NIH Pragmatic Trials Collaboratory

Enabling research embedded in healthcare delivery since 2012

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

Updated January 30, 2025

History: Initiated in 2012 via the NIH Common Fund, now transitioned to sustained funding from multiple NIH Institutes and Centers plus NIH HEAL Initiative

Goal: Strengthen the national capacity to implement cost-effective, large-scale research studies that engage healthcare delivery organizations as partners

Vision: Support the design and conduct of innovative embedded pragmatic clinical trials (ePCTs) to establish best practices and disseminate knowledge

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Why Do an ePCT? The 5 Rs

Relevant Question

The question is pressing, and healthcare system leaders, patients, and front-line clinicians care about the answer.

Real-World Setting

Desire to test in diverse healthcare delivery settings with the hope of implementing findings widely.

Representative Population

Ability to recruit a population reflective of patients with the condition, including those from minoritized communities.

Routinely Collected Data

Can use data collected as part of healthcare delivery to answer the question, supplemented by data from other sources.

Rigorous Methods

Randomized research is needed to answer the question and inform changes in care, policy, or reimbursement.

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

	Clinical Trials Networks	NIH Pragmatic Trials Collaboratory	Quality Improvement
Purpose	Provides infrastructure for clinical trial conduct	Provides **expertise and support** for pragmatic trials (Resource Coordinating Center)	Provides data for immediate improvements in a particular healthcare delivery setting
Setting	Establishes partnerships with clinical sites, primarily academic medical centers	Researchers bring their own partnerships with **diverse healthcare delivery sites**	Individual health system
Population	Patients with condition recruited by trial (homogenous)	Patients with condition receiving healthcare (heterogeneous)	Patients at facility
Data	Creates new data systems for research	Leverages **existing infrastructure** (EHR, etc.)	Leverages existing infrastructure (EHR, etc.)
Research	Rigorous, randomized (individual) clinical trials	Rigorous, randomized (individual or cluster) **pragmatic trials**	Systematic and data-guided activities
Intervention	Delivered by trial staff	Delivered by health system staff	Delivered by health system staff
Outcomes	Efficacy, safety	Effectiveness, implementation	Effectiveness, implementation
Conditions	Highly controlled	**Real-world**	Real-world
Comparator	Placebo or control	Usual care or active comparison	Pre-post comparison

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

- **Support center** for catalyzing pragmatic research
- Researchers establish their own partnerships—possibilities unlimited
- Offers expertise and technical assistance
- Different model for scaling learning health
- No centralized data requirements
- Gathers and shares lessons widely to advance methods

COMPLEMENTARY INITIATIVES

pcornet®

The National Patient-Centered Clinical Research Network

pcori

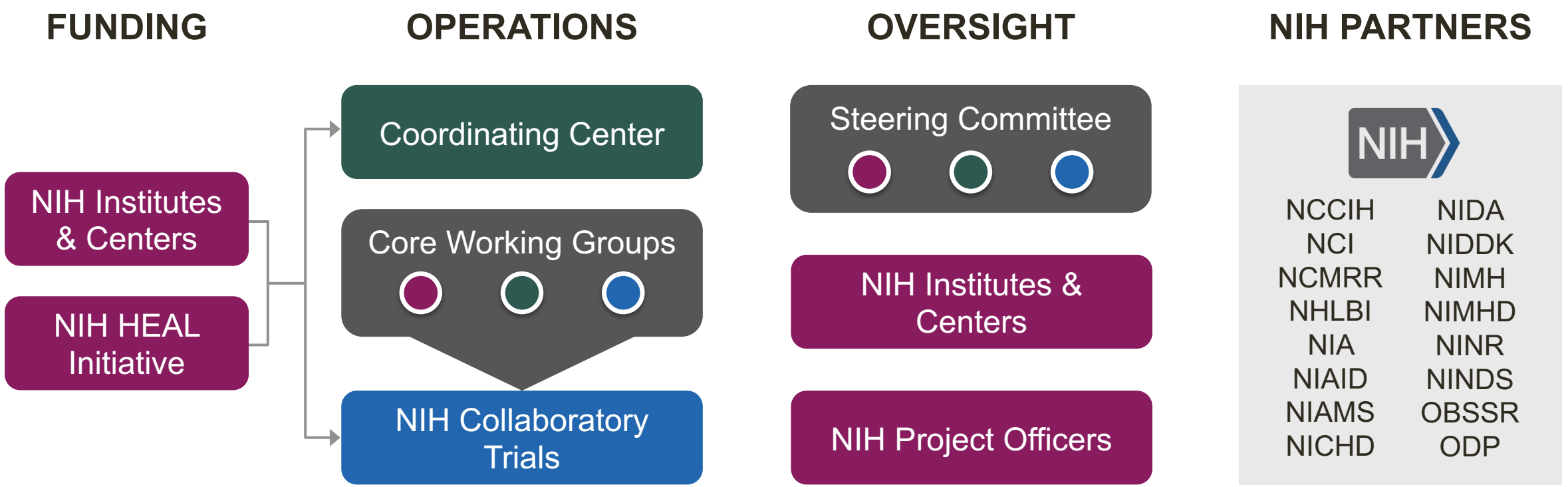
- **Reusable infrastructure**
- Nationwide network of diverse clinical research networks
- Research-ready, standardized clinical data
- Researchers can securely query data
- Community partnerships
- Supports efficient pragmatic research, population health research, and more

Program Success and Evolution

- Initial funding from Common Fund gave support for new ways to think about clinical research and allowed these ideas to take hold by demonstrating feasibility and rigor
- Successful transition from Common Fund to IC support showed appreciation of the program's value and uptake among broad group of ICs
- Integration with NIH HEAL Initiative extended the program's reach into a major NIH-wide program to address the overdose and pain crisis
- Informed other NIH initiatives (PMC & IMPACT) using ePCTs to address major health challenges
  - Pain Management Collaboratory (PMC) in military and Veterans healthcare systems
  - People living with dementia and their care partners (IMPACT Collaboratory)

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Program Structure



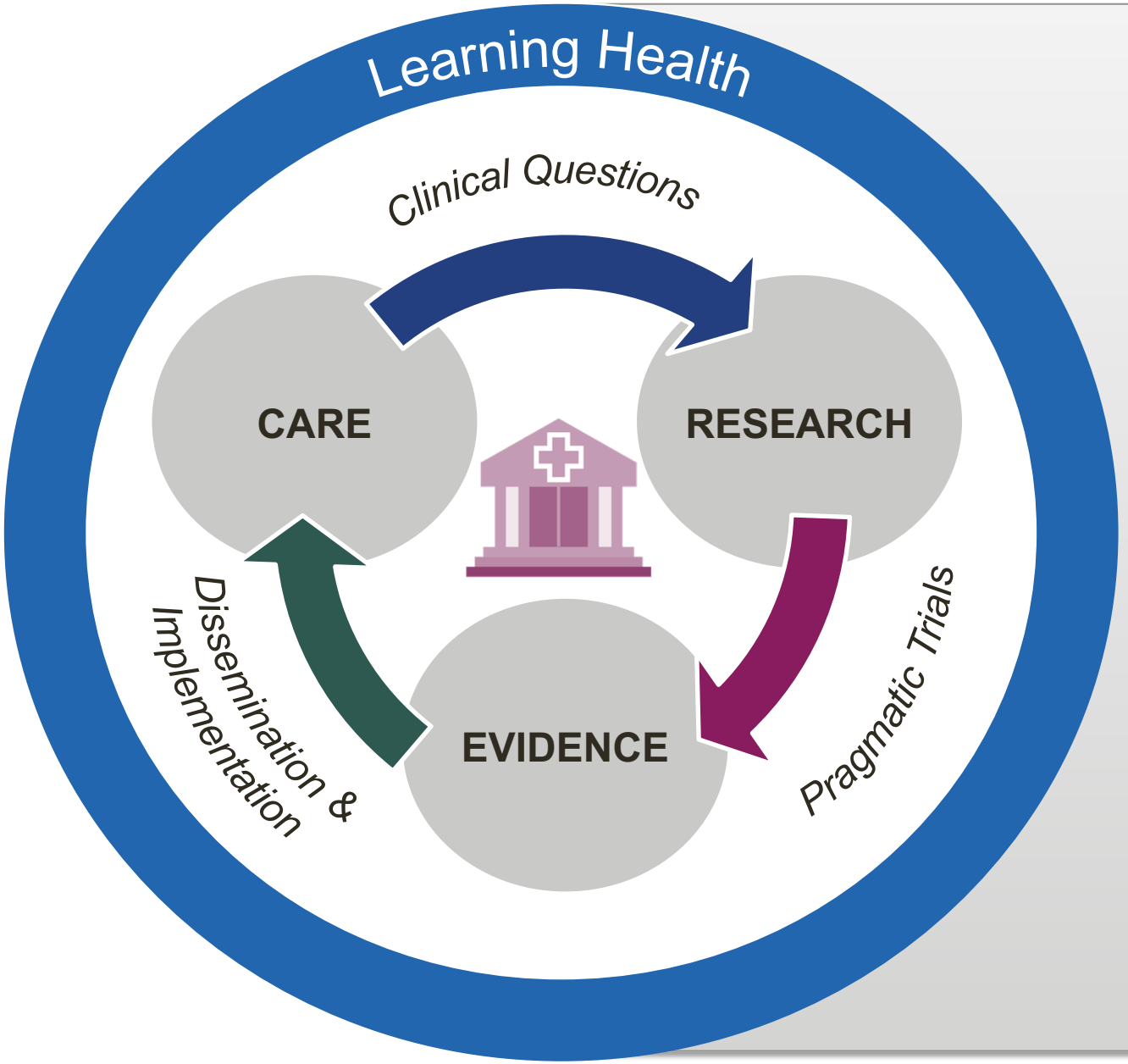
NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Coordinating Center

Functions

- Provide national leadership and technical expertise
- Produce, document, and disseminate standards
- Support synergy within program
- Coordinate communication and dissemination

