NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

NIH Pragmatic Trials Collaboratory Steering Committee Meeting

April 13-14, 2026

Congressional Ballroom, Bethesda Marriott

SUPPLEMENTAL MEETING MATERIALS

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2026 Annual Steering Committee Meeting Agenda

April 13-14, 2026
Congressional Ballroom, Bethesda Marriott

Meeting Purpose

Day 1: Address challenges and share lessons from new, in-progress, and completed NIH Collaboratory Trials to promote meaningful evidence generation; learn about new methodologies and areas of focus for embedded pragmatic clinical trials (ePCTs); and have rich discussions on topics including qualitative research and in-depth feasibility assessment.

Day 2: Address challenges and share lessons from new, in-progress, and completed NIH Collaboratory Trials; discuss strategies for boosting the efficiency, relevancy, and impact of ePCTs, including approaches for interpretation and dissemination of findings and innovative, responsible use of artificial intelligence tools.

Day 1: April 13, 2026 Setting the Stage for Meaningful Evidence Generation			
WHEN	**TOPIC**	**WHO**	**GOALS**
8:15-8:30 AM	**Welcome and Opening Remarks**	David Shurtleff Richard Hodes Wendy Weber Beda Jean-Francois Lesley Curtis	• Welcome participants • Review meeting goals and expectations
8:30-10:00 AM	**Charting the Course for Pragmatic Research: Pain Care and Beyond** *IMPACT Collaboratory* *Pain Mgmt. Collaboratory* *BeatPain/Care for Health* *PCORI*	**Moderator** Rob Califf **Presenters** Kevin Weinfurt David Shurtleff **Panel** Ab Brody Alicia Heapy Julie Fritz Tracy Wang	• Explore what's on the horizon for the ePCT ecosystem (NIH Collaboratory and beyond) • Discuss priority evidence needs that may be addressed through ePCTs • Identify the methods and knowledge required for the next generation of ePCTs, including existing gaps
10:00-10:20 AM	**Break**		
10:20-10:45 AM	**Campfire Session: EquiP PC**	Kari Stephens	*See study snapshot in folder, meeting materials* • Describe challenges and ongoing issues • Hear advice from other investigators
10:45 AM-12:15 PM	**Discovery in Disguise: Lessons From "Neutral" ePCTs**	**Moderator** Josie Briggs **Panel** Andrea Cheville Steve George Patrick Heagerty Michael Ho Tracy Wang	• Discuss techniques for designing ePCTs that provide reliable, actionable evidence • Share statistical approaches and considerations based on ePCTs with nonsignificant effects on their primary outcomes • Examine what is gained from ePCTs that do not meet their primary outcome
12:15-1:15 PM	**Lunch**		

Day 1: April 13, 2026 Setting the Stage for Meaningful Evidence Generation			
WHEN	**TOPIC**	**WHO**	**GOALS**
1:15-2:45 PM	**Harnessing Qualitative Research in ePCTs**	**Moderator** Emily O'Brien **Presenter** David Chambers **Panel** Michele Balas Melissa Basile Jennifer Kawi Richard Skolasky	• Describe opportunities for qualitative methods to enhance ePCTs (eg, refining workflows, preparing for implementation) • Share successful qualitative research methods employed by NIH Collaboratory Trials • Discuss ways to navigate challenges of qualitative research in ePCTs, such as timing, resources, and how to share qualitative data
2:45-3:15 PM	**Lightning Talks: Sharing Lessons and Top-Level Results**	Andrea Cheville Ardith Doorenbos Natalia Morone Kathleen Sluka	*See study snapshots in folder, meeting materials* • Describe top-level results, lessons learned, and future plans • 3 minutes per trial followed by 15 minutes of open discussion with attendees Results displayed during the break and reception, where discussions may continue
3:15-3:30 PM	**Break**		
3:30-5:00 PM	**More Than Kicking the Tires: Assessing Feasibility in the Planning Phase**	**Moderator** Angelo Volandes **Panel** Karen Kehl Amanda Petrik Sebastian Tong Chenchen Wang	• Discuss how assessing feasibility is not only about meeting milestones • Share examples of how ePCT researchers can discover and tackle difficult challenges in the planning phase • Explore benefits and challenges of an in-depth feasibility assessment in ePCTs
5:00-5:15 PM	**Closing Remarks**	David Shurtleff Richard Hodes Wendy Weber Beda Jean-Francois Lesley Curtis	• Summarize Day 1 and give a preview of Day 2
5:30-7:00 PM	**Networking Reception**		• Join your colleagues for socializing and fun activities • Hors d'oeuvres served

Day 2: April 14, 2026 Strategies for Boosting Efficiency, Relevancy, and Impact of ePCTs			
WHEN	**TOPIC**	**WHO**	**GOALS**
7:45-8:15 AM	**Breakfast Roundtables**		• Chat with colleagues about topics of interest
8:15-8:30 AM	**Opening Remarks**	David Shurtleff Richard Hodes Wendy Weber Beda Jean-Francois Lesley Curtis	• Share highlights of evening activities • Review goals for Day 2
8:30-9:00 AM	**Campfire Session: CARNATION**	Lynn DeBar Rachel Gold Nicole Cook	*See study snapshot in folder, meeting materials* • Describe challenges and ongoing issues • Hear advice from other investigators
9:00-10:00 AM	**Networking**	**Facilitators** Steve George Christine Goertz Andrea Cheville Keith Marsolo Joe Ali Luke Gelinas	• Engage in small group discussion ○ Russell Room: **Slow Recruitment** *Strategies for prevention and mitigation* ○ Chesapeake Room: **Data Sharing and Repositories for HEAL/PRISM Trials** *Best practices, HEAL CDE framework, etc* ○ Annapolis Room: **Use of Digital Tools** *Practical, regulatory, and ethical issues* • Consult with Core chairs and colleagues on issues your trial is facing
10:00-10:15 AM	**Break**		
10:15-11:30 AM	**Dissemination Done Better: Practical Tips for ePCT Researchers**	**Moderator** Hayden Bosworth **Panel** Diana Burgess Lynn DeBar Christine Goertz Cherise Harrington Elizabeth Wick	• Describe how to collaborate with partners in interpreting findings prior to dissemination • Share successful dissemination strategies from NIH Collaboratory Trials that have helped promote changes in care • Explore approaches for dissemination of findings beyond the publication of results in an academic journal
11:30 AM-12:00 PM	**Box Lunch**		
12:00-1:45 PM	**ePCTs in the AI Revolution: Balancing Innovation With Responsibility**	**Moderator** Adrian Hernandez **Presenter** Emily O'Brien **Panel** Guilherme Del Fiol Michael Ho Keith Marsolo Jeremy Sugarman Angelo Volandes	• Share new and emerging AI capabilities with the potential to transform ePCTs • Discuss ethical considerations associated with AI use in research, such as when a human should be in the loop • Describe challenges and areas of uncertainty for ePCTs in the era of AI
1:45-2:00 PM	**Closing Remarks**	David Shurtleff Richard Hodes Wendy Weber Beda Jean-Francois Lesley Curtis	• Describe key lessons from the meeting

