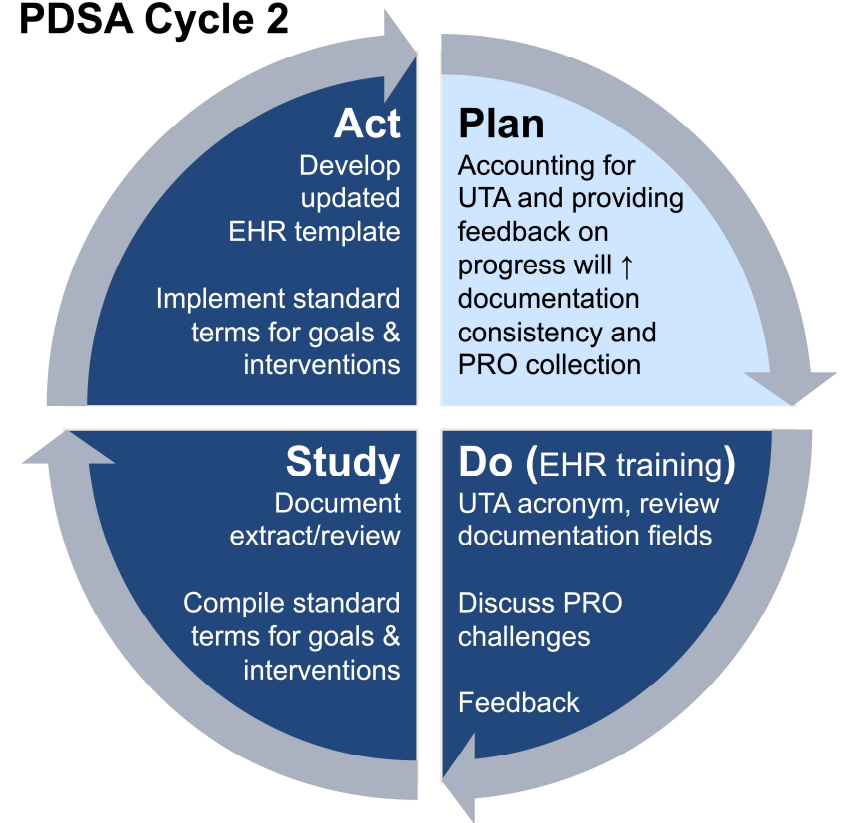


EMMPIRE Aim 2 methods

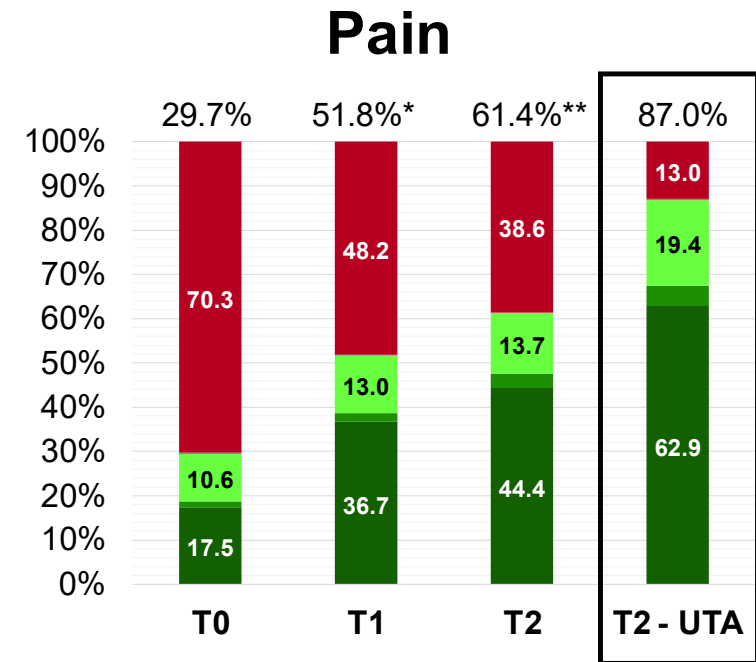
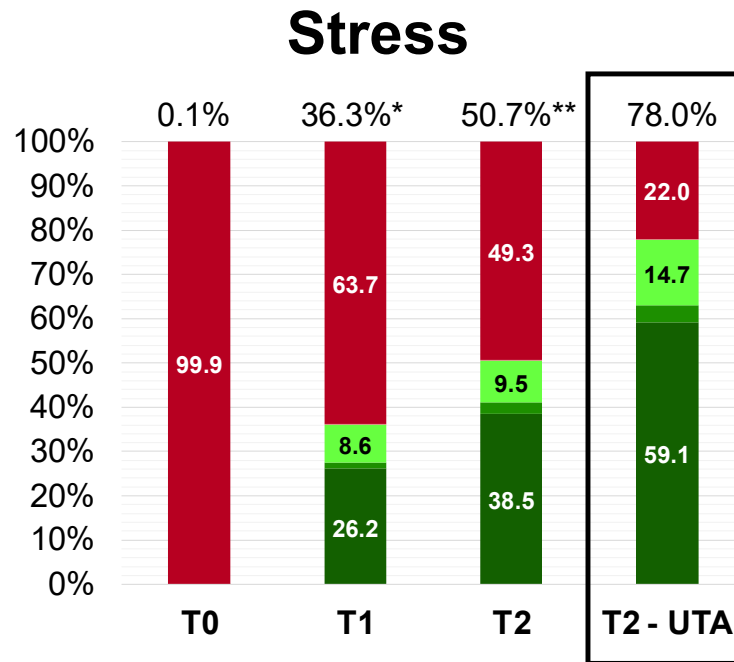
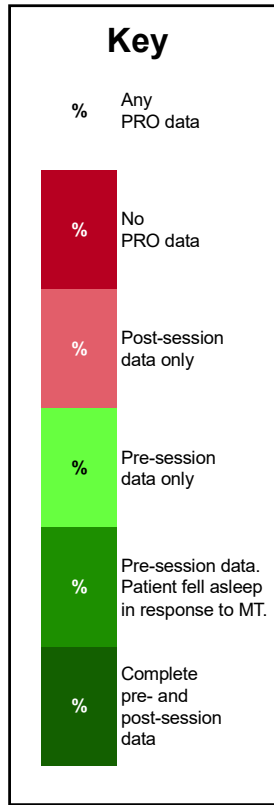
PDSA Cycle 1