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®



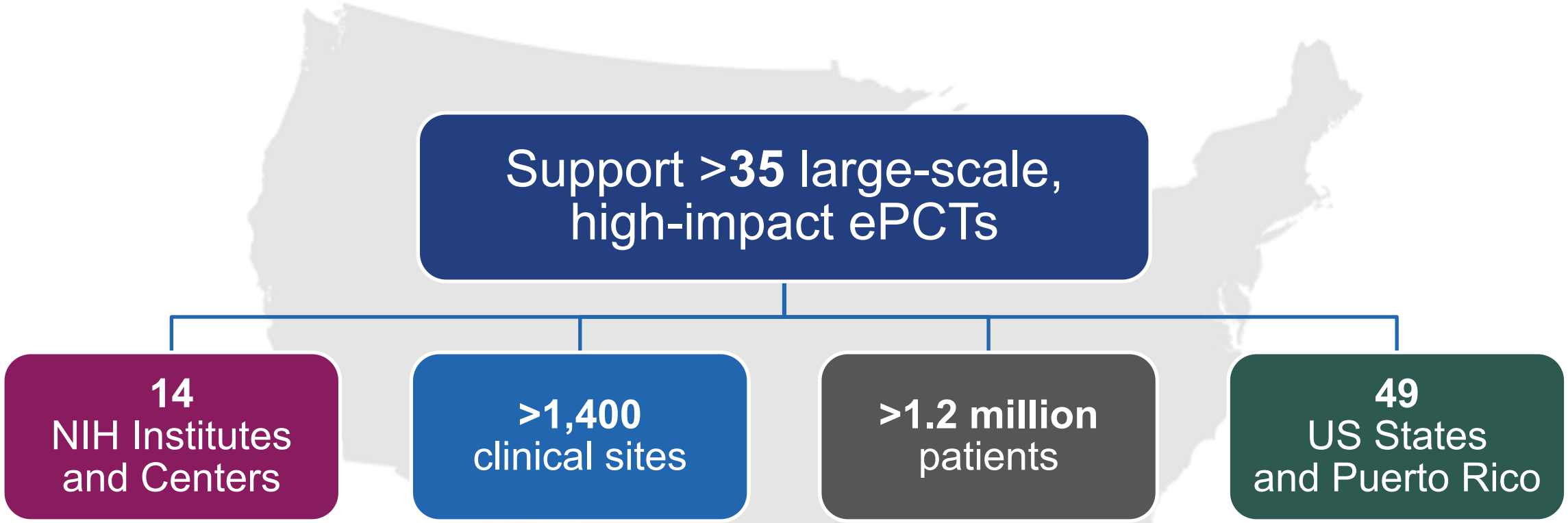
NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

SUPPORT SERVICES

- Consult and provide guidance on:
  - Study design and analysis
  - Regulatory issues and consent practices
  - Use of EHR and real-word data sources
  - Translating results into practice
- Offer strategies to:
  - Improve diversity, equity, and inclusion
  - Engage health system partners
- Assist with:
  - Defining study endpoints
  - Measuring patient-centered outcomes
  - Assessing feasibility of clinical workflows
  - Addressing challenges that arise

Program Reach



No sites in Arkansas

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

NIH Collaboratory Trials

- ePCTs addressing questions of major public health importance
- Wide variety of therapeutic areas
- Many have phased funding
  - Planning/Startup phase
  - Implementation phase

HEAL-Funded NIH Collaboratory Trials

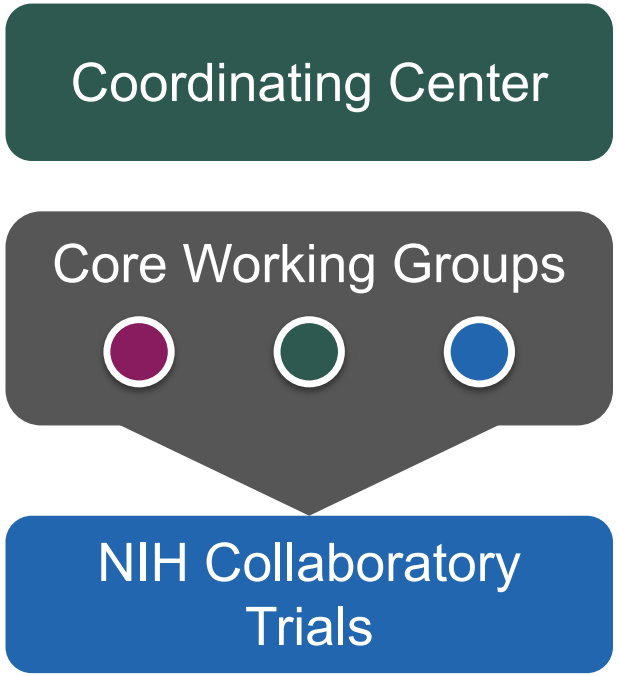
- NIH HEAL Initiative® funding since 2019
- Supports ePCTs of non-opioid interventions for:
  - Treating pain
  - Improving pain management
  - Reducing reliance on opioids

Aim: Improve availability of, effectiveness of, and adherence to evidence-based, nonpharmacologic pain management

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Core Working Groups

- Component of Coordinating Center focusing on key areas of ePCTs
- Led by Chairs from Coordinating Center
- Include representatives from
  - NIH Collaboratory Trials
  - NIH



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Core Working Groups: Purpose

COORDINATING CENTER

- Biostatistics and Study Design
- Electronic Health Records
- Ethics and Regulatory
- Health Care Systems Interactions
- Health Equity
- Implementation Science
- Patient-Centered Outcomes

- Guide and support NIH Collaboratory Trials
- Disseminate knowledge
  - Guidance
  - Lessons learned

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Biostatistics and Study Design Core

Co-Chairs:

- Patrick Heagerty, PhD
- Elizabeth L. Turner, PhD

Mission

- Provide expertise in novel designs and methods for ePCTs
- Document new statistical issues and share knowledge
- Develop methods to address challenges

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Electronic Health Records Core

Co-Chairs:

- Rachel Richesson, PhD, MPH
- Keith A. Marsolo, PhD

Mission

- Help trials acquire, assess, and use real-world data
- Create tools to leverage EHRs for research across multiple health systems
- Share lessons broadly

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Health Care Systems Interactions Core

Chair:

- Greg Simon, MD, MPH

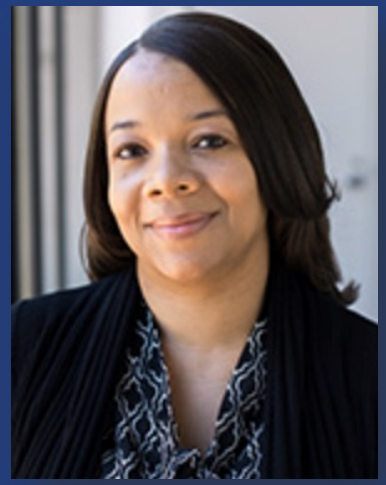
Mission

- Engage those involved in healthcare delivery systems to:
  - Participate in research
  - Help design research attractive to practitioners
  - Lower administrative barriers
  - Communicate results to all parties

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Co-Chairs:

- Rosa Gonzalez-Guarda, PhD, MPH
- Cherise Harrington, PhD, MPH



Health Equity Core

Mission

- Develop guidance for ePCTs on how to integrate a health equity lens, including:
  - Considerations for enrollment
  - Strategies for selecting outcomes
  - Tailored research methods that better suit the study population

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Patient-Centered Outcomes Core

Co-Chairs:

- Christy Zigler, PhD, MSEd
- Emily C. O'Brien, PhD

Mission

- Define best practices for:
  - Selecting, compiling, and curating appropriate PRO measures
  - Developing new instruments when needed
  - Creating efficient, quality data collection systems compatible with EHRs

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Ethics and Regulatory Core

Co-Chairs:

- Jeremy Sugarman, MD
- Pearl O'Rourke, MD
- Stephanie Morain, PhD, MPH



Mission

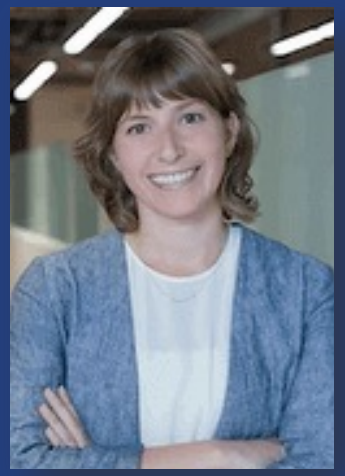
- Identify areas of regulatory and ethical uncertainty for ePCTs
- Help trials navigate regulatory and ethical complexities
- Provide a framework for ethical, compliant conduct of ePCTs

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Implementation Science Core

Co-Chairs:

- Devon Check, PhD
- Hayden Bosworth, PhD



Mission

- Support trials in achieving their implementation-related research aims
- Promote the uptake and sustainability of effective interventions
- Produce guidance for conducting implementation research in ePCTs

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Impact of Cores

>235 trial consultations

>175 publications & products

>1,000 Core meetings

PI Testimonials

"Take the Biostats Core Working Group advice seriously—get it early and act on it early."

"The CC helped greatly with the selection of our secondary outcome measures."

"Have as many key members of your team work closely with Collaboratory Cores."

"Having adjusted our strategy prior to IRB submission based on input from the Core was likely a major reason the IRB review went so smoothly."

Examples: NIH Collaboratory Trials Informing Clinical Care

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

Question:
Does daily antiseptic bathing reduce drug-resistant infections in hospitalized (non-ICU) patients?

Pragmatic Trial:
53 hospitals randomized to routine care or intervention

ABATE Infection Project

NIH Collaboratory Support:

- *Regulatory:* Consulted regarding FDA oversight
- *Data:* Advised on data standardization, cleaning, and sharing
- *Engagement:* Underscored partnerships between health systems and researchers

Study Population:
>500,000 patients with 20 million data records

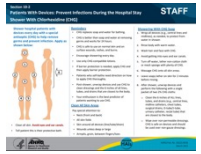
Results:
Negative primary outcome but reduced infections in patients with medical devices

Clinical Impact:

Adopted intervention
in all health system hospitals for patients with medical devices

Implementation toolkit
published for hospitals

AHRQ



Care

Research

NIH PRAGMATIC TRIALS COLLABORATORY

Evidence

Question:
Does an EHR-based outreach program with mailed stool-tests improve rates of colorectal cancer screening?