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PARTICIPANT LIST
2026 Steering Committee Meeting

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NIH COLLABORATORY TRIALS PORTFOLIO

NIH Collaboratory Trials Roadmap FY26, Q1

Milestones and major activities occurring within the lifecycle of a NIH Collaboratory Trial

PILOT/START-UP

- UG3 Award Date
- R01 Award Date *

CARNATION, EquiP PC, LungSMART, STEP-2

TRIAL INITIATION

- UH3 Award
- Trial Registration
- Protocol Approved for Trial Initiation
- Initial IRB Approval (UH3 Phase)
- Initial IRB Approval (R01)
- Statistical Analyses Plan Finalized

SITE ACTIVATION

- First Site Activated

AIM-CP, RAMP

ENROLLMENT

- First Patient Enrolled

APA-SM, ARBOR-Telehealth, BEST-ICU, Chat 4 Heart Health, I CAN DO Surgical ACP, iPATH*, MOMs*, TAICHIKNEE

FOLLOW-UP

- Last Patient Enrolled
- Last Day for Intervention
- End of Outcome Observation Period

BeatPain Utah, IMPACt-LBP

PLANNING COMPLETED

- Did not proceed to trial initiation

BPMedTime

DATA ANALYSIS

- Database Lock
- Final Statistical Analysis

GGC4H, GRACE

DATA AVAILABILITY

- Key Data Available
- Secondary Endpoint Data Available
- All Data Available

REPORTING: Internal Dissemination

- Topline Results Report
- Topline Results (or Full Results) to Health System Partners
- Topline Results to Leadership/SC and Other Partners
- Topline Results to Investigators/Sites

FM TIPS, NOHARM

REPORTING: Public Dissemination

- Topline Results to Public via Press Release (if done)
- Full Results to Public
- First Presentation Results
- Main Manuscript Submitted
- Main Manuscript Accepted
- ClinicalTrials.gov Reporting

OPTIMUM

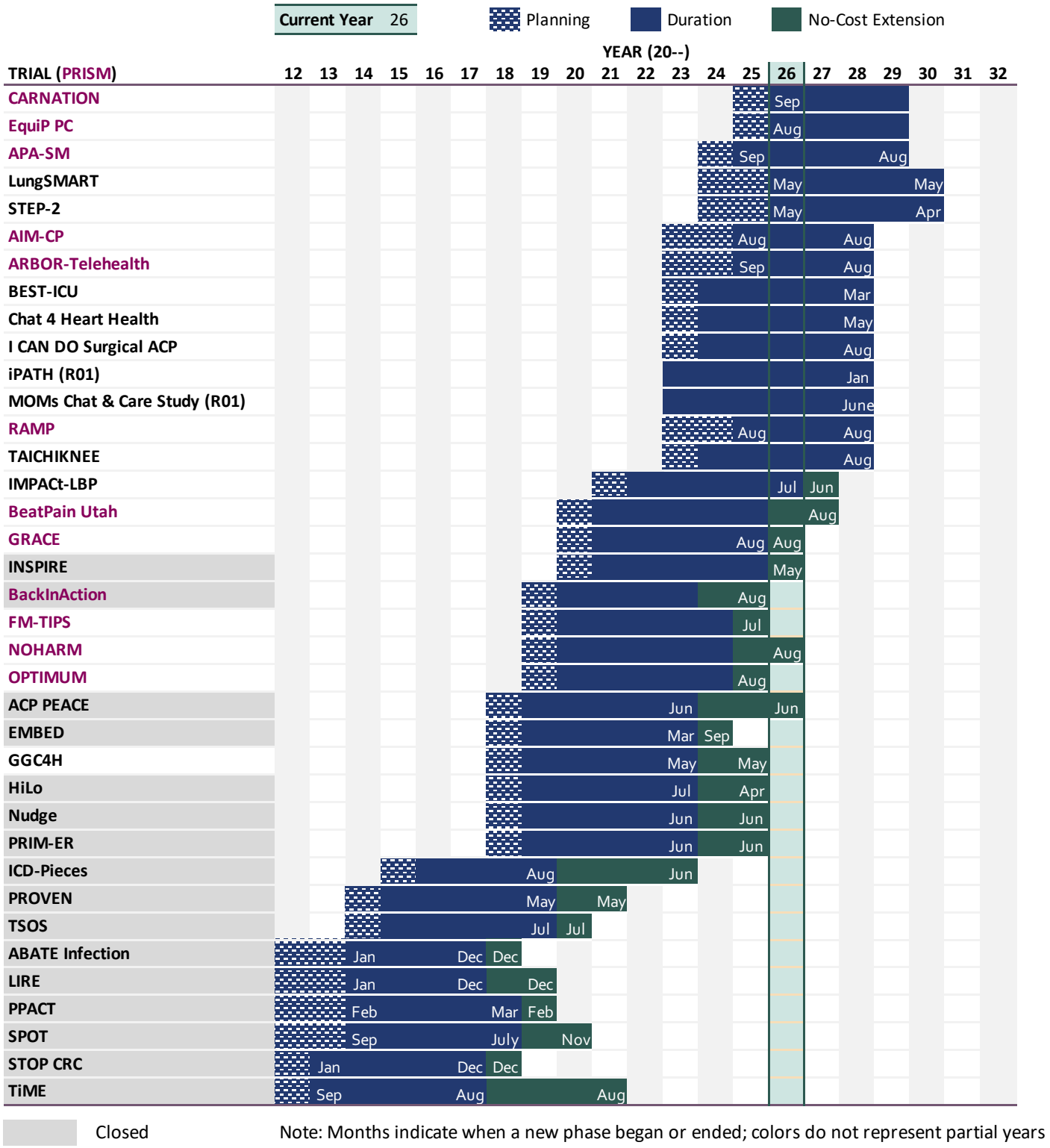
COMPLETED

- Manuscript published and/or
- Close out process completed with the CC

ABATE, ACP PEACE, BackInAction, EMBED, HiLo, ICD-Pieces, INSPIRE, LIRE, Nudge, PPACT, PRIM-ER, PROVEN, SPOT, STOP CRC, TiME, TSOS

NIH Collaboratory Trials Timeline

Total Trials in Current Year: 21



Closed

Note: Months indicate when a new phase began or ended; colors do not represent partial years

NIH Collaboratory Trials

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This handout lists key details of NIH Collaboratory Trials at the 2026 Steering Committee Meeting for reference throughout the discussions.