PDSA Cycle 2

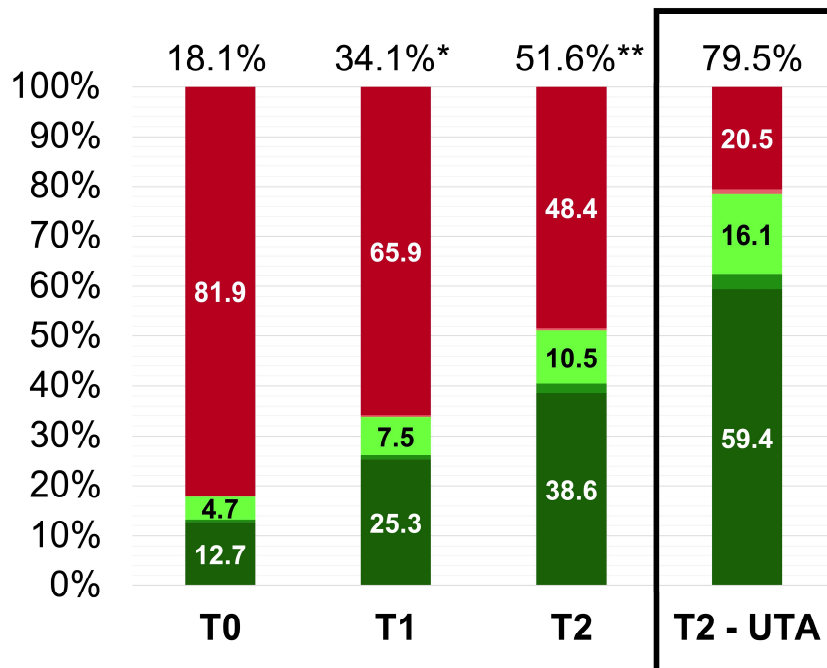


Quality improvement initiative to increase PROMs collection

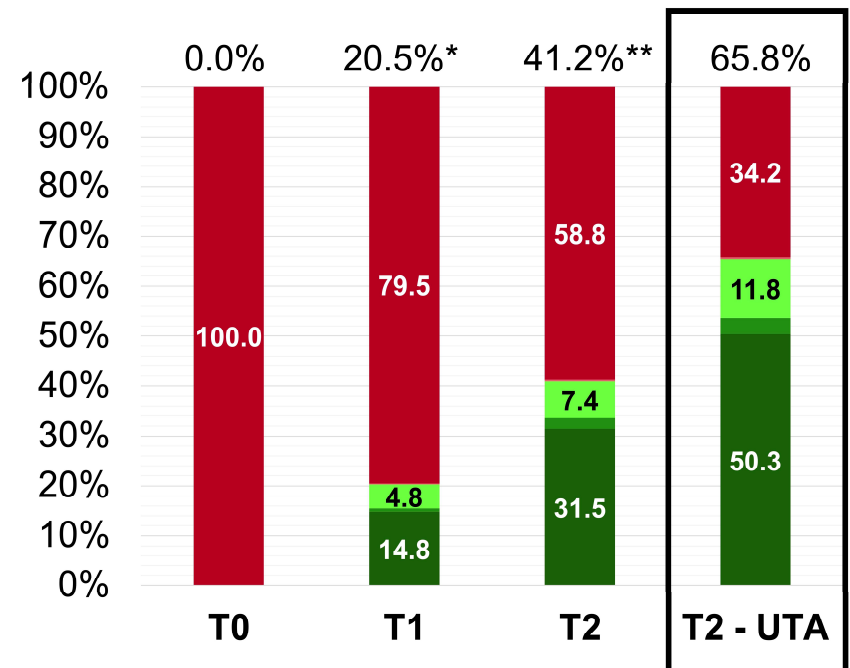


Quality improvement initiative to increase PROMs collection

Anxiety

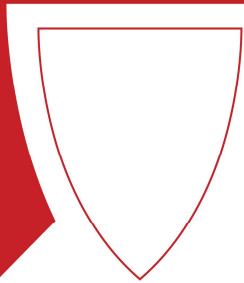


Coping



Generate
ElecTronic
health record
Data to
Advance
Transformative
cAre





Data Extraction



No template? Use regular expressions in

Step 1: Look for patterns

comb_text

ENTERED TIME: 11:29:00 AM : Pt referred to me for anxiety reduction. Pt in bed, greets me with, "I'm very musical!" and tells me about her participation in a choir. **She reported 3/10 pain and 3/10 stress level.** Pt is very tangential, but redirectable. Pt's son was present in the room briefly. I facilitated live pt preferred music to decrease pain and stress. During the music pt lay back, closed her eyes, and sang along. Afterwards pt expressed gratitude: "I feel about four inches taller and five years younger!" **She reported 0/10 pain and 1/10 stress** and requested follow-up tomorrow. Will follow.

comb_text

ENTERED TIME: 11:02:57 AM : Pt in bed, as I come in she is saying to herself, "What will become of me? What will become of me?" Upon my introduction pt reports feeling "weepy" and anxious today. **She is able to rank her stress level at 7.5/10.** I facilitated live pt preferred music with themes of positivity and at a slow tempo to decrease stress. During the music pt maintained eye contact with me and sang along with brightening affect. Afterwards pt expressed gratitude with a smile: "You really cheered me up." She reported decreased **stress level (5.5/10).** I educated pt on music channels via TV and pt chose a "Golden Oldies" station to listen to. Will follow.