Pragmatic Trial:
26 FQHC clinics randomized to routine care or intervention

stop screen to prevent colon cancer

NIH Collaboratory Support:

- *Biostatistics:* Extensive support to modify analysis, develop secondary analysis
- *Data:* Helped team learn and implement standards and methods for validating EHR code
- *Overall:* Knowledge sharing, troubleshooting

Study Population:
>40,000 patients and ~6,300 mailed stool-tests

Results:
Significantly improved screening rates

Clinical Impact:

Adopted intervention
in at least 150 clinics

Implementation materials
published to support uptake

Care

Research

Evidence

NIH PRAGMATIC TRIALS COLLABORATORY

FQHC, federally qualified health center

Question:
Can an interdisciplinary intervention improve chronic pain among patients receiving long-term opioid therapy?

Pragmatic Trial:
273 PCPs randomized to routine care or intervention

PPACT Pain Program for Active Coping & Training

NIH Collaboratory Support:

- *Regulatory:* Facilitated conversations with IRBs
- *Engagement:* Discussed challenges and strategies for working with providers, clinic leaders
- *Patient-centered outcomes:* Learned from researchers in other fields

Study Population:
850 patients

Results:
Improved pain, disability, and care satisfaction;
no change in opioid use

Clinical Impact:

Intervention partially sustained in many clinics

App for patients developed by managed care organization

KAISER PERMANENTE®

Reversing the Persistent Pain Cycle — Beyond Pain

HEAL — NIH • Helping to End Addiction Long term℠

Care

Research

Evidence

NIH PRAGMATIC TRIALS COLLABORATORY

PCP, primary care provider

Question:
Does offering low-intensity care management or skills training to adults experiencing frequent suicidal ideation reduce their risk of self-harm?

Pragmatic Trial:
Patients at 4 health systems randomized to usual care or 1 of 2 interventions

SUICIDE PREVENTION OUTREACH TRIAL

Clinical Impact:

Findings *did not support implementation* of the approaches

Future resources not spent on ineffective (or harmful) practices

Suggests exploring other methods

KAISER PERMANENTE®

MHRN Mental Health Research Network

Care → Research → Evidence

NIH PRAGMATIC TRIALS COLLABORATORY

NIH Collaboratory Support:

- *Regulatory:* Helped navigate consent, IRB, and data monitoring issues
- *Biostatistics:* Guidance on analytic considerations
- *Electronic health records:* Advice on handling major change in diagnostic coding mid-study

Study Population:
18,882 patients

Results:
Increased risk of self-harm with brief skills training and no difference with care management, vs usual care

Disseminating Knowledge and Best Practices

NIH PRAGMATIC TRIALS COLLABORATORY

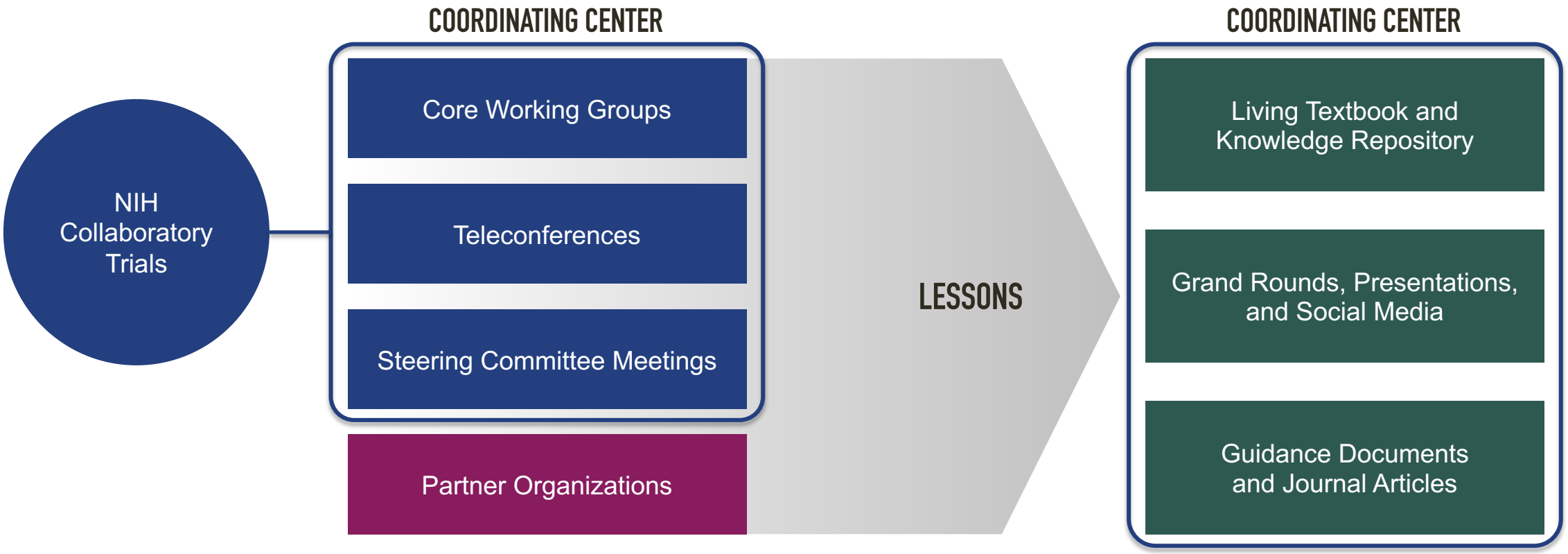
Rethinking Clinical Trials®

We've learned a lot about how to integrate research with practice…

- Using EHRs for research is complex
- Unexpected changes occur, but there are ways to mitigate their effects
- Strong partnerships with healthcare systems are essential
- Some ethical and regulatory uncertainties remain
- Many factors involved in whether an intervention will be sustained
- **Sharing challenges and lessons promotes success, advances methods**

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Flow of Information



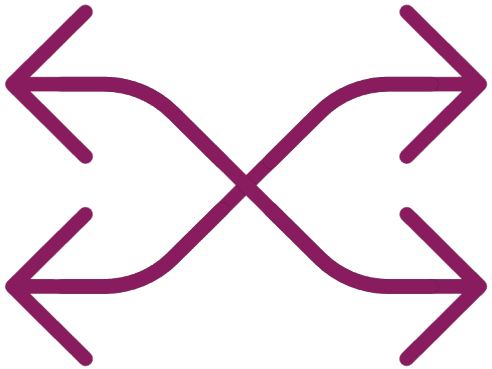
NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Partnerships

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

- Grand Rounds
- Workshops
- Publications
- Living Textbook
- Tools
- Resources
- Knowledge

COLLABORATION



SHARING

pcornet · AHRQ · Sentinel Initiative · Department of Veterans Affairs · Clinical Trials Transformation Initiative · FDA U.S. Food & Drug Administration · The Office of the National Coordinator for Health Information Technology · health care systems research network · National Academy of Medicine · MHRN Mental Health Research Network · NIA IMPACT COLLABORATORY Transforming Dementia Care · pmc painmanagement collaboratory · AcademyHealth · pcori · Réseau de recherche sur les données de santé du Canada Health Data Research Network Canada · All of Us Research Program · CTSA Clinical & Translational Science Awards · CMS Centers for Medicare & Medicaid Services · National Library of Medicine · OHRP Office for Human Research Protections · HEAL NIH · Helping to End Addiction Long-term · AMIA Informatics Professionals. Leading the Way. · PEIJ Pharmacological Evaluation Institute of Japan

NIH **NCCIH NCI NCMRR NHLBI NIA NIAID NIAMS NICHD NIDA NIDDK** NIMH **NIMHD NINR NINDS OBSSR ODP**

Bold denotes current NIH partner

Publications*

TOTAL PUBLISHED

>340

CITATIONS

>9700

JOURNALS

>130

*As of January 30, 2025

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Living Textbook of Pragmatic Clinical Trials

Website & Online Textbook

rethinkingclinicaltrials.org

- Program information
- Comprehensive ePCT resource
- Continuously updated and expanded
- Internal and external contributors
- Reliable and citable

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Living Textbook Content and Reach

30+ chapters

>100,000
visitors/year

>100
contributors

TOPICS INCLUDE:

Design

- Developing a Grant
- Experimental Designs
- Building Partnerships
- Patient Engagement
- What Is a Pragmatic Trial
- Endpoints & Outcomes
- Using EHR Data
- Intervention Complexity

Data, Tools, and Conduct

- Assessing Feasibility
- Acquiring & Assessing Real-World Data
- Study Startup
- Participant Recruitment
- Monitoring Fidelity
- Clinical Decision Support
- Patient-Reported Outcomes
- Mobile Health