Trial	PIs	Population	Design	Intervention	Primary Outcome
AIM-CP	Tong, Patel	Rural-dwelling patients with chronic pain	Hybrid II with patient-level randomization	Nurse care management model	Pain impact
APA-SM	Kawi, Bolin, Wu	Rural-dwelling patients with chronic musculoskeletal pain	Hybrid II with patient-level randomization	Auricular point acupressure delivered via mobile app	Pain intensity, pain interference, and function
ARBOR-Telehealth	Skolasky, McLaughlin	Rural-dwelling patients with chronic low back pain	Hybrid I with patient-level randomization	Risk-stratified telerehabilitation model	Change in pain-related disability and opioid use
BeatPain Utah	Fritz	Adults with back pain in FQHCs in Utah	Hybrid implementation-effectiveness with patient-level randomization	Phone-based physical therapy	Pain impact
BEST-ICU	Balas, Vasilevskis	Critically ill adults	Hybrid III stepped-wedge CRT	Strategies to increase adoption of a ventilation liberation approach	Effectiveness of intervention adoption
CARNATION	DeBar, Gold, Cook	Patients with chronic musculoskeletal pain	Hybrid III implementation-effectiveness CRT	Multicomponent implementation support intervention	Effectiveness of implementation support strategies
Chat 4 Heart Health	Ho, Bull	Patients from FQHCs with suboptimal control of CV risk factors	Effectiveness with patient-level randomization	Multilevel intervention leveraging text messages	Global CV health and control of CV risk factors
EquiP PC	Stephens, Kessler	Patients with chronic pain	Hybrid I CRT	Behavioral health integration toolkit and digital apps	Pain
FM-TIPS	Crofford, Sluka	Patients with fibromyalgia	Effectiveness CRT	Addition of TENS to physical therapy	Movement-evoked pain
GGC4H	Kuklinski, Sterling	Parents of early adolescents	Hybrid implementation-effectiveness CRT	Anticipatory guidance curriculum	Substance use initiation
GRACE	Doorenbos, Schlaeger, Molokie, et al.	Patients with sickle cell disease	Hybrid implementation-effectiveness with patient-level randomization (SMART)	Acupuncture and guided relaxation	Pain impact
I CAN DO Surgical ACP	Wick, Melton-Meaux, Sudore	Older adults undergoing major elective survey	Hybrid III with patient-level randomization	Patient-facing advance care planning tool	Presence of advance directive in the EHR
IMPACt-LBP	Goertz, Goode, Lurie, Chakraborty	Adults with low back pain	Effectiveness CRT	Doctors of chiropractic and physical therapists as first-line providers	Pain interference and physical function

Trial	PIs	Population	Design	Intervention	Primary Outcome
LungSMART	Wetter, Del Fiol, Kawamoto	Current and former smokers, aged 50-80	Effectiveness with patient-level randomization	Telehealth tools to engage people in lung cancer screening	Lung cancer screening completion
MOMs Chat & Care Study	Fitzpatrick	Black birthing people	Effectiveness with patient-level randomization	Integrated care model approach	Maternal morbidity
NOHARM	Cheville, Tilburt	Postoperative pain	Effectiveness stepped-wedge CRT	EHR-embedded tools to aid shared decision-making about pain management	Postoperative pain and function
OPTIMUM	Morone	Chronic low back pain	Effectiveness with patient-level randomization	Group-based mindfulness in outpatient settings	Pain impact
RAMP	Burgess, Evans, Hadlandsmyth	Rural-dwelling Veterans with chronic pain	Hybrid II with patient-level randomization	Telehealth with complementary and integrative approaches	Pain interference
STEP-2	Winer, Petrik, Tiro	Women aged 30-65	Hybrid implementation-effectiveness CRT	HPV self-sampling	Screening proportion
TAICHIKNEE	Wang, Lavretsky, Roseen, Saper	Patients with knee pain due to osteoarthritis	Effectiveness with patient-level randomization	Remotely delivered web-based Tai Chi intervention	Pain interference

PROGRAM HANDOUTS

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About

Since 2012, the NIH Pragmatic Trials Collaboratory has helped rigorous trials be successful in real-world settings, creating standards for more efficient, large-scale clinical research.

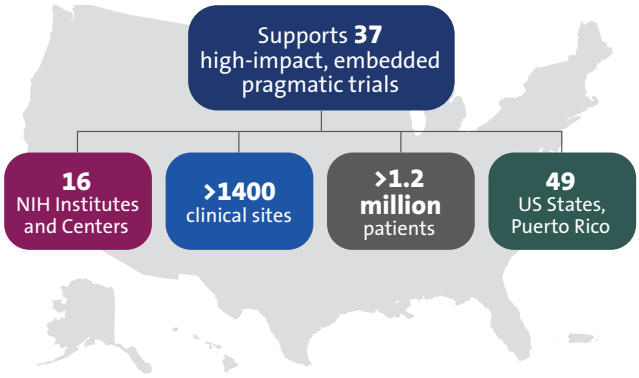
What Are Embedded Pragmatic Clinical Trials?

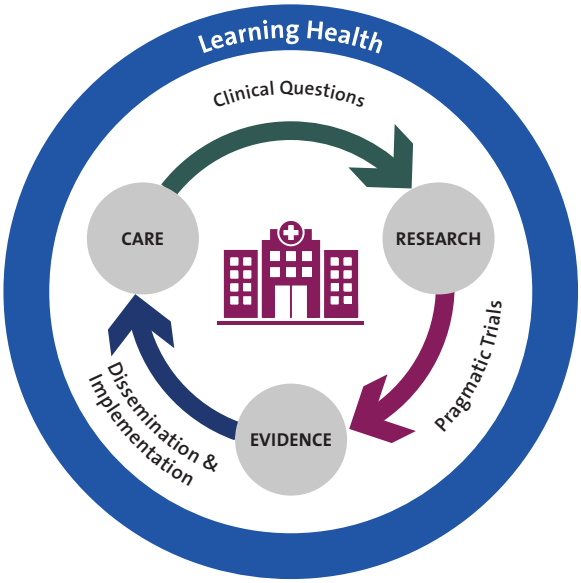
- Conducted in healthcare systems
- Use existing infrastructure and streamlined procedures
- Provide high-quality evidence
- More efficient and cost effective than traditional trials

Our Role

Pragmatic trials are foundational to the learning health model where ongoing evidence generation improves care. The NIH Pragmatic Trials Collaboratory is the nation's leading resource on how to conduct randomized trials embedded in healthcare delivery.

Our Reach





NIH Partners, Past and Present

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

Bold denotes current partners (Grant U24AT009676)

Our Impact

We learn and share knowledge from each trial we support to advance pragmatic research methods.

- **>385** publications*
- Work cited **>13,000** times
- **>250** trial consultations
- **>600** Grand Rounds webinars
- **>100,000** website visitors annually
- **30+** Living Textbook chapters

Wide Influence

The success of the NIH Pragmatic Trials Collaboratory and its extensive resources have informed subsequent NIH initiatives for pain management, dementia care, and primary care, as well as research programs in Canada and Japan.

*LAST UPDATED JANUARY 19, 2026

Our Support

As a Resource Coordinating Center, we provide comprehensive expertise and technical assistance to researchers conducting pragmatic trials.