Finding patient-reported outcomes with regular expressions in R

Step 2: Write code to detect patterns: `library(tidyverse)`

`comb_text`

ENTERED TIME: 11:29:00 AM : Pt referred to me for anxiety reduction. Pt in bed, greets me with, "I'm very musical!" and tells me about her participation in a choir. She reported 3/10 pain and **3/10 stress level**. Pt is very tangential, but redirectable. Pt's son was present in the room briefly. I facilitated live pt preferred music to decrease pain and stress. During the music pt lay back, closed her eyes, and sang along. Afterwards pt expressed gratitude: "I feel about four inches taller and five years younger!" She reported 0/10 pain and **1/10 stress** and requested follow-up tomorrow. Will follow.

Find StressRaw

```
StressRaw <- stringr::str_extract_all(mt_train$comb_text,  
"[:digit:]+\.\. *[:digit:]]*/10( *)[Ss]tress|[Ss]tress( +[^\s]{1,5}(\s)?[:digit:]]+\.\. *[:digit:]]*/10",  
simplify = TRUE)
```

Join Stress RAW to Table

```
mt_train <- cbind.data.frame(mt_train, StressRaw)
```

CleanStressPre

```
StressPre <- as.numeric(stringr::str_extract(mt_train$StressPreRaw,  
"[:digit:]]+\.\. *[:digit:]]*"))  
mt_train$StressPre <- StressPre
```

CleanStressPost

```
StressPost <- as.numeric(stringr::str_extract(mt_train$StressPostRaw,  
"[:digit:]]+\.\. *[:digit:]]*"))  
mt_train$StressPost <- StressPost
```

Finding patient-reported outcomes with regular expressions in R

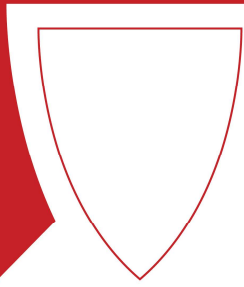
Step 3: Validate output and prepare for analysis

comb_text	StressPre Raw	StressPost Raw	StressPre	StressPost	PainPre Raw	PainPost Raw	PainPre Score	PainPost Score
<p>ENTERED TIME: 11:29:00 AM : Pt referred to me for anxiety reduction. Pt in bed, greets me with, "I'm very musical!" and tells me about her participation in a choir. She reported 3/10 pain and 3/10 stress level. Pt is very tangential, but redirectable. Pt's son was present in the room briefly. I facilitated live pt preferred music to decrease pain and stress. During the music pt lay back, closed her eyes, and sang along. Afterwards pt expressed gratitude: "I feel about four inches taller and five years younger!" She reported 0/10 pain and 1/10 stress and requested follow-up tomorrow. Will follow.</p>	3/10 stress	1/10 stress	3	1	3/10 pain	0/10 pain	3	0



Take home tips for implementing PROMs

- **Use the best tools available**
 - Flexible/collaborative EHR team? → build a note
 - Institution has REDCap? → Use REDCap
 - Institution has some other app-based solution? → Use that
- **Document once and accurately whenever possible**
- **Have a plan for data extraction!**
 - How can you get the data out?
 - You can get data from big full text with regular expressions
- **Have a plan for how to use the data**
 - Communicating the meaning of the data to patients
 - Track progress
 - What data do you really need?



Practice Based Research Network (PBRN)



What is the BraveNet PBRN?

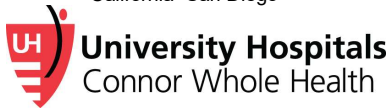
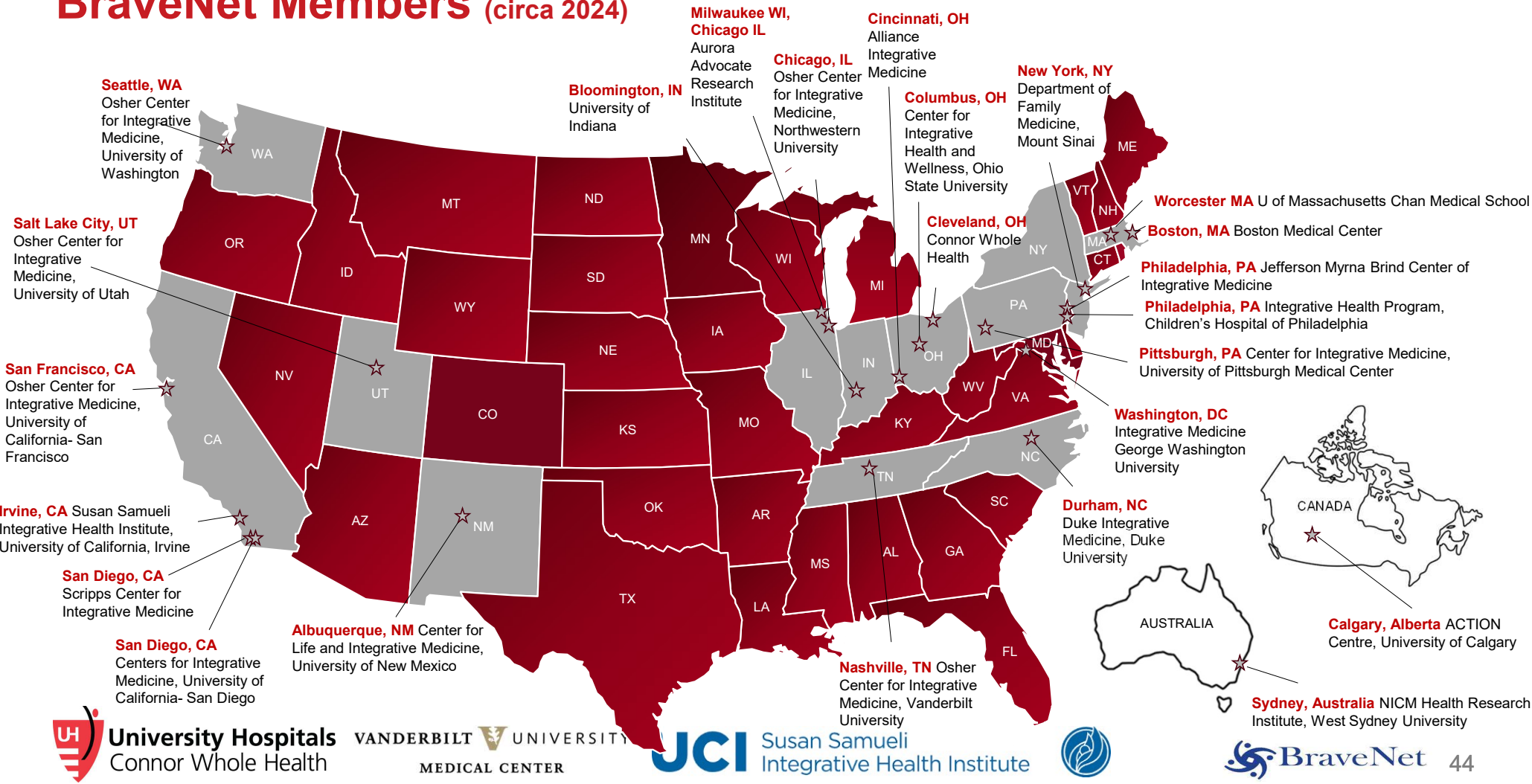
Mission