Dissemination

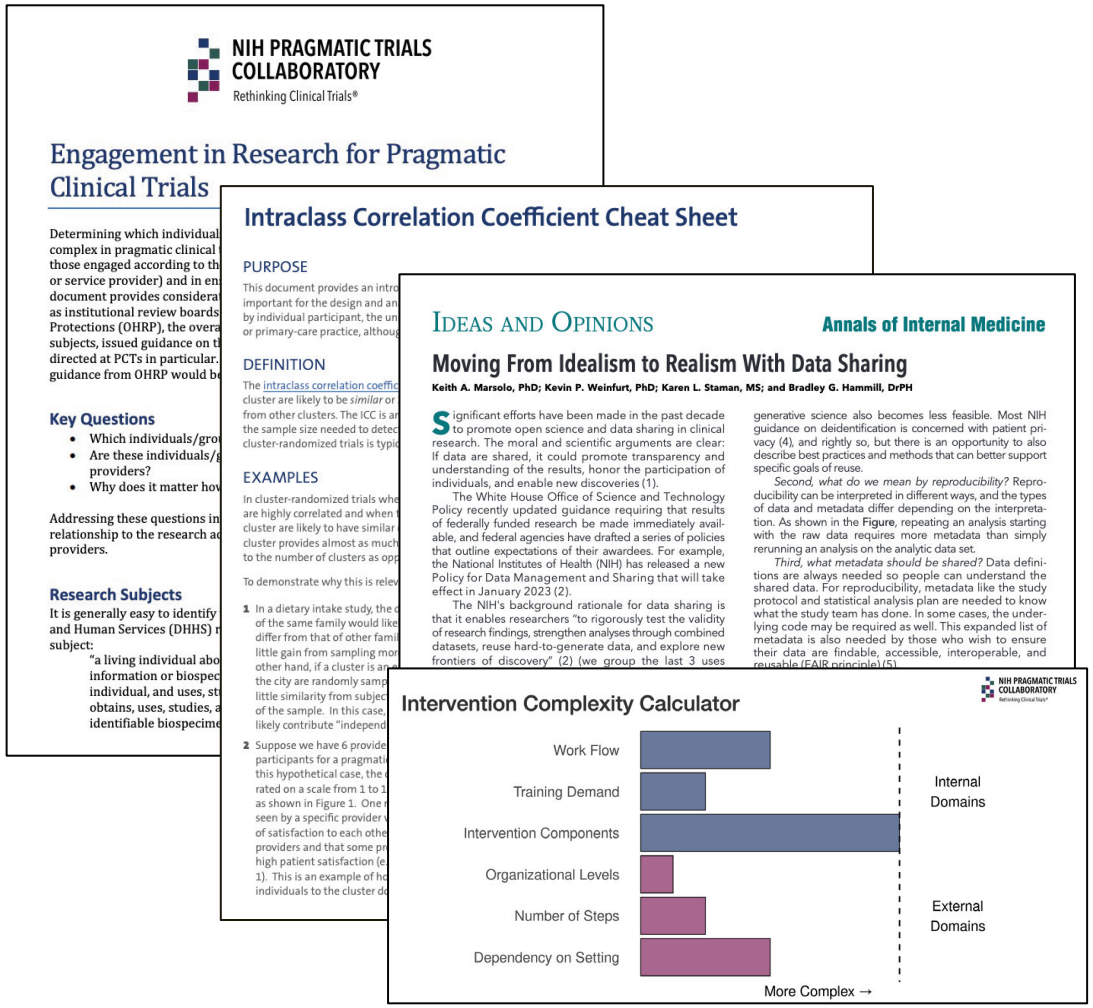
- Data Sharing
- Dissemination
- Implementation

Ethics and Regulatory

- Privacy
- Consent, Waiver, & Notification
- Collateral Findings
- Data & Safety Monitoring
- Single IRB

Tools and Guidance Documents

CHEAT SHEETS	• Intraclass Correlation Coefficient • Equitable Language • Assessing Fitness-for-Use of Clinical Data for ePCTs
TOOLS & TOOLKITS	• Intervention Complexity Calculator • Patient-Centered Outcomes Toolkit • Data Sharing Information • Quick Start Guides
TEMPLATES & CHECKLISTS	• Data Monitoring Committee Charter • Reporting ePCTs Template • Trial Documentation Checklist • Data Sharing Checklist
GUIDANCE DOCUMENTS	• Engagement in ePCTs • Assessing Data Quality • Cluster Randomized Trial Design • Data Sharing



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Learn About Our ePCTs

TRIAL WEBPAGES

- Trial details
- Study snapshots
- News & Interviews
- Publications
- Presentations
- Shared resources

Publications

Patient engagement with prescription refill text reminders across time and major societal events

Description of patient questions received by clinical pharmacists in the Nudge Study

Secondary analysis of electronic opt-out consent in pragmatic research: A study design method to diversify clinical trials?

Data and Resource Sharing

TSOS Data Dictionary

TSOS Protocol

TSOS Data Quality and Phenotyping Manual

TSOS Consent Form

Study Snapshot

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Pragmatic Trial of User-Centered Clinical Decision Support to Implement Emergency Department–Initiated Buprenorphine for Opioid Use Disorder (EMBED)

Principal Investigators
Edward Melnick, MD, MHS; Gail D'Onofrio, MD, MS

ClinicalTrials.gov Identifier
NCT03658642

Sponsoring Institution
Yale University

Collaborators
- University of North Carolina at Chapel Hill
- University of Alabama at Birmingham
- University of Colorado Denver
- UMass Chan Medical School-Baystate

NIH Institutes Providing Oversight
- National Institute on Drug Abuse (NIDA)

DATA AND RESOURCE SHARING
- Data sharing checklist
- Melnick ER, Nath B, Dziura JD, et al. User centered clinical decision support to implement initiation of buprenorphine for opioid use disorder in the emergency department: EMBED pragmatic cluster randomized controlled trial. *BMJ*. 2022 Jun 27;377:e069271. doi: 10.1136/bmj-2021-069271. PMID: 35760423.

STUDY AT A GLANCE

STUDY QUESTION AND SIGNIFICANCE
Patients with untreated opioid use disorder often seek medical care in emergency departments (EDs). ED-initiated buprenorphine doubles the rate of engagement in addiction treatment by these patients. However, the practice of initiating buprenorphine in the ED has not been implemented into ED care. One major challenge for implementing evidence-based medicine has been the poor usability of health information technology. User-centered design of health information technology interventions can improve the user experience and the uptake of evidence-based medical care.

DESIGN AND SETTING
Pragmatic cluster randomized controlled trial with 599 attending emergency physicians caring for 5047 adult patients who presented with opioid use disorder in 18 ED clusters across 5 healthcare systems in 5 states between November 2019 and May 2021.

INTERVENTION AND METHODS
The study seamlessly integrated a user-centered, physician-facing clinical decision support system into user workflows in the electronic health record (EHR) to support initiation of buprenorphine in the ED. The system was designed to help clinicians diagnose opioid use disorder, assess withdrawal severity, motivate patients to accept treatment, and complete EHR tasks by automating clinical and after-visit documentation, order entry, prescribing, and referral. The primary study outcome was the rate of buprenorphine administration or prescription in the ED among patients with opioid use disorder. Secondary implementation outcomes were measured using the RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework.

FINDINGS
Assessment of 1,413,693 ED visits for study eligibility identified 5047 patients with opioid use disorder (2787 in the intervention arm, 2260 in the usual care arm) under the care of 599 attending physicians (340 in the intervention arm, 259 in the usual care arm) for analysis. Buprenorphine was initiated in 347 patients (12.5%) in the intervention arm and 271 patients (12.0%) in the usual care arm (odds ratio [OR] from adjusted generalized estimating equations, 1.22; 95% CI, 0.61-2.43; $P = .58$). Buprenorphine was initiated at least once by 151 physicians (44.4%) in the intervention arm and 88 physicians (34.0%) in the usual care arm (OR, 1.83; 95% CI, 1.16-2.89; $P = .01$).

CONCLUSIONS AND RELEVANCE
Although user-centered clinical decision support did not increase patient-level rates of buprenorphine initiation in the ED, when used, EMBED was associated with high rates of initiation of buprenorphine. EMBED also increased the number of unique physicians who provided initiation of buprenorphine in the ED and prescribed naloxone. Clinical decision support that streamlines and automates electronic workflows can increase physician adoption of complex, unfamiliar evidence-based practices. More interventions are needed to examine other barriers to the treatment of addiction at the patient level in the ED for patients with opioid use disorder.

rethinkingclinicaltrials.org

Sharing Trial Resources & Data

rethinkingclinicaltrials.org/data-and-resource-sharing/

Completed trials share data and resources publicly

STUDY TOOLS

- Protocols
- Consent forms
- Implementation tools
- Site materials
- Questionnaires
- Toolkits
- Ethics and regulatory documentation

DATASETS AND DOCUMENTATION

- Data dictionaries
- Public use datasets
- Analytic code
- Computable phenotypes
- Data quality manuals
- Data request forms
- Data sharing checklists

PUBLICATIONS

- Study design papers
- Main outcomes papers
- Qualitative research
- Other publications

Rethinking Clinical Trials® Grand Rounds

Weekly webinars

- **Fridays 1-2 pm ET**
- Open to public
- >550 held to date
- >150 attendees/session
- Timely, high-interest topics
- Feature NIH Collaboratory work and beyond

Podcast episodes

- 50 available

Training Activities

13 workshops

>700 attendees

48 presenters

84 hours
of presenter-led training

AUDIENCES REACHED

- Academic researchers
- Funding agencies
- Investigators
- Health system leaders
- Healthcare practitioners
- Other ePCT partners