Consult and provide guidance on:

- Study design and analysis
- Regulatory issues and consent practices
- Use of real-word data sources
- Translating results into practice

Offer strategies to:

- Contribute to healthier communities
- Engage health system partners

Assist with:

- Defining study endpoints
- Measuring patient-centered outcomes
- Assessing feasibility of clinical workflows
- Addressing challenges that arise

Why Do an Embedded Pragmatic Clinical Trial? The 5 Rs

Relevant Question	Real-World Setting	Representative Population	Routinely Collected Data	Rigorous Methods
The question is pressing, and healthcare system leaders, patients, and front-line clinicians care about the answer.	Desire to test in diverse healthcare delivery settings with the hope of implementing findings widely.	Ability to enroll participants who reflect the real-world population with the disease or condition.	Can use data collected as part of healthcare delivery to answer the question, supplemented by data from other sources.	Randomized research is needed to answer the question and inform changes in care, policy, or reimbursement.

About NIH Collaboratory Trials

SETTINGS

- Academic health centers
- Community clinics
- Federally qualified health centers
- For-profit health systems
- Hospitals
- Managed care organizations
- Primary care
- Specialty care

CHARACTERISTICS

- Trials in multiple therapeutic areas
- Each works across multiple health systems
- Use electronic health records, administrative, and claims data
- Strong partnerships with health systems
- Committed to sharing lessons and data

How We Learn and Share

Pragmatic research poses unique challenges that the NIH Pragmatic Trials Collaboratory has a wealth of experience navigating. Through the program's Core Working Groups, research teams are part of a community of scientists with a shared mission to help each other be successful and create generalizable knowledge about the design, conduct, and dissemination of pragmatic research.

DISSEMINATION

Grand Rounds
Weekly webinar with >94,000 all-time attendees and >50 podcast episodes with >24,000 total plays

Living Textbook
Free online textbook, continually updated and expanded, with 30+ chapters, >1800 pages, and >120 contributors

Resources and Tools
Publications, guidance documents, Quick Start Guides, checklists, etc—over 140 study tools available

Education
Provided >90 hours of presenter-led training at 14 workshops, plus video modules, self-paced learning, fellowships, and more

This work was supported within the NIH Pragmatic Trials Collaboratory under award number U24AT009676 from multiple NIH Institutes, Centers, and Offices. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

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Rethinking Clinical Trials®: A Living Textbook of Pragmatic Clinical Trials

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A comprehensive, authoritative guide to pragmatic clinical trials and research that engages healthcare delivery organizations as partners.

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WHAT IS THE LIVING TEXTBOOK?

- Free, online textbook that it is continually updated and expanded
- Contains the latest emerging knowledge on pragmatic research methods
- Developed by NIH Collaboratory experts, researchers, and partners
- Reputable, citable resource

Training Resources

Videos
Self-paced learning modules and videos featuring experts in pragmatic research

Resources
Downloadable Quick Start Guides, checklists, handouts, guidance documents, etc

Workshops
Materials including agendas, recordings, summaries, and slides

Grand Rounds & Podcast

Library of our popular weekly webinar (recordings, summaries) and podcast episodes featuring timely topics in pragmatic research.

>600 webinars

>50 podcasts

TOOLS FOR TRIALS

NIH Collaboratory Trials share their data and resources publicly via the Living Textbook.

- **Study tools:** Protocols, consent forms, site materials, questionnaires, toolkits, etc
- **Datasets and documentation:** Datasets, dictionaries, analytic code, etc

Textbook Content

30+ chapters

>120 contributors

Launched in 2013, the Living Textbook has grown to cover all aspects of designing, conducting, and disseminating pragmatic trials.

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 & Conduct

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

Dissemination & Implementation

- Data Sharing
- Dissemination
- Implementation
- End-of-Trial Decision-Making

Ethics & Regulatory

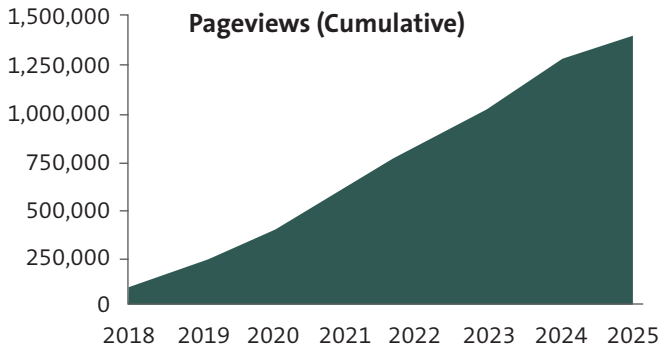
- Privacy
- Consent Disclosure & Nondisclosure
- Collateral Findings
- Data & Safety Monitoring
- IRB

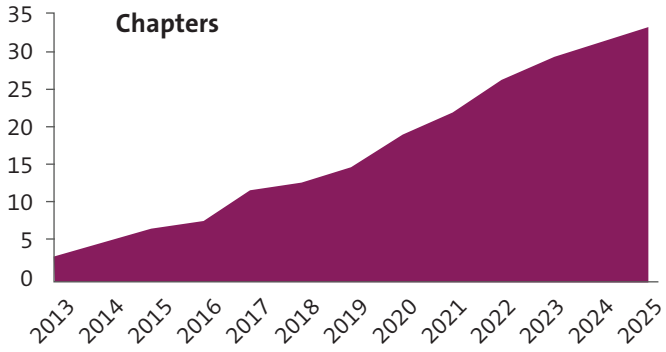
Program Information

Learn about the NIH Pragmatic Trials Collaboratory, including its trials, Core Working Groups, and Coordinating Center.

- Latest program news and interviews
- Publication updates

Living Textbook Growth





FUN FACTS

>100,000
visitors annually

>1800
webpages

More words
than *War and Peace*

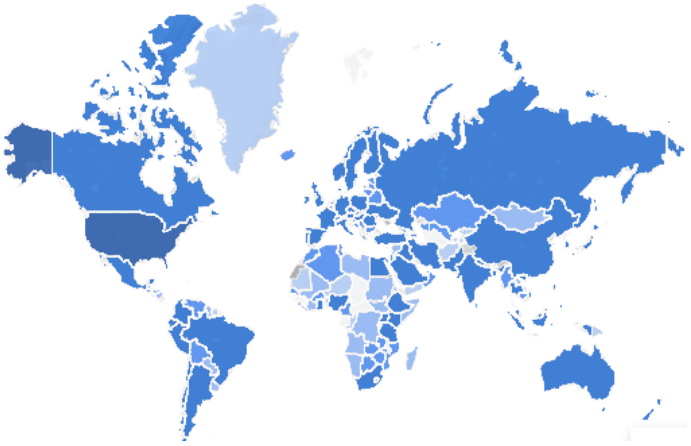
>3 days
total video runtime viewed monthly

Users Around the World

~%60 of users are in the United States

Other top countries:
- United Kingdom
- India
- Canada
- Germany
- Australia
- China
- Singapore

Top cities:
- Washington DC
- San Jose
- New York
- London
- Los Angeles
- Chicago
- Boston



DID YOU KNOW?