To conduct and disseminate high quality practice-based research that evaluates the effectiveness, safety, cost and impact on patient experience of integrative medicine approaches.

2024 SnapShot

- 24 site **Practice Based Research Network**
- Focus on patient reported outcomes in real world integrative health settings
- Multi-site collaboration for
 - ✓ Observational ambulatory CIH care
 - ✓ Randomized controlled trials

BraveNet Members (circa 2024)





Diversity and Integration with the Biomedical Model

- Mostly academic medical centers, two health systems, one independent community clinic
- **Housed in various departments:** cancer, psychiatry, internal medicine, family medicine
- **Outpatient:** primary care, consultative clinics
- **In-patient:** med/surg, orthopedics, emergency department, cancer
- **Insurance based vs. Cash based/Retail payments**
- **Wide variety of clinicians and services offered:**
 - ✓ acupuncture
 - ✓ physician or nurse consults
 - ✓ massage therapy
 - ✓ chiropractic
 - ✓ yoga therapy, mindfulness
 - ✓ music therapy

PRIMIER

Design: **Prospective, non-randomized, observational study** conducted at 17 BraveNet sites.

Data Collection: *Patient Reported* data and Demographics: Primarily **REDCap**, paper forms, electronic assessment center; *Health Service Utilization:* Electronic Health Records

Primary Outcome: Health related QoL. PROMS collected at enrollment, 2, 4, 6, 12 months.

- PROMIS-29
- Perceived Stress Scale-4
- Patient Activation Measure



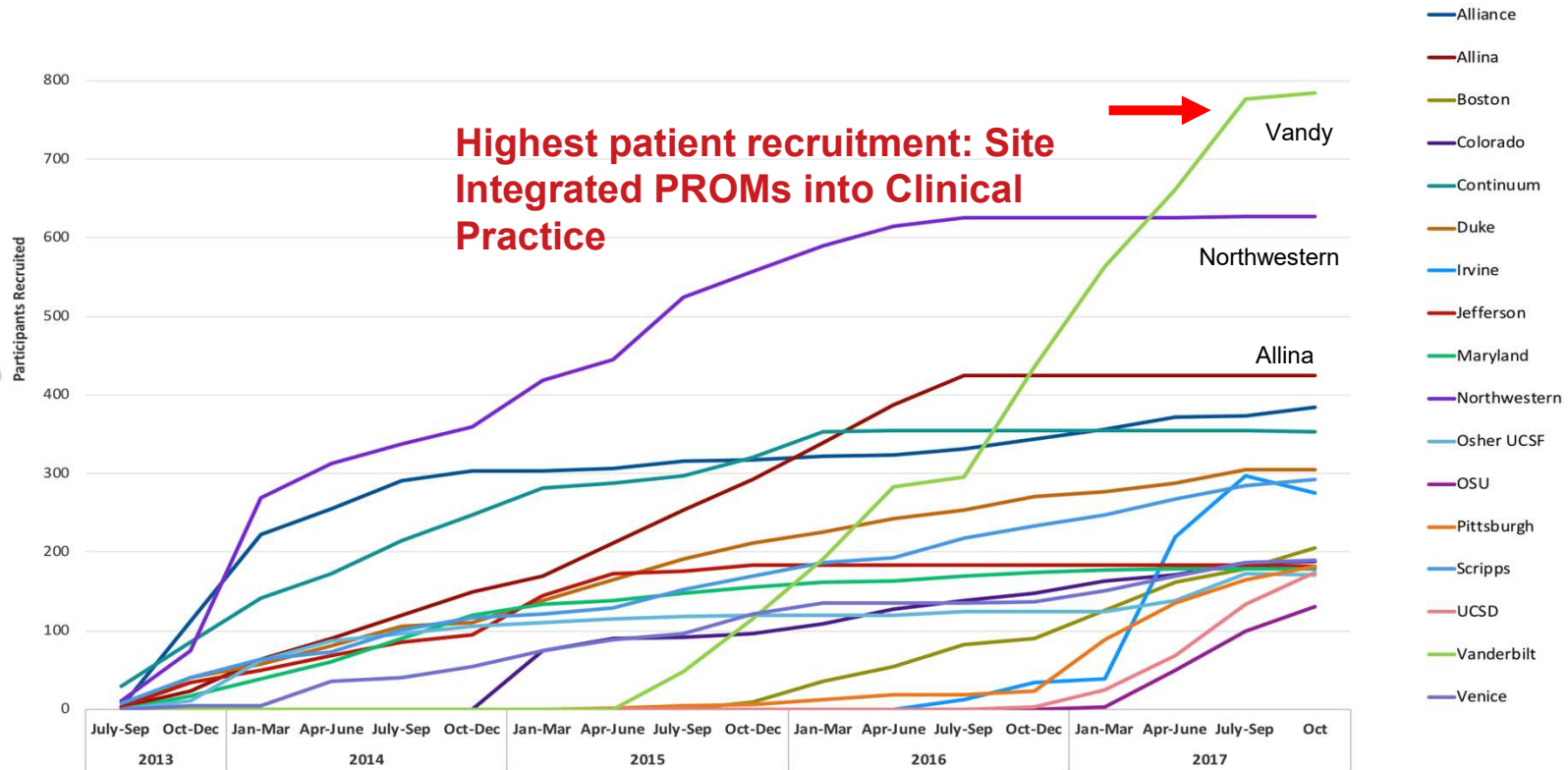
Secondary Outcome: Integrative Health service utilization (from electronic health records): **ICD diagnostic codes, CPT codes, Clinician type, Visit date**