AcademyHealth

SCT
Society for Clinical Trials

health care systems research network

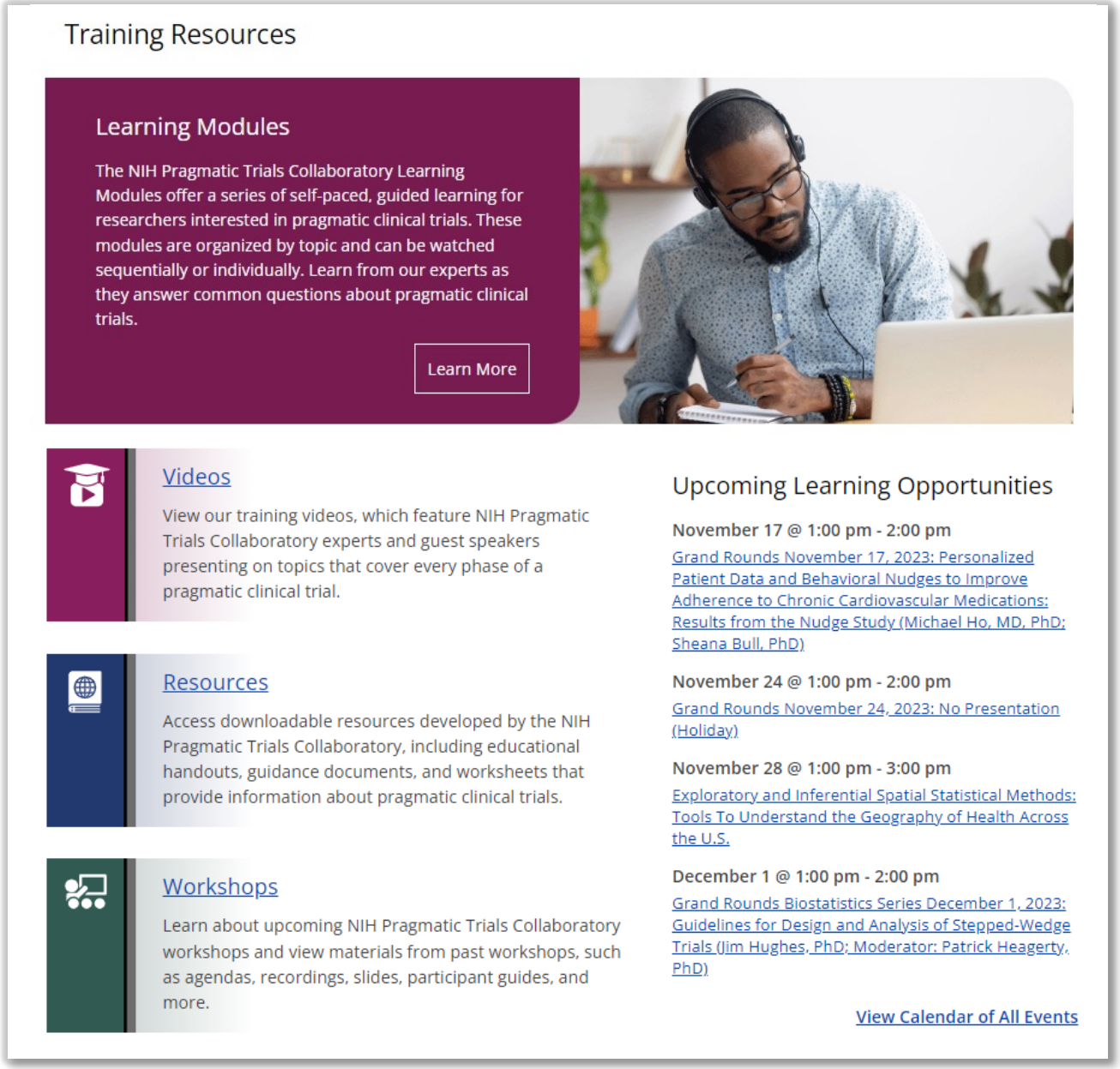
NIH
National Institutes of Health

Duke
University

ePCT Training Resources

rethinkingclinicaltrials.org/training-resource/

- Learning modules
- Video library
- Resources (handouts, checklists, guides, etc)
- Workshop materials (slides, recordings, etc)
- Upcoming opportunities



Receive ePCT Updates

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

April 2022 • Subscribe to the Newsletter • Living Textbook • Grand Rounds Hub

News From the NIH Pragmatic Trials Collaboratory

FDA Commissioner Rob Califf Reflects on Origins and Impact of NIH Pragmatic Trials Collaboratory

In a keynote speech at the NIH Pragmatic Trials Collaboratory Steering Committee annual meeting, Dr. Rob Califf called for more and faster evidence generation. "We have to generate evidence more quickly and then insist that it gets used," he said. After his remarks, Califf joined Dr. Wendy Weber of the National Center for Complementary and Integrative Health to reflect on the origins and impact of the program. Califf was the first principal investigator of the program's Coordinating Center. View the full interview.

FDA Announces Draft Guidance for Increasing Diversity in Clinical Trials: The US Food and Drug Administration issued draft guidance recommending clinical trial sponsors develop a "race and ethnicity diversity plan" to ensure representative enrollment of racially and ethnically diverse participants in clinical trials developing medical products.

TSOS Implements Suicide Assessment and Monitoring Method: The TSOS study, an NIH Collaboratory Demonstration

Subscribe

Monthly email newsletter

rethinkingclinicaltrials.org/newsletter-subscribe/

Follow Us

https://www.linkedin.com/company/nih-pragmatic-trials-collaboratory/

@Collaboratory1

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

Appendix: NIH Collaboratory Trials

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

NIH Collaboratory Trials: Completed

Project	Population	Intervention	Outcome
ABATE	Non-ICU patients	Decolonization strategies	MRSA and VRE clinical cultures
EMBED	Patients with opioid use disorder	User-centered computerized clinical decision support	Rate of emergency department–initiated buprenorphine/naloxone; referral for ongoing medication assisted treatment
ICD-Pieces	Comorbid diabetes, chronic kidney disease, hypertension	Collaborative primary care program	All-cause hospitalizations for 3 conditions
LIRE	Low back pain	Insertion of epidemiologic benchmarks in lumbar spine imaging reports	Relative value unit for spine-related interventions
Nudge	Patients with chronic CV conditions	Text messages and chat bot	Adherence to CV medications
PPACT	Nonmalignant chronic pain	Multidisciplinary behavioral care management	Brief Pain Inventory
PRIM-ER	Older adults (>65 years)	Palliative care education; simulation-based workshops; clinical decision support; provider audit and feedback	Healthcare utilization and survival

NIH Collaboratory Trials: Completed (cont)

Project	Population	Intervention	Outcome
PROVEN	Nursing home residents	Advance care planning video (behavioral program)	Hospitalizations; presence of advance directives
SPOT	Suicidal ideation or depression	Collaborative care behavioral program (care management & skills training)	Suicide attempts
STOP CRC	Adults aged 50-75 years	Direct mail colorectal cancer (CRC) screening program (FIT kit)	CRC screening rates
TiME	Patients initiating dialysis	Dialysis session of at least 4.25 hours	All-cause mortality, hospitalization
TSOS	Traumatic injury	Collaborative care management program	PTSD checklist; PHQ-9 scale; alcohol use disorders; SF-12/36

Completed

ABATE *Active Bathing to Eliminate Infection*

- Cluster trial comparing 2 **quality improvement strategies to reduce multidrug-resistant organisms and healthcare-related infections** in non-ICU population
- 53 hospitals
- 331,584 patients

THE LANCET

Chlorhexidine versus routine bathing to prevent multidrug-resistant organisms and all-cause bloodstream infections in general medical and surgical units (ABATE Infection trial): a cluster-randomised trial

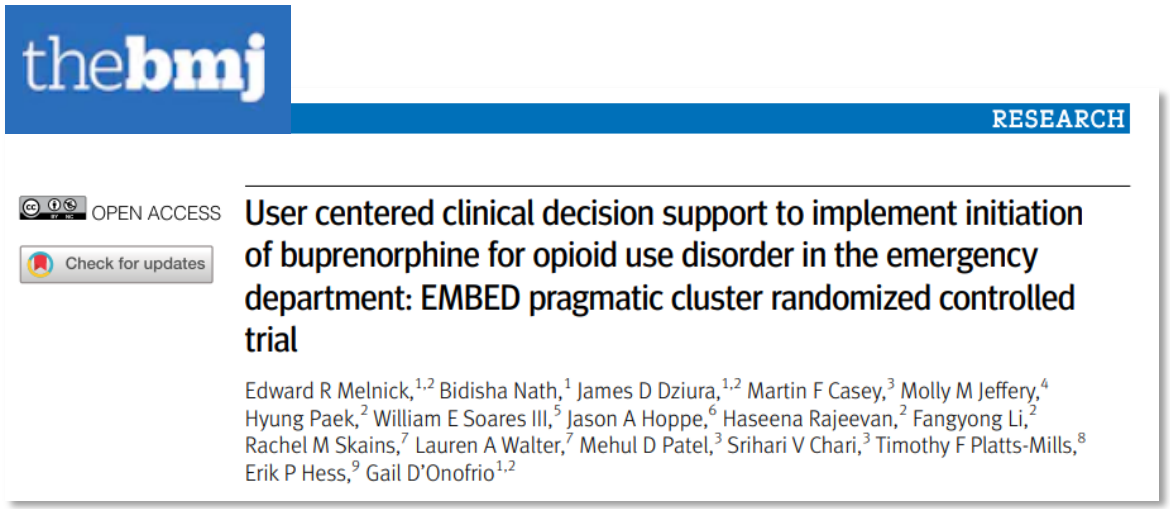
Susan S Huang, Edward Septimus, Ken Kleinman, Julia Moody, Jason Hickok, Lauren Heim, Adrijana Gombosev, Taliser R Avery, Katherine Haffenreffer, Lauren Shimelman, Mary K Hayden, Robert A Weinstein, Caren Spencer-Smith, Rebecca E Kaganov, Michael V Murphy, Tyler Forehand, Julie Lankiewicz, Micaela H Coady, Lena Portillo, Jalpa Sarup-Patel, John A Jernigan, Jonathan B Perlin, Richard Platt, for the ABATE Infection trial team

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Completed

EMBED *Pragmatic Trial of User-Centered Clinical Decision Support to Implement Emergency Department-Initiated Buprenorphine for Opioid Use Disorder*

- Cluster trial testing the effect of user-centered computerized clinical decision support on rates of **emergency department–initiated buprenorphine/naloxone and referral for ongoing medication-assisted treatment** in patients with opioid use disorder
- 3 health systems
- 5,047 patients



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Completed

ICD-Pieces *Improving Chronic Disease Management with Pieces™*

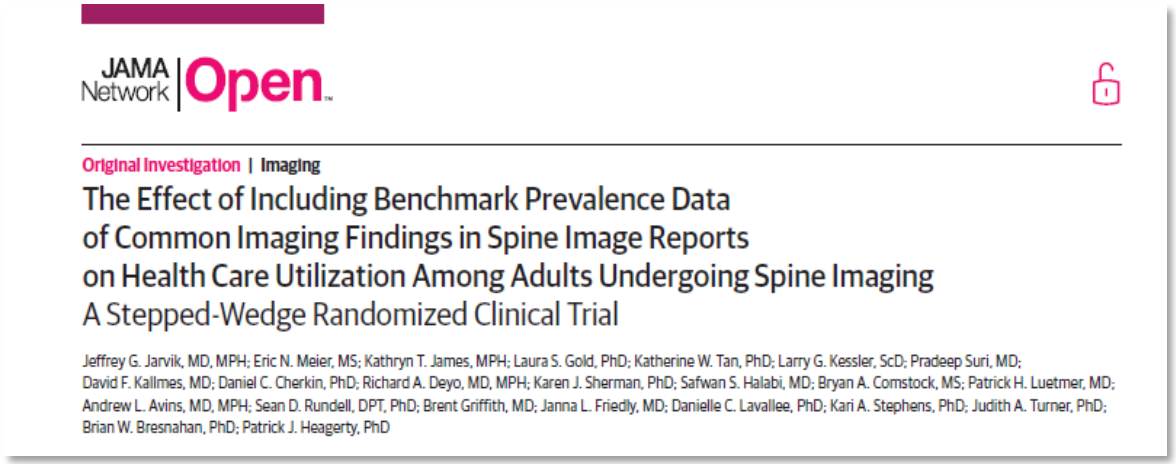
- Novel platform to test effective ways to **reduce heart problems, hospitalizations & deaths in patients with multiple chronic conditions**
- 94 clinical sites
- 11,000 patients