- Researchers at the Pharmacological Evaluation Institute of Japan translated key parts of the Living Textbook into Japanese to inform their work
- Canada's Pragmatic Trials Training Program is using the Living Textbook to help educate future trial leaders

Top Content

Our most accessed topics include:
- Cluster randomized trials
- Endpoints and outcomes
- What is a pragmatic trial?
- Intraclass correlation
- Stepped-wedge designs
- Real-world data sources
- Clinical decision support
- Data and safety monitoring

Trial Information

The Living Textbook contains complete information on all NIH Collaboratory Trials, including trial details, publications, presentations, interviews, resources, and more.

LEARN MORE
rethinkingclinicaltrials.org

FOLLOW US

This work was supported within the NIH Pragmatic Trials Collaboratory under award number U24AT009676 from multiple NIH Institutes, Centers, and Offices. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

NIH Collaboratory Trials Publication Types

The NIH Pragmatic Trials Collaboratory makes contributions to the peer-reviewed literature on a wide range of topics relating to the design and conduct of pragmatic clinical trials embedded within healthcare systems. Every NIH Collaboratory Trial team publishes a **study design paper** and a **main outcome paper**. Many research teams also publish papers in other categories. To help researchers understand potential opportunities for publication of their work, this handout offers examples of the types of papers that commonly arise from the NIH Collaboratory Trials. For more information about publications from the NIH Collaboratory, visit rethinkingclinicaltrials.org/publications.

Background & Motivation

Includes literature reviews, commentaries, and other articles that provide clinical context, policy context, and other background for the study.

Example — **STOP CRC** — "BeneFITs" to increase colorectal cancer screening in priority populations. *JAMA Intern Med.* 2014;174(8):1242-3.

Preparatory Work

Includes stakeholder interviews, intervention development, phenotype validation, simulations, pilot studies, and other work to inform the design and conduct of the study.

Example — **Nudge** — Text message medication adherence reminders automated and delivered at scale across two institutions: testing the Nudge system: pilot study. *Circ Cardiovasc Qual Outcomes.* 2021;14(5):e007015.

Study Design

The NIH Collaboratory Trial's milestone publication reporting the design and rationale of the study.

Example — **FM-TIPS** — The Fibromyalgia Transcutaneous Electrical Nerve Stimulation in Physical Therapy Study (FM-TIPS) protocol: a multisite embedded pragmatic trial. *Phys Ther.* 2022;102(11):pzac116.

Main Outcomes

The NIH Collaboratory Trial's milestone publication reporting the primary results of the study.

Example — **ABATE Infection** — 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. *Lancet.* 2019;393(10177):1205-15.

Other Outcomes

Includes cost-effectiveness studies, qualitative evaluations, ancillary studies, and secondary analyses, such as implementation outcomes, subgroup analyses, and more.

Example — **EMBED** — Trends in emergency department visits and hospital admissions in health care systems in 5 states in the first months of the COVID-19 pandemic in the US. *JAMA Intern Med.* 2020;180(10):1328-33.

Example — **TSOS** — Post-traumatic stress disorder (PTSD) symptoms and alcohol and drug use comorbidity at 25 US level I trauma centers. *Trauma Surg Acute Care Open.* 2022;7(1):e000913.

Example — **LIRE** — Patient, provider, and clinic characteristics associated with opioid and non-opioid pain prescriptions for patients receiving low back imaging in primary care. *J Am Board Fam Med.* 2021;34(5):950-63.

Lessons Learned: Design & Analysis

Lessons learned from the study relating to the design and analysis of pragmatic clinical trials.

Example — **PPACT** — Interactive group-based orientation sessions: A method to improve adherence and retention in pragmatic clinical trials. *Contemp Clin Trials Commun.* 2020;17:100527.

Lessons Learned: Ethics & Regulatory

Lessons learned from the study relating to ethical and regulatory aspects of pragmatic clinical trials.

Example — **TiME** — Ethical issues in pragmatic cluster-randomized trials in dialysis facilities. *Am J Kidney Dis.* 2019;74(5):659-66.

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

Dissemination Opportunities for Pragmatic Trials

Embedded pragmatic clinical trials are designed to answer pressing questions of interest to healthcare system leaders, patients, and front-line clinicians. The results can also inform regulators, policymakers, payers, and others. Disseminating findings widely is paramount for these trials to have real-world impact. This handout offers examples of strategies beyond academic publications to help investigators plan for broad dissemination.

Presentations to Partners

Present findings to your trial partners first. This includes healthcare systems, site clinicians, professional associations, advocacy or community groups, patient engagement panels, and others as appropriate.

Public Webinars

Speak at venues such as Grand Rounds, research forums, webinars of societies or organizations, or a virtual "town hall" for patients and the community.

Examples – ACP PEACE Grand Rounds, ADAPTABLE Town Hall

Implementation Tools

Provide implementation tools to promote uptake of effective interventions. Options include toolkits, guides, training materials (slides, videos, etc), protocols, workflows, handouts, and patient materials.

Example – ABATE Implementation Toolkit

Website

Post findings on your trial website and announcements on websites of partners and other relevant organizations. Consider including written or video testimonials from participants.*

Example – Greenlight Study Website

Policymaker Outreach

Share results with relevant policymakers at the state and national level. This can be through formal submissions, discussions, presentations, or a policy brief that outlines evidence-based recommendations.

Example – STOP CRC–related policy advocacy

Press

Boost awareness with press releases and interviews. Institutions' media offices often help. Connect press with participants willing to share their experiences.*

Examples – BackInAction on Good Morning America, RAMP in the *Star Tribune*

Lay Summary

Create a summary of your findings in a handout written in plain language that is understandable by trial participants, patients, and the general public.

Example – ADAPTABLE Lay Summary

Social Media

Announce findings on social media accounts for your trial or institution. Provide a social media toolkit to partners so they can share posts on their social channels and broaden your reach.

Example – RECOVER Social Media Toolkit

Tech Tip

Consider using generative AI to save time when repackaging your findings for different audiences. For example, AI might help translate technical abstracts into plain language summaries, draft social media posts, or structure evidence-based recommendations for policymaker outreach. Always check AI outputs carefully before use.

*Obtain IRB approval and participant permission before contacting or featuring trial participants.

GOVERNANCE POLICIES

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Publications, Presentations, and Products Policy

CONTENTS

I. Purpose

The National Institutes of Health (NIH) Pragmatic Trials Collaboratory is supported by cooperative agreements and grant awards from NIH Institutes, Centers, and Offices. A principal goal of the NIH Collaboratory is to produce generalizable knowledge by publishing high-quality, timely research findings and perspectives in the peer-reviewed literature; delivering presentations of NIH Collaboratory scholarship in public forums; and sharing guidance, tools, best practices, and other resources for healthcare systems research.

It is recognized that NIH Pragmatic Trials Collaboratory investigators will publish manuscripts, submit abstracts, and deliver presentations that directly reflect NIH Collaboratory activities. Investigators will also publish manuscripts, submit abstracts, and deliver presentations that either mention NIH Collaboratory activities or address topics that are related to NIH Collaboratory activities but are funded from other sources.

The NIH Pragmatic Trials Collaboratory includes the individual NIH Collaboratory Trials, the Coordinating Center, the Core Working Groups, and ad hoc working groups, all of which may develop publications, presentations, and other products. Manuscripts, abstracts, presentations, and other products derived from NIH Collaboratory–supported activities will be designated as NIH Collaboratory products.