Inclusion/Exclusion criteria: Age 18+, seen by a clinician in IM clinics, consented to study

Recruitment: Fliers, QR Code, email blast to clinic patients, **Integration into clinical care**



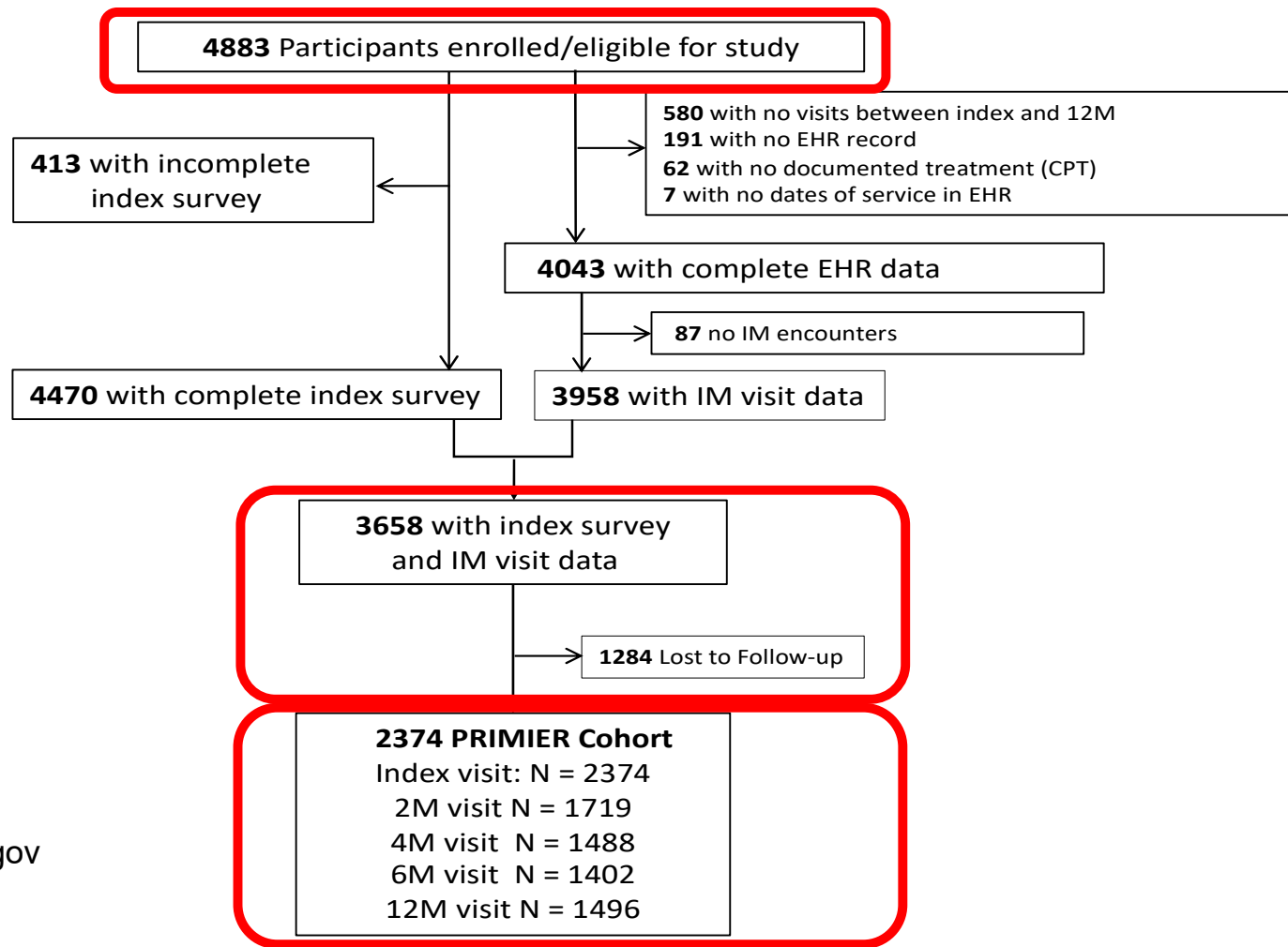
Final PRIMIER Participants Recruited by Site