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Completed

LIRE *Lumbar Imaging with Reporting of Epidemiology*

- Cluster trial evaluating whether **inserting epidemiologic benchmarks** into lumbar spine imaging reports reduces subsequent tests and treatments
- 98 clinical sites
- 246,289 patients



JAMA Network | Open

Original Investigation | Imaging

The Effect of Including Benchmark Prevalence Data of Common Imaging Findings in Spine Image Reports on Health Care Utilization Among Adults Undergoing Spine Imaging

A Stepped-Wedge Randomized Clinical Trial

Jeffrey G. Jarvik, MD, MPH; Eric N. Meier, MS; Kathryn T. James, MPH; Laura S. Gold, PhD; Katherine W. Tan, PhD; Larry G. Kessler, ScD; Pradeep Suri, MD; David F. Kallmes, MD; Daniel C. Cherkin, PhD; Richard A. Deyo, MD, MPH; Karen J. Sherman, PhD; Safwan S. Halabi, MD; Bryan A. Comstock, MS; Patrick H. Luetmer, MD; Andrew L. Avins, MD, MPH; Sean D. Rundell, DPT, PhD; Brent Griffith, MD; Janna L. Friedly, MD; Danielle C. Lavallee, PhD; Kari A. Stephens, PhD; Judith A. Turner, PhD; Brian W. Bresnahan, PhD; Patrick J. Heagerty, PhD

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Completed

Nudge *Personalized Patient Data and Behavioral Nudges to Improve Adherence to Chronic Cardiovascular Medications*

- Patient-level randomized pragmatic trial comparing the effects of digital interventions (text messages and chat bot) on **medication adherence** in patients with chronic cardiovascular conditions
- 3 health systems

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Completed

PPACT *Collaborative Care for Chronic Pain in Primary Care*

- Mixed-methods cluster trial evaluating **integration of multidisciplinary services within the primary care** environment to improve chronic pain management
- 3 regional health systems
- 2,000 patients

PPACT
Pain
Program for Active Coping & Training

JGIM
Journal of General Internal Medicine

CrossMark

Automating Collection of Pain-Related Patient-Reported Outcomes to Enhance Clinical Care and Research

Ashli Owen-Smith, PhD, SM[1,2], Meghan Mayhew, MPH[3], Michael C. Leo, PhD[3], Alexandra Varga, MPH[3], Lindsay Benes, PhD, RN, CNS[3,4], Allison Bonifay, MA, LPC[3], and Lynn DeBar, PhD, MPH[5]

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Completed

PRIM-ER *Primary Palliative Care for Emergency Medicine*

- Cluster trial testing the effects of implementing primary palliative care in emergency medicine on **healthcare utilization and survival**
- 35 emergency departments across 18 health systems

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Completed

PROVEN *Pragmatic Trial of Video Education in Nursing Homes*

- Evaluating the **effectiveness of advance care planning video** shown in nursing homes of 2 large healthcare systems
- 359 nursing homes
- 211,469 patients

PROVEN

PRagmatic Trial of Video Education in Nursing Homes

Research

JAMA Internal Medicine | Original Investigation

Advance Care Planning Video Intervention Among Long-Stay Nursing Home Residents

A Pragmatic Cluster Randomized Clinical Trial

Susan L. Mitchell, MD, MPH; Angelo E. Volandes, MD, MPH; Roee Gutman, PhD; Pedro L. Gozalo, MSc, PhD; Jessica A. Ogarek, MS; Lacey Loomer, MSPH; Ellen M. McCreedy, PhD; Ruoshui Zhai, MS; Vincent Mor, PhD

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

Completed

SPOT *Suicide Prevention Outreach Trial*

- Collaborative care model to test treatments intended to reach large groups of **adult patients who have serious thoughts of suicide**
- 4 clinical sites
- 18,644 patients

SUICIDE PREVENTION OUTREACH TRIAL


Research

JAMA | Original Investigation

Effect of Offering Care Management or Online Dialectical Behavior Therapy Skills Training vs Usual Care on Self-harm Among Adult Outpatients With Suicidal Ideation
A Randomized Clinical Trial

Gregory E. Simon, MD, MPH; Susan M. Shortreed, PhD; Rebecca C. Rossom, MD, MS; Arne Beck, PhD; Gregory N. Clarke, PhD; Ursula Whiteside, PhD; Julie E. Richards, MPH, PhD; Robert B. Penfold, PhD; Jennifer M. Boggs, PhD, MSW; Julia Smith, MS

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Completed

STOP CRC *Strategies and Opportunities to Stop Colorectal Cancer*

- Cluster trial testing a culturally tailored, healthcare system–based program to **improve CRC screening rates** in community-based collaborative network
- 30 clinical sites
- 62,155 patients

stop
screen to prevent
colon cancer

JAMA Internal Medicine | Original Investigation

Effectiveness of a Mailed Colorectal Cancer Screening Outreach Program in Community Health Clinics
The STOP CRC Cluster Randomized Clinical Trial

Gloria D. Coronado, PhD; Amanda F. Petrik, MS; William M. Vollmer, PhD; Stephen H. Taplin, MD, MPH; Erin M. Keast, MPH; Scott Fields, MD; Beverly B. Green, MD, MPH

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Completed

TiME *Time to Reduce Mortality in End-Stage Renal Disease*

- Cluster trial testing whether a **longer hemodialysis session can improve survival & quality of life** for patients with kidney failure who require chronic treatment with dialysis
- 256 clinical sites
- 7,053 patients

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Completed

TSOS *Trauma Survivors Outcomes and Support*

- Stepped-wedge cluster trial **testing innovative intervention for patients with PTSD and comorbidity**
- 25 level 1 trauma centers
- 960 patients

JAMA Surgery | Original Investigation

Stepped Collaborative Care Targeting Posttraumatic Stress Disorder Symptoms and Comorbidity for US Trauma Care Systems
A Randomized Clinical Trial

Douglas Zatzick, MD; Gregory Jurkovich, MD; Patrick Heagerty, PhD; Joan Russo, PhD; Doyanne Darnell, PhD; Lea Parker, BA; Michelle K. Roberts, MPH; Rddhi Moodliar, BA; Allison Engstrom, MSW; Jin Wang, PhD; Eileen Bulger, MD; Lauren Whiteside, MD; Deepika Nehra, MD; Lawrence A. Palinkas, PhD; Kathleen Moloney, BA; Ronald Maier, MD

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

NIH Collaboratory Trials: Planning Phase

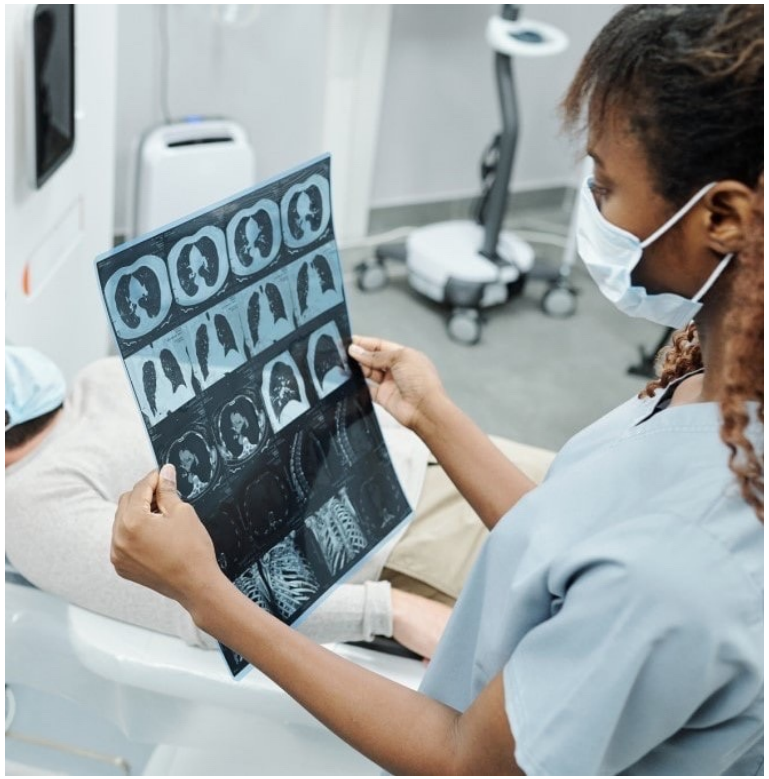
Project	Population	Intervention	Outcome
LungSmart	Current and former smokers, aged 50-80	Telehealth tools designed to engage people in lung cancer screening	Lung cancer screening completion
STEP-2	Women aged 30-65	HPV self-sampling	Screening proportion

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

LungSmart

Population Health Management Approaches to Increase Lung Cancer Screening in Community Health Centers

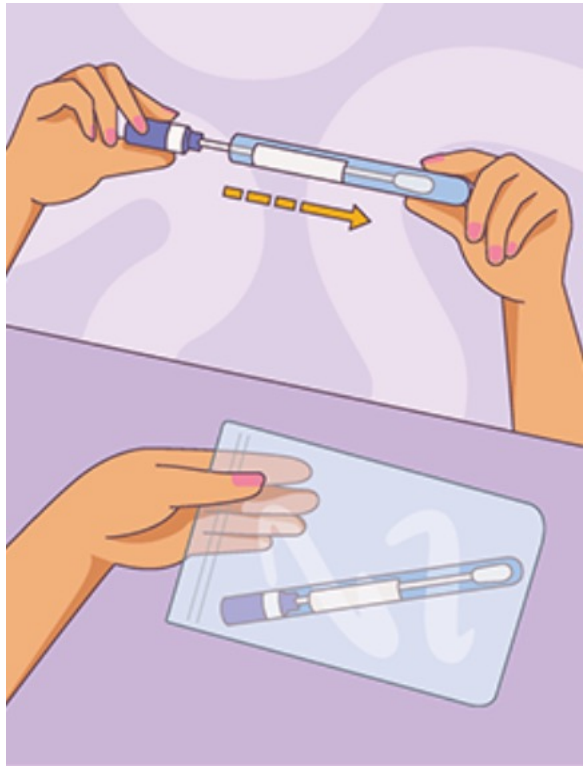
- Patient-level randomized trial
- Evaluating the effectiveness of digital and telehealth tools to **increase the reach of lung cancer screening** among people who get care at community health centers
- 14 federally qualified health centers in Utah operating ~50 primary care clinics