II. Definitions

A. NIH Collaboratory Trial Publications and Presentations

NIH Collaboratory Trial publications and presentations are manuscripts, abstracts, and presentations that deal directly with knowledge derived from the NIH Collaboratory Trials. For example, a manuscript, abstract, or presentation that reports methods or results of an NIH Collaboratory Trial is an NIH Collaboratory Trial publication or presentation. Review and approval of NIH Collaboratory Trial publications and presentations will follow the procedures described in Section IV of this policy.

B. Core Working Group Publications and Presentations

Core Working Group publications and presentations are manuscripts, abstracts, and presentations produced by a Core Working Group as part of the Core's efforts to create generalizable knowledge. For example, a manuscript, abstract, or presentation that reports a comparison of methods for validating phenotypes across

NIH Collaboratory Trials undertaken by members of a Core is a Core Working Group publication or presentation. Review and approval of Core Working Group publications and presentations will follow the procedures described in Section V of this policy.

C. Guidance Documents

Guidance documents are official statements by the NIH Pragmatic Trials Collaboratory meant to describe procedures or principles for the conduct of healthcare systems research. These documents are intended to have an enduring quality and to represent a synthesis of considerable evidence. Guidance documents may be produced by one or more Core Working Groups or by an ad hoc working group. Guidance documents are published on the NIH Collaboratory website. Review and approval of guidance documents will follow the procedures described in Section VI of this policy.

D. Tools, Best Practice Documents, and Other Resources

Tools, best practice documents, and other resources are products that represent a consensus within one or more Core Working Groups about approaches to healthcare systems research. Examples include, but are not limited to, checklists, tips and frequently asked questions, executive summaries, and other information resources. Tools, best practice documents, and other resources are intended to evolve and may be subject to frequent revision as lessons emerge from the NIH Collaboratory Trials and Core Working Groups. Tools, best practice documents, and other resources are published on the NIH Pragmatic Trials Collaboratory website. Review and approval of tools, best practice documents, and other resources will follow the procedures described in Section VII of this policy.

E. Short Communications

Short communications are products hosted on the NIH Pragmatic Trials Collaboratory website or social media accounts—such as news articles, video and audio recordings, and social media posts—about NIH Collaboratory activities and other topics relevant to healthcare systems research. Short communications are produced by the Coordinating Center communications team in consultation with the Coordinating Center leadership. Review and approval of short communications will follow the procedures described in Section VIII of this policy.

III. Publications, Presentations, and Products Committee

A. Members and Decision Making

The Publications, Presentations, and Products Committee ("Publications Committee") consists of Coordinating Center investigators, representatives from the NIH Collaboratory Trials, and the NIH project officer and project scientist, as well as nonvoting Coordinating Center staff who serve as committee staff. The Coordinating Center leadership appoints the chair of the committee. Decisions of the committee will be made by majority vote, although consensus will be sought in all cases.

B. Responsibilities

1. The Publications Committee oversees all NIH Pragmatic Trials Collaboratory–supported publication and presentation activities, with final adjudication of decisions made by the Steering Committee as needed. Oversight includes the following specific activities:

    a. The Publications Committee reviews and approves (1) Core Working Group manuscripts before they are submitted and (2) guidance documents before they are published to ensure that descriptions of NIH Collaboratory activities are accurate and to share comments and suggestions. Committee staff review these documents to ensure the use of required acknowledgment and disclaimer language.

    b. Committee staff review manuscripts from the NIH Collaboratory Trials before they are submitted to ensure the use of required acknowledgment language and to check for mentions of other NIH Collaboratory Trials. Committee staff also review tools, best practice documents, and other resources before they are published on the NIH Collaboratory website to ensure the use of required acknowledgment and disclaimer language and to check for mentions of NIH Collaboratory Trials.

2. The Publications Committee also monitors the overall NIH Collaboratory publications pipeline and proposes new topics for cross-Collaboratory publications. A cross-Collaboratory publication may be prepared by an ad hoc working group or by one or more Core Working Groups or NIH Collaboratory Trial teams.

IV. NIH Collaboratory Trial Publications and Presentations

A. Authorship

Decisions regarding the content and authorship of NIH Collaboratory Trial publications and presentations will be made by the individual trial's steering committee, including NIH staff who provide oversight for the project (when allowed by NIH policy specific to the supporting Institute, Center, or Office).

B. Review

1. NIH Collaboratory Trial **manuscripts** will be submitted by the authors to the Coordinating Center (nih-collaboratory@dm.duke.edu) at least 10 business days before the planned submission to allow Publications Committee staff to review the document to ensure the use of required acknowledgment and disclaimer language and to check for mentions of other NIH Collaboratory Trials. Committee staff will respond within 10 business days.

   Abstracts and presentations should acknowledge NIH Pragmatic Trials Collaboratory support but need not be submitted to the Coordinating Center in advance. See Section IX of this policy for funding acknowledgment language.

2. For draft NIH Collaboratory Trial manuscripts that include descriptions of or details about an NIH Collaboratory Trial other than the authors' own, committee staff will notify the Publications Committee chair and will share the manuscript or other materials with the principal investigator of the other NIH Collaboratory Trial. That investigator will be given the opportunity to review the pertinent section for accuracy, comment on the portrayal of their trial, and offer corrections of errors, but will not exercise editorial control over other sections of the manuscript. If no response is received from the principal investigator within 10 business days of receiving the manuscript for review, assent and approval will be assumed. In the event of disagreements between the authors and the principal investigator of the other NIH Collaboratory Trial, the issue will be referred to the chair of the NIH Collaboratory Steering Committee for adjudication.

3. There may be circumstances (for example, if an author is an NIH staff member) wherein an NIH Institute, Center, or Office for a given NIH Collaboratory Trial would require review of a manuscript, abstract, or presentation before its submission. Authors are expected to work with NIH staff to determine whether such a review is required and, if so, to ensure that the requirement is addressed before submission.

4. Final editorial authority and the decision to publish will reside with the NIH Collaboratory Trial's steering committee, including NIH staff who provide oversight for the project. The Publications Committee will provide advice and assistance with dissemination as needed.

5. Other manuscripts, abstracts, and presentations arising from NIH Collaboratory Trials without specific aims of being designated as NIH Collaboratory publications or presentations will be provided by NIH Collaboratory Trial investigators in a listing submitted biannually to the Coordinating Center. The NIH Collaboratory Trial investigator or Publications Committee chair may request that a manuscript be shared for comment due to high interest.

6. All NIH Collaboratory Trial manuscripts submitted to the Coordinating Center before publication will remain confidential and will not be shared outside the Publications Committee membership and staff, NIH Collaboratory Trial principal investigators (if applicable), Coordinating Center principal investigators, and the authors.

C. After Publication or Presentation

1. Once an NIH Collaboratory Trial manuscript, abstract, or presentation has been accepted for publication or presentation, the lead author or their designee will inform the Coordinating Center staff and provide them with a final copy of the accepted publication or presentation.