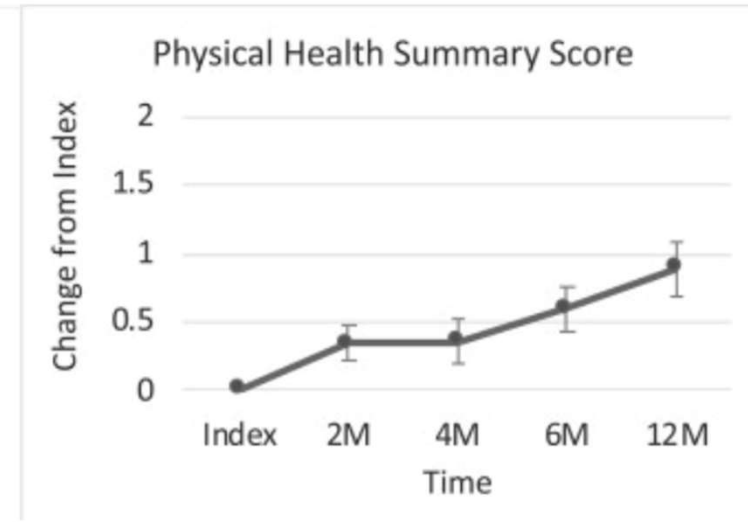
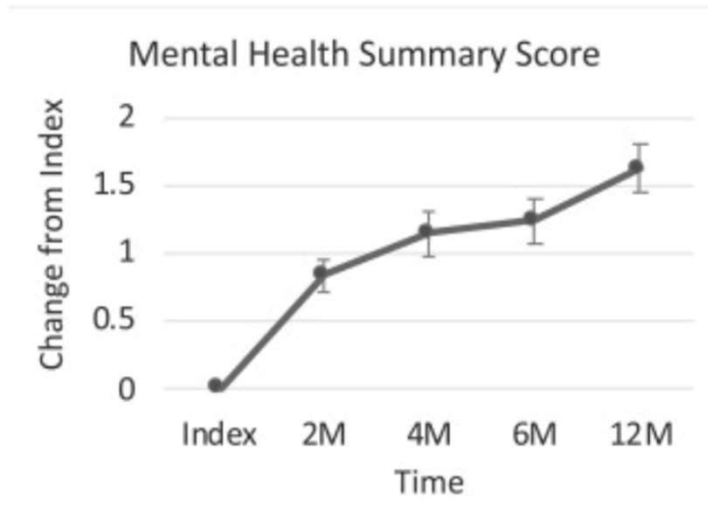
Participant Flow

Demographics:
 Participants were **white** (88.4%), **female** (79.7%), **college-educated** or beyond (78.5%) with a **mean age of 51.4 years** (SD 14.5)

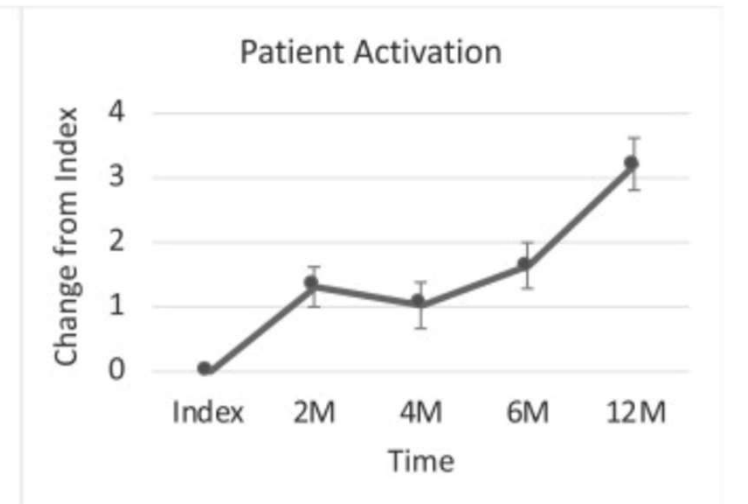
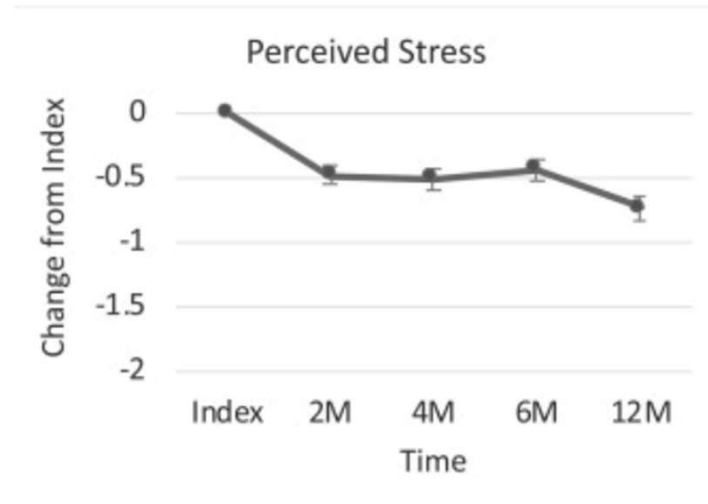
The study is registered in Clinical Trials.gov (NCT01754038).



Primary Outcomes



Secondary Outcomes

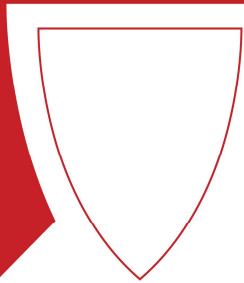


IHM Service Utilization

IM Service	Index - 2 months	2 - 4 months	4 - 6 months	6 - 12 months	Index - 12 months
Consult MD/NP	45.9%	31.2%	26.2%	38%	67.8%
Acupuncture	23.5%	16.6%	13.6%	17.9%	32.9%
Manual therapy	10.7%	8.5%	8.2%	11.3%	19.1%
Chiropractic	6.4%	4.9%	4.4%	6.8%	11%
Mind and body	6.8%	4.6%	3.4%	3.8%	10%
Consult coaching	5.7%	3.2%	2.9%	3.7%	9.5%
Energy therapy	0.8%	1%	1%	2.7%	3.4%
Other	0.8%	0.5%	0.4%	1.6%	2.1%
Any CIH	1768 (74.5%)	1233 (51.9%)	1025 (43.2%)	1394 (58.7%)	2374 (100%)

Summary of Findings

- **2,374 (65%)** completed at least 1 follow-up assessment, had evaluable EHR data and >1 CIH visit through 12 months.
- At index visit, **most common conditions** were **chronic pain** (18.9%), **acute pain** (9.3%), and **wellness** (9.2%).
- Significant improvements ($p < 0.001$) observed at 12-months on **all 7 PROMIS-29 measures, PSS-4 and PAM**.
- At 12 months, clinically meaningful improvements found on **PROMIS-29 Mental Health** (38%) and **Physical Health** (28%) summary scores.