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

STEP-2 *Self-Testing for Cervical Cancer in Priority Populations*

- Cluster randomized trial
- Evaluating the effectiveness and implementation of **HPV self-sampling interventions**
- 42 federally qualified health center clinics



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

R01 NIH Collaboratory Trials

Project	Population	Intervention	Outcome
iPATH	Patients with type 2 diabetes from health disparity populations	Multi-level, multi-component, technology-enabled practice transformation strategy	Reduction in patients with poorly controlled diabetes (A1c>9%) at 12 and 24 months
MOMs Chat & Care Study	Black birthing people	Integrated care model approach at 2 different levels of intensity, high or low	Incidence of severe maternal morbidity at time of labor and delivery and related hospital admissions at 1-month and 1-year postpartum

iPATH

Implementing Scalable, PAtient-centered Team-based Care for Adults with Type 2 Diabetes and Health Disparities

- Hybrid type 2 effectiveness implementation study, including a stepped-wedge cluster randomized trial
- Evaluating whether an innovative multi-level, multi-component, technology-enabled **practice transformation strategy** can improve outcomes for patients with type 2 diabetes from health disparity populations
- 8 federally qualified health centers

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

MOMs Chat & Care

Maternal OutcoMes Program: Testing Integrated Maternal Care Model Approaches to Reduce Disparities in Severe Maternal Morbidity

- Testing the effectiveness of an **integrated care model approach** at 2 different levels of intensity to facilitate timely, appropriate care for high-risk Black birthing people and reduce risk for severe maternal morbidity
- Largest healthcare provider in New York
- 674 expected patients

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

NIH Collaboratory Trials: Implementation Phase

Project	Population	Intervention	Outcome
ACP PEACE	Patients with advanced cancer	Clinician communication skills training and patient video decision aids for advanced care planning	Advance care plans completion; medical orders for resuscitation preferences; palliative care consultations; hospice use
BEST-ICU	Critically ill adults	Strategies to increase adoption of the ABCDEF bundle, a mechanical ventilation liberation and symptom management approach	Implementation (primary) and clinical (secondary) effectiveness outcomes
Chat 4 Heart Health	Patients from Federally Qualified Health Centers with sub-optimal control of their cardiovascular (CV) risk factors	Multilevel intervention leveraging cellphone-based text messages	Global CV health and control of CV risk factors (e.g., hypertension, diabetes)
GGC4H	Parents of early adolescents	Anticipatory guidance curriculum	Behavioral health problems; health service utilization
HiLo	Patients undergoing hemodialysis	Liberalizing serum phosphate target	Rate of hospitalization
I CAN DO Surgical ACP	Older adults undergoing major elective survey	Patient-facing advance care planning (ACP) tool	ACP completion rates and patient engagement with ACP

NIH Collaboratory Trials: Implementation Phase (cont)

Project	Population	Intervention	Outcome
IMPACt-LBP	Adults with low back pain	Primary Spine Practitioner (PSP) Model using doctors of chiropractic and physical therapists as first-line providers	Improve physical function, decrease pain, decrease opioid prescriptions, improve patient satisfaction, and decrease costs and utilization of healthcare services when compared with usual medical care
INSPIRE	Non–critically ill hospitalized patients with abdominal infections or skin and soft tissue infections	Predictive algorithm integrated into the computerized provider order entry system, plus audit and feedback	Reduction in prescribing of unnecessary extended-spectrum antibiotics while maintaining good clinical outcomes as measured by length of stay and transfer to an intensive care unit
TAICHIKNEE	Patients with knee pain due to osteoarthritis	Remotely delivered web-based Tai Chi intervention	Physical health (including knee-related pain and function), mental health, and healthcare utilization

ACP PEACE *Advance Care Planning: Promoting Effective and Aligned Communication in the Elderly*

- Cluster trial testing whether clinician communication skills training and patient video decision aids will increase **advance care plan completion** in patients >65 with advanced cancer
- 36 oncology clinics across 3 health systems
- 4,500 expected patients

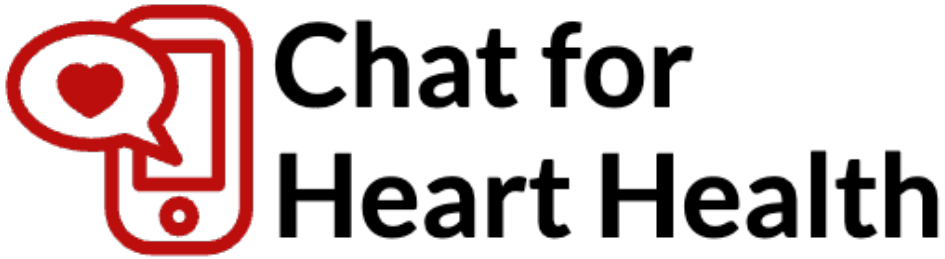
BEST-ICU *Behavioral Economic and Staffing Strategies to Increase Adoption of the ABCDEF Bundle in the ICU*

- 3-arm stepped-wedge, cluster-randomized trial to evaluate 2 strategies grounded in behavioral economic and implementation science theory to **increase adoption of the ABCDEF bundle**, a mechanical ventilation liberation and symptom management approach, in critically ill adults
- 12 ICUs from 3 safety net hospitals
- 8,100 expected patients

Chat 4 Heart Health

Using Artificially Intelligent Text Messaging Technology to Improve AHA's Life's Essential 8 Health Behaviors

- Patient-level randomized trial to evaluate the implementation and effectiveness of 3 different **automated patient communication approaches** for self-management support to improve control of cardiovascular disease risk factors
- Federally Qualified Health Centers in 3 health systems
- 6,000 expected patients

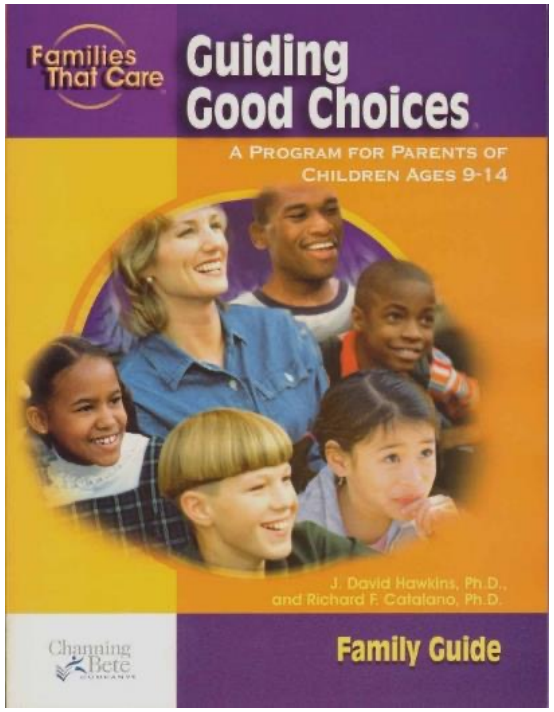


NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

GGC4H *Guiding Good Choices for Health*

- Cluster trial testing whether an anticipatory guidance curriculum for parents of early adolescents will reduce **behavioral health problems and health service utilization**
- 3 health systems
- 72 pediatricians and 4,500 families expected

GUIDING GOOD CHOICES



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

HiLo *Pragmatic Trial of Higher vs. Lower Serum Phosphate Targets in Patients Undergoing Hemodialysis*

- Cluster trial testing whether less stringent control of serum phosphate levels will yield **noninferior rates of all-cause hospitalization** in patients with end-stage renal disease undergoing hemodialysis
- >100 dialysis facilities
- 4,400 expected patients

A Pragmatic Trial Sponsored by the National Institutes of Health

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

I CAN DO Surgical ACP

Improving Completion, Accuracy, and Dissemination of Surgical Advanced Care Planning

- Patient-level randomized trial to evaluate a system-based approach to help older adults undergoing elective surgery **engage in advance care planning**
- 3 health systems

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

IMPACt-LBP *Implementation of the American College of Physicians Guideline for Low Back Pain*

- Refine and implement a **multidisciplinary collaborative care model for low back pain**
- Evaluate the effectiveness of this care model compared to usual medical care for low back pain
- 3 academic healthcare systems

IMPACt LBP
LOW BACK PAIN

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

INSPIRE *INtelligent Stewardship Prompts to Improve Real-time Empiric Antibiotic Selection for Patients*

- 2 cluster randomized trials using personalized clinical decision support to improve judicious antibiotic prescribing for non–critically ill patients hospitalized with **abdominal infections or skin and soft tissue infections**
- 90,000 expected patients

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

TAICHIKNEE *Remote Tai Chi for Knee Osteoarthritis: an Embedded Pragmatic Trial*

- Compare the effects of a remotely delivered **web-based Tai Chi intervention** versus routine care for patients with knee pain due to osteoarthritis
- 20-25 clinics across 4 health systems
- 600 expected patients

TaiChiKnee
A Path to Knee Pain Relief

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

HEAL Trials: Planning Phase

Project	Population	Intervention	Outcome
AIM CP	Rural-dwelling patients with chronic pain	Nurse care management model incorporating care coordination, cognitive behavioral therapy, and a remotely delivered exercise program	Pain interference, physical functioning, mental health, treatment satisfaction, sleep, pharmacologic treatments, and healthcare utilization
APA-SM	Rural-dwelling patients with chronic musculoskeletal pain	4-week auricular point acupressure self-management program delivered via mobile app	Pain intensity, pain interference, and function; cost-effectiveness
RAMP	Rural-dwelling Veterans with chronic pain	Telehealth intervention with multiple evidence-based complementary and integrative health approaches for chronic pain	Pain interference at 13 and 26 weeks; opioid use