2. NIH Collaboratory Trial principal investigators or their designees will submit quarterly updates to the Coordinating Center about all publication and presentation activity related to the project.

V. Core Working Group Publications and Presentations

A. Authorship

Decisions regarding the content and authorship of Core Working Group publications and presentations will be made by the members of the Core Working Group(s) involved in creation of the work. All members of the respective Core Working Group(s) will be given an opportunity for comment. If 10 business days pass without feedback, assent to that version of the manuscript will be assumed.

B. Review

1. Core Working Group **manuscripts** will be submitted by the authors to the Coordinating Center (nih-collaboratory@duke.edu) for delivery to the Publications Committee staff, who will have 10 business days to collect and forward comments and suggestions from (a) Core Working Group members, (b) Publications Committee members, and (c) any additional Coordinating Center members involved. There may be circumstances (for example, if an author is an NIH staff member) wherein an NIH Institute, Center, or Office would require review before submission. Authors are expected to work with NIH staff to determine whether such a review is required and, if so, to ensure that the requirement is addressed before submission.

   Abstracts and presentations should acknowledge NIH Pragmatic Trials Collaboratory support but need not be submitted to the Coordinating Center in advance. See Section IX of this policy for funding acknowledgment language.

2. For draft Core Working Group manuscripts that include descriptions of or details about an NIH Collaboratory Trial, the Publications Committee staff will share the manuscript with the NIH Collaboratory Trial's principal investigator. The NIH Collaboratory Trial's principal investigator will be given the opportunity to review the pertinent section for accuracy, comment on the portrayal of their trial, and offer corrections of errors, but will not exercise editorial control over other sections of the manuscript. If no response is received from the NIH Collaboratory Trial's principal investigator within 10 business days of receiving the manuscript for review, assent and approval will be assumed. In the event of disagreements between the authors and the NIH Collaboratory Trial's principal investigator, the issue will be referred to the chair of the NIH Collaboratory Steering Committee for adjudication.

3. An additional 10 days may be taken by the Publications Committee after comments are generated to adjudicate any resulting editorial changes.

   a. Where intractable differences of opinion remain, suggested changes from all sides will be forwarded to the designated authors.

   b. Comments from any Publications Committee member, NIH or otherwise, will not constitute official positions of the NIH.

4. Final editorial authority and the decision to publish will reside with the designated authors, although the Publications Committee will have the right

to vote on the designation of the final proposed manuscript as an NIH Collaboratory publication or presentation.

a. Manuscripts, abstracts, and presentations that are not designated as NIH Collaboratory publications or presentations will not be listed on the NIH Collaboratory website and will not benefit directly from any public relations or news items published on the NIH Collaboratory website.

5. In the event that authors of a publication must meet an impending deadline for a special issue or call for papers or respond to an invitation to submit within a brief period of time, authors should contact the Coordinating Center to request expedited review of the manuscript. If an expedited review is not possible before submission, the authors will send the manuscript to the Coordinating Center within 10 business days after submission; the Publications Committee will still consider whether the manuscript will be designated as an NIH Collaboratory publication.

6. All Core Working Group manuscripts submitted to the Coordinating Center before publication will remain confidential and will not be shared outside the Publications Committee membership and staff, NIH Collaboratory Trial principal investigators (if applicable), Coordinating Center principal investigators, and the author(s).

C. After Publication

Once a Core Working Group manuscript, abstract, or presentation has been accepted for publication or presentation, the lead author or their designee will inform the Coordinating Center staff, who will notify the NIH program official and the Publications Committee staff.

VI. Core Working Group Guidance Documents

A. Authorship

Decisions regarding the content and authorship of guidance documents will be made by the members of the Core Working Group(s) or ad hoc working group involved in creation of the work. All members of the respective working group(s) will be given an opportunity for comment. If 10 business days pass without feedback, assent to that version of the guidance document will be assumed.

B. Review

1. Guidance documents will be submitted by the author(s) to the Coordinating Center (nih-collaboratory@duke.edu) for delivery to the Publications Committee staff, who will have 10 business days to collect and forward comments and suggestions from (a) working group members, (b) Publications Committee members, and (c) any additional Coordinating Center members involved. There may be circumstances (for example, if an author is an NIH staff member) wherein an NIH Institute, Center, or Office would require review before publication of the guidance document. Authors are expected to work with NIH staff to determine whether such a review is required and, if so, to ensure that the requirement is addressed before submission.

2. For guidance documents that include descriptions of or details about an ongoing or completed NIH Collaboratory Trial, the Publications Committee staff will share the document with the trial's principal investigator. The trial's principal investigator will be given the opportunity to review the pertinent section for accuracy, comment on the portrayal of their trial, and offer corrections of errors, but will not otherwise exercise editorial control over the document. If no response is received from the principal investigator within 10 business days of receiving the guidance document, assent and approval will be assumed. In the event of disagreements between the authors and the NIH Collaboratory Trial's principal investigator, the issue will be referred to the chair of the NIH Collaboratory Steering Committee for adjudication.

3. An additional 10 days may be taken by the Publications Committee after comments are generated to adjudicate any resulting editorial changes.

    a. Where intractable differences of opinion remain, suggested changes from all sides will be forwarded to the authors.

    b. Comments from any Publications Committee member, NIH or otherwise, will not constitute official positions of the NIH.

4. Final editorial authority and the decision to publish the guidance document will reside with the authors.

VII. Core Working Group Tools, Best Practice Documents, and Other Resources

A. Authorship

Decisions regarding the content (and authorship, if applicable) of tools, best practice documents, and other resources will be made by the members of the Core Working Group(s) or ad hoc working group involved in the creation of the work. All members of the respective Core Working Group(s) or ad hoc working group will be given an opportunity for comment. If 10 business days pass without feedback, assent to that version of the document will be assumed.

B. Review

1. Tools, best practice documents, and other resources will be submitted by the authors to the Coordinating Center (nih-collaboratory@duke.edu) for delivery to Publications Committee staff at least 10 business days before publication to allow staff to review the document to ensure the use of required disclaimer language, if applicable, and to check for mentions of NIH Collaboratory Trials. The committee staff will respond within 10 business days.

2. For tools, best practice documents, and other resources that include descriptions of or details about an ongoing or completed NIH Collaboratory Trial, committee staff will share the document with the trial's principal investigator. The trial's principal investigator will be given the opportunity to review the pertinent section for accuracy, comment on the portrayal of their trial, and offer corrections of errors, but will not exercise editorial control over other sections of the document. If no response is received from the principal investigator within 10 business days of receiving the document, assent and approval will be assumed. In the event of disagreements between the authors and the NIH Collaboratory Trial's principal investigator, the issue will be referred to the chair of the NIH Collaboratory Steering Committee for adjudication.

3. There may be circumstances (for example, if an author is an NIH staff member) wherein an NIH Institute, Center, or Office for a given NIH Collaboratory Trial would require review of a best practice document before its publication. Authors are expected to work with NIH staff to determine whether such a review is required and, if so, to ensure that the requirement is addressed before publication.