Vanderbilt Experience



VUMC experience as a BraveNet Site

Joined in 2015

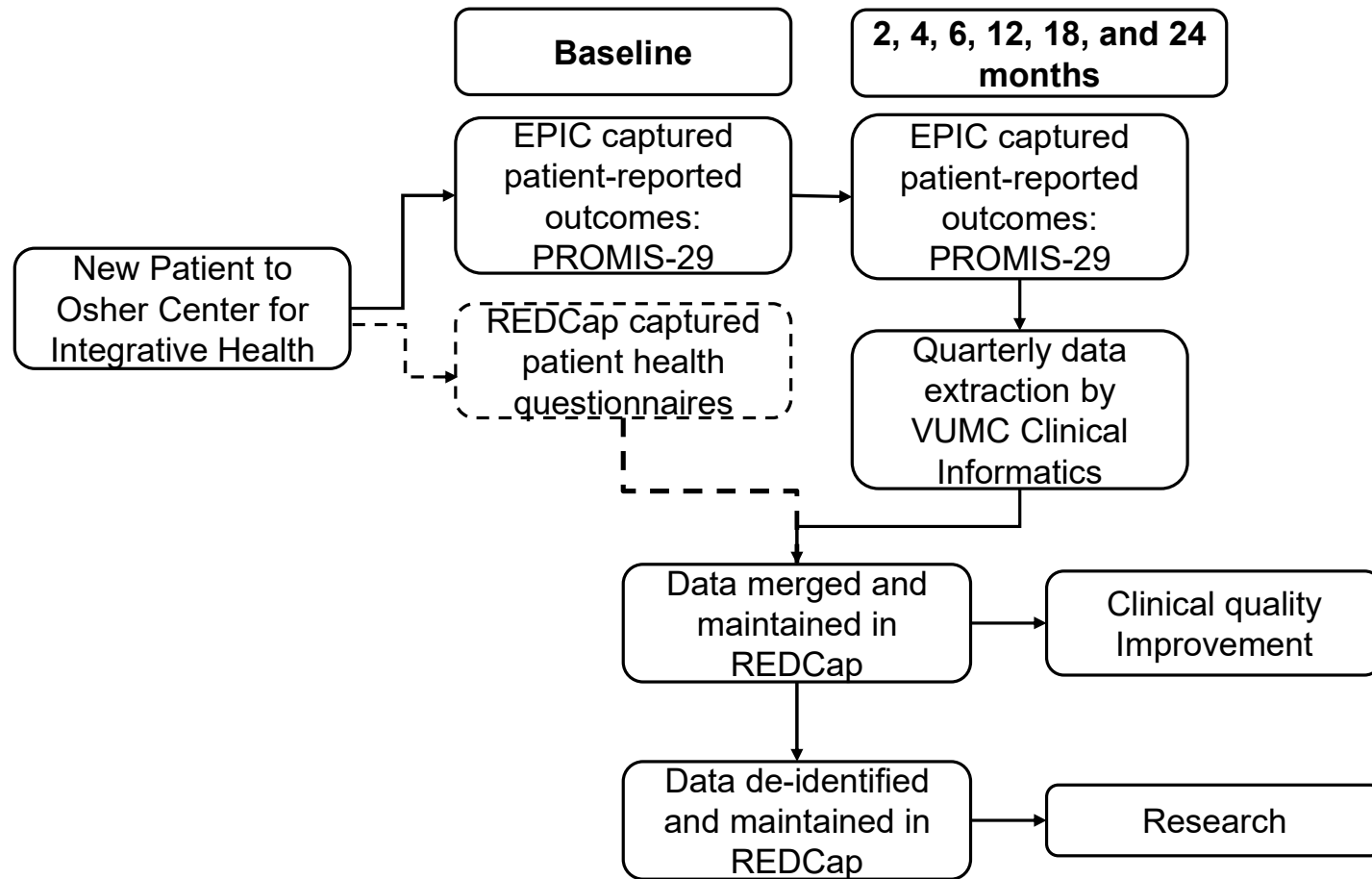
- Started with 
- Implementation as clinical intake

What value to clinicians over 9 years?

Barriers

- Patient burden
- Provider access to data
- Patient access to data

Flow Diagram of Current PROMs Capture at VUMC



Critical Tasks Using an Iterative Approach



Phase 1:
Preliminary analysis
and planning

Task
Metrics:
<ul style="list-style-type: none"> • Patient • Provider • Financial
Create new group protocols



Phase 2:
Implementation
feasibility

Task
Administer new group protocols
Re-evaluate metrics
Modify group protocol



Phase 3:
Re-evaluation
and refinement

Task
Administer modified group
Re-evaluate metrics
Collect preliminary data on cost-effectiveness



Phase 4:
Measure cost-
effectiveness

Task
Large-scale implementation trial
Develop plans for scaling
Dissemination



Collaborative Efforts: Seeking Institutional Support



Phase 1:
Preliminary analysis
and planning

Support
Qualitative core
Clinical and business office for revenue analysis



Phase 2:
Implementation
trial

Support
Qualitative core
Clinical and Business Office for revenue analysis
Provider and staff training
Implementation core