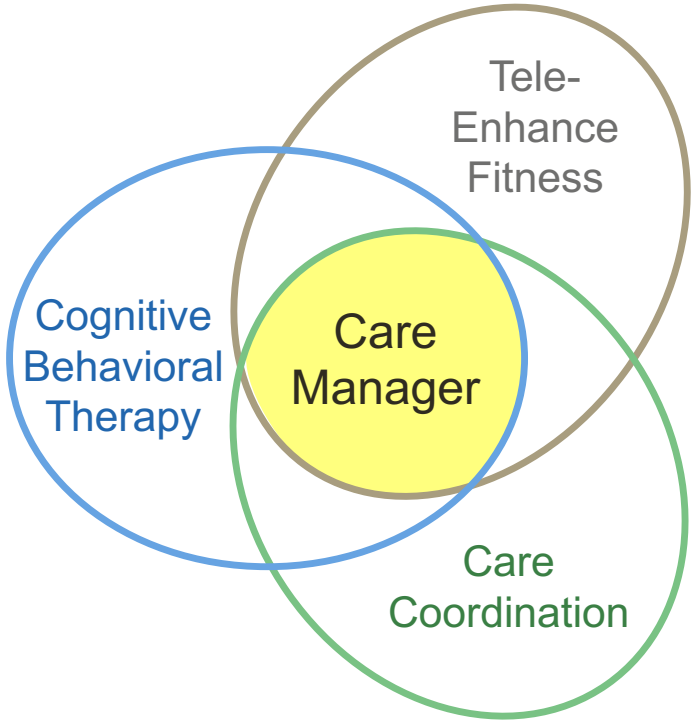
APA-SM *Personalized Auricular Point Acupressure for Chronic Pain Self-Management in Rural Populations*

- Evaluating an **auricular point acupressure self-management** program for rural populations with chronic musculoskeletal pain
- Hybrid implementation-effectiveness trial

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

AIM-CP *Adapting and Implementing a Nurse Care Management Model to Care for Rural Patients with Chronic Pain*

- Adapting and test a **nurse care management model** to provide comprehensive coordinated care for patients with chronic pain in rural communities
- 6 health systems
- 416 expected patients



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

RAMP *Reaching Rural Veterans: Applying Mind-Body Skills for Pain Using a Whole Health Telehealth Intervention*

- Hybrid type 2 effectiveness-implementation trial evaluating a **telehealth intervention** with multiple evidence-based complementary and integrative health approaches for chronic pain
- VA health system
- 500 expected patients (rural-dwelling Veterans)

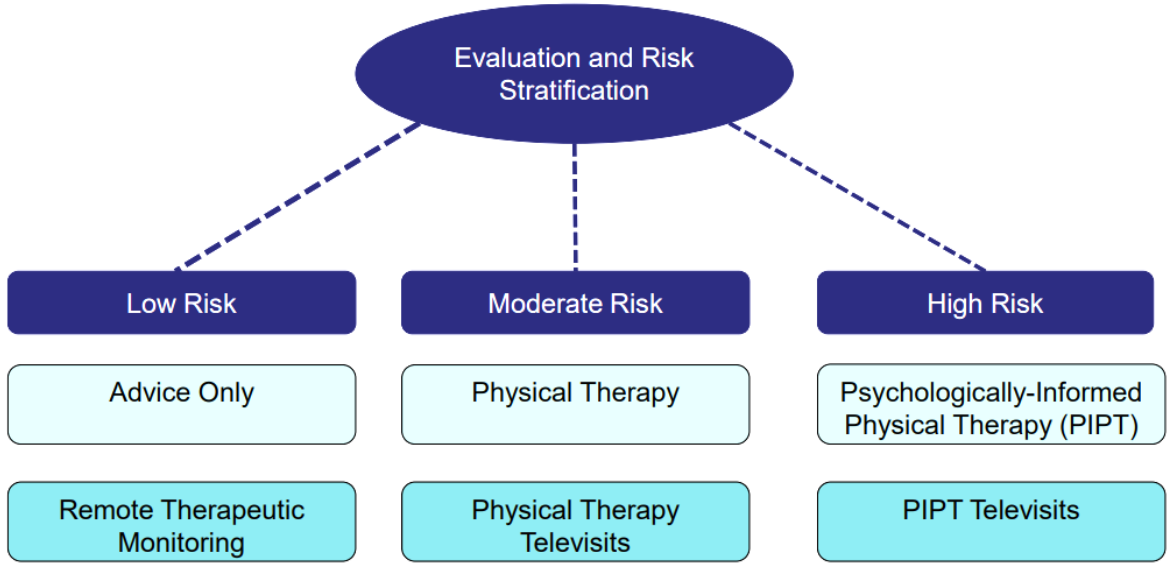
NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

HEAL Trials: Implementation Phase

Project	Population	Intervention	Outcome
ARBOR-Telehealth	Rural-dwelling patients with chronic low back pain	Risk-stratified telerehabilitation model	Change in low back pain-related disability and opioid use after 8 weeks
BackInAction	Older adults with low back pain	Standard and enhanced 12-week courses of acupuncture	Back-related function at 26 weeks; cost-effectiveness
BeatPain Utah	Adults with back pain in federally qualified health centers in Utah	Brief pain teleconsult and phone-based physical therapy	Pain management; reduction of disparities; evaluation of implementation strategies
FM-TIPS	Fibromyalgia	Addition of transcutaneous electrical nerve stimulation (TENS) to physical therapy	Fibromyalgia symptoms; adherence to therapy; meeting therapeutic goals; medication use
GRACE	Patients with sickle cell disease	Acupuncture and guided relaxation	Pain control; effective treatment sequence; evaluation of implementation strategies
NOHARM	Postoperative pain	EHR-embedded tools to aid shared decision making about pain management	Postoperative opioid use, pain, function
OPTIMUM	Chronic low back pain	Group-based mindfulness in outpatient clinical settings	Pain, physical, and psychological function; opioid prescriptions for chronic low back pain

ARBOR-Telehealth *Advancing Rural Back Pain Outcomes through Rehabilitation Telehealth*

- Comparing the effectiveness of a **risk-stratified telerehabilitation model** to improve outcomes in patients with chronic low back pain in rural communities
- Primary care clinics in Maryland
- 434 expected patients



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

BackInAction

Pragmatic Trial of Acupuncture for Chronic Low Back Pain in Older Adults

- Evaluating the **safety and effectiveness of acupuncture** in older adults with chronic low back pain
- 4 performance sites
- 828 expected patients

BACK IN ACTION

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

BeatPain Utah

Nonpharmacologic Pain Management in Federally Qualified Health Centers Primary Care Clinics

- Testing the feasibility of a **telehealth strategy** that provides a brief **pain teleconsult** along with phone-based **physical therapy**
- Federally Qualified Health Centers in Utah

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

FM-TIPS *Fibromyalgia TENS in Physical Therapy Study*

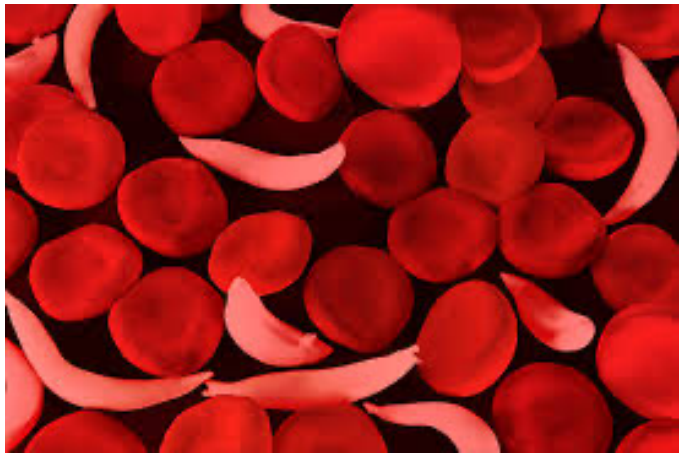
- Testing the feasibility and effectiveness of **adding TENS** to treatment of patients with fibromyalgia **in a real-world physical therapy practice setting**
- 5 physical therapy health systems

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

GRACE *Hybrid Effectiveness-Implementation Trial of Guided Relaxation and Acupuncture for Chronic Sickle Cell Disease Pain*

- Testing the effectiveness of **guided relaxation and acupuncture** to improve pain control and determine the most appropriate and effective treatment sequence for **patients with sickle cell disease pain**
- 3 health systems

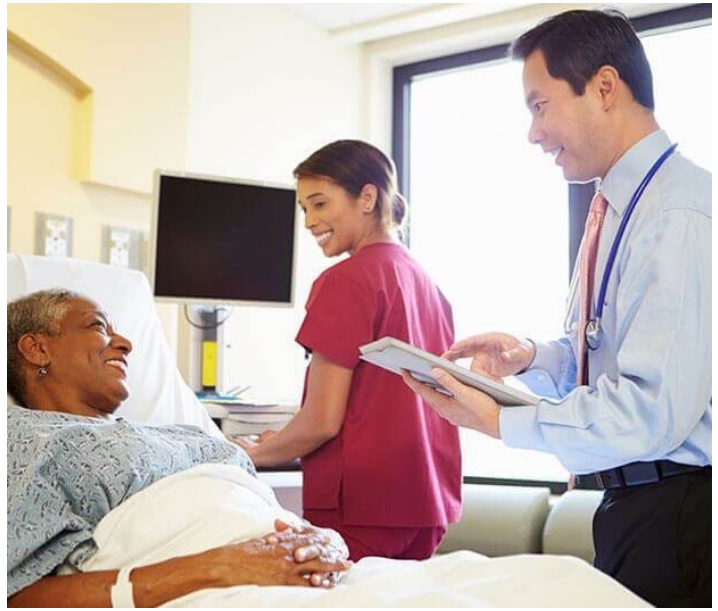
GRACE TRIAL



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

NOHARM *Nonpharmacologic Options in Postoperative Hospital-based and Rehabilitation Pain Management*

- Testing the feasibility of EHR-embedded **patient- and clinician-facing decision support for non-pharmacologic pain care** after surgery
- 4 health systems



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

OPTIMUM *Group-Based Mindfulness for Patients With Chronic Low Back Pain in the Primary Care Setting*

- Evaluating effectiveness of a **group-based mindfulness intervention** for patients with chronic low back pain in a usual care setting
- 3 health systems
- 450 expected patients

Optimum
Optimizing Pain Treatment in Medical Settings Using Mindfulness

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®