Phase 3:
Re-evaluation
and refinement



Phase 4:
Measure cost-
effectiveness

Support
Extramural funding
Scaling support
Ongoing evaluation tools



Critical features

Research protocol

- IRB → to consent or not consent

Data capture

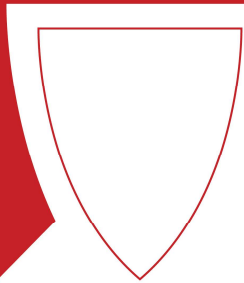
Clinical implementation of research or vice versa

- UI
- Provider

Building data capture system

- Patient-Reported Outcomes: Paper, REDCap, EHR
- Healthcare utilization
- Merger of data

Database extraction and analyses → maintenance and reports



Future Directions



Lesson Learned from PRIMIER: Improve IHM Coding and Tracking

Table: Total # of IM Encounters by Type

IM Service	Index - 12 months
Acupuncture	6,914 (40.1%)
Consult MD/NP	5,971 (34.6%)
Manual therapy	2,869 (16.6%)
Chiropractic	1,746 (10.1%)
Mind and body	1,432 (8.3%)
Consult coaching	602 (3.5%)
Other	343 (2%)
Energy therapy	302 (1.8%)
Total	17,255

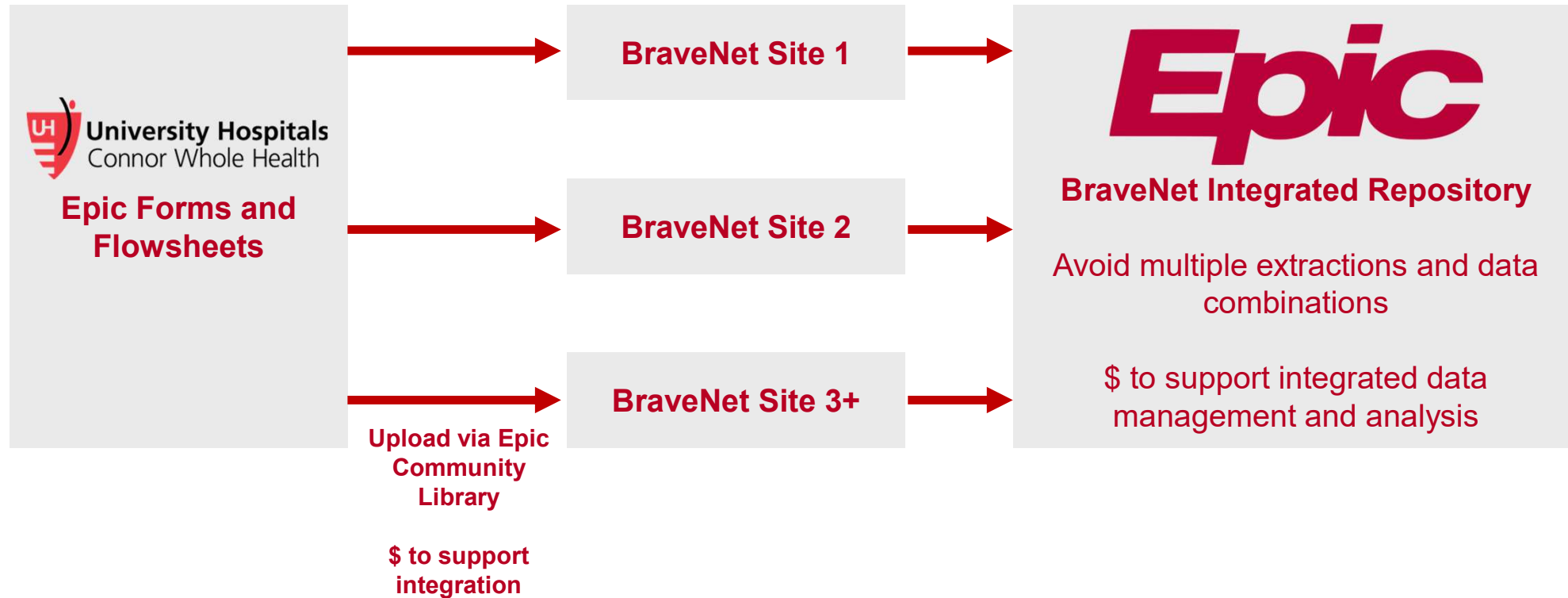
PRIMIER 2.0: working on improving descriptions of IM services in EHR.

- **More specific visit types** (yoga individual, yoga group, etc)
- **Accurate therapist types** (massage therapist, yoga therapist, etc.)
- **Documentation templates** that more specifically identify services received during a visit (mindfulness, health coaching, music therapy, herbals, etc)

BraveNet PBRN Future Directions

- Standardize documentation and data collection practices across BraveNet sites using Epic.
- **PROMs:** Use of common data elements with customization for each clinical site's needs to **incorporate recruitment and data collection into routine clinical care**
- **IHM Utilization:** Use of common visit types to be able to identify when IHM has occurred
- Use of propensity scores to control for selection bias in comparative cohort studies
- With work towards understanding how to deliver IHM to the **correct patient**, at the **right time**, in the right dose, for the **most effective duration**

Working together



Moving forward

- BraveNet
 - ✓ Using these tools to collect PROMs
- Use consistent PROMs
 - ✓ Accurately measure impact
 - ✓ Develop standards for assessment and evaluation
- Consistent description of modalities to advance health services measurement in our field
- Demonstrating value to patients, health systems, and payors

Conclusion

- Data is valuable at all levels of patient care and research.
- There are multiple strategies for data collection.
- Documentation is data.
- Data can be used to advocate for whole person care.
- Real-world data demonstrates clinically meaningful improvements in symptoms and function.
- There can be a synergy between research and clinical practice.

Thank you for attending!

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