4. Final editorial authority and the decision to publish will reside with the authors.

VIII. Short Communications by the Coordinating Center

Short communications are produced by the Coordinating Center communications team in consultation with the Coordinating Center leadership. They are prepared in accordance with the Coordinating Center staff's relevant operational processes.

IX. Acknowledgment of NIH Collaboratory Support

A. When to Acknowledge NIH Funding

Authors should only acknowledge NIH awards on manuscripts, abstracts, and presentations when the activities that contributed to the manuscript, abstract, or presentation directly arose from the award and are within the scope of the award being acknowledged. The scope of the award includes the aims, objectives, and purposes of the award, as well as the methodology, approach, analyses, or other activities; and the tools, technologies, and timeframes needed to meet the award's objectives.

When considering whether acknowledgment of an NIH award is necessary or appropriate, the authors should consider the following questions:

- Did activities supported by the award contribute to the manuscript, abstract, or presentation?
- Did the award support the conduct of experiments or the analysis of data that contributed to the manuscript, abstract, or presentation?
- Is there a clear and apparent link between the work described in the manuscript, abstract, or publication with the aims and objectives of the award?

If the answer is yes to any of these questions, the NIH support should be acknowledged.

See also Communicating and Acknowledging Federal Funding at https://grants.nih.gov/policy/federal-funding.htm.

B. Preferred Acknowledgment Language for Manuscripts

1. Manuscripts **derived from work of the Coordinating Center or Core Working Groups** should include the following acknowledgment:

   "This work was supported within the National Institutes of Health (NIH) Pragmatic Trials Collaboratory through cooperative agreement U24 AT009676 from the National Center for Complementary and Integrative Health (NCCIH), the National Cancer Institute (NCI), the National Heart, Lung, and Blood Institute (NHLBI), the National Institute of Allergy and Infectious Diseases (NIAID), the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), the National Institute of Minority Health and Health Disparities (NIMHD), the National Institute of Neurological Disorders and Stroke (NINDS), the National Institute of Nursing Research (NINR), the National Institute on Aging (NIA), the NIH Office of Behavioral and Social Sciences Research (OBSSR), and the NIH Office of Disease Prevention (ODP). [If supplemental funding was provided for specific activities, acknowledge the Institute, Center, or Office providing the support here.] The content is solely the responsibility of the authors and does not necessarily represent the official views of the NCCIH, NCI, NIA, NIAMS, NHLBI, NIAID, NIMHD, NINDS, NINR, OBSSR, or ODP, or the NIH."

2. Manuscripts **derived from one or more NIH Collaboratory Trials**:

   a. Manuscripts derived from **BackInAction, BeatPain Utah, FM-TIPS, GRACE, NOHARM, or OPTIMUM** should include the following acknowledgment:

      "This work was supported within the National Institutes of Health (NIH) Pragmatic Trials Collaboratory through the NIH HEAL Initiative under award number [UG3, UH3, and/or R01 grant number] administered by the [Institute, Center, or Office providing oversight]. This work also received logistical and technical support from the PRISM Resource Coordinating Center under award number U24 AT010961 from the NIH through the NIH HEAL Initiative, and from the NIH Pragmatic Trials Collaboratory Coordinating Center under award number U24 AT009676 from the National Center for Complementary and Integrative Health (NCCIH), the National Cancer Institute (NCI), the National Heart, Lung, and Blood Institute (NHLBI), the National Institute of Allergy and Infectious Diseases (NIAID), the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), the National Institute of Minority Health and Health Disparities (NIMHD), the National Institute of Neurological Disorders

and Stroke (NINDS), the National Institute of Nursing Research (NINR), the National Institute on Aging (NIA), the NIH Office of Behavioral and Social Sciences Research (OBSSR), and the NIH Office of Disease Prevention (ODP). The content is solely the responsibility of the authors and does not necessarily represent the official views of [Institute, Center, or Office providing funding or oversight] or the NCCIH, NCI, NIA, NIAMS, NHLBI, NIAID, NIMHD, NINDS, NINR, OBSSR, or ODP, or the NIH or its HEAL Initiative."

b. Manuscripts derived from **all other NIH Collaboratory Trials** should include the following acknowledgment:

"This work was supported within the National Institutes of Health (NIH) Pragmatic Trials Collaboratory by cooperative agreement [UG3, UH3, and/or R01 grant number] from the [Institute, Center, or Office providing funding or oversight]. This work also received logistical and technical support from the NIH Pragmatic Trials Collaboratory Coordinating Center under award number U24 AT009676 from the National Center for Complementary and Integrative Health (NCCIH), the National Cancer Institute (NCI), the National Heart, Lung, and Blood Institute (NHLBI), the National Institute of Allergy and Infectious Diseases (NIAID), the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), the National Institute of Minority Health and Health Disparities (NIMHD), the National Institute of Neurological Disorders and Stroke (NINDS), the National Institute of Nursing Research (NINR), the National Institute on Aging (NIA), the NIH Office of Behavioral and Social Sciences Research (OBSSR), and the NIH Office of Disease Prevention (ODP). The content is solely the responsibility of the authors and does not necessarily represent the official views of [Institute, Center, or Office providing funding or oversight] or the NCCIH, NCI, NIA, NIAMS, NHLBI, NIAID, NIMHD, NINDS, NINR, OBSSR, or ODP, or the NIH."

3. Manuscripts supported by both the Coordinating Center and one or more NIH Collaboratory Trials:

a. Manuscripts derived from the work of the **Coordinating Center or Core Working Groups and BackInAction, BeatPain Utah, FM TIPS, GRACE, NOHARM, or OPTIMUM** should include the following acknowledgment:

"This work was supported within the National Institutes of Health (NIH) Pragmatic Trials Collaboratory under award number

U24 AT009676 from the National Center for Complementary and Integrative Health (NCCIH), the National Cancer Institute (NCI), the National Heart, Lung, and Blood Institute (NHLBI), the National Institute of Allergy and Infectious Diseases (NIAID), the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), the National Institute of Minority Health and Health Disparities (NIMHD), the National Institute of Neurological Disorders and Stroke (NINDS), the National Institute of Nursing Research (NINR), the National Institute on Aging (NIA), the NIH Office of Behavioral and Social Sciences Research (OBSSR), and the NIH Office of Disease Prevention (ODP), and by the NIH through the NIH HEAL Initiative under award number [UG3, UH3, and/or R01 grant number] administered by the [Institute, Center, or Office providing funding or oversight]. This work was also supported by the NIH through the NIH HEAL Initiative under award number U24 AT010961. [If supplemental funding was provided for specific activities, acknowledge the Institute, Center, or Office providing the support here.] The content is solely the responsibility of the authors and does not necessarily represent the official views of the [Institute, Center, or Office providing funding or oversight] or the NCCIH, NCI, NIA, NIAMS, NHLBI, NIAID, NIMHD, NINDS, NINR, OBSSR, or ODP, or the NIH or its HEAL Initiative."

b. Manuscripts derived from work of the **Coordinating Center or Core Working Groups and any other NIH Collaboratory Trial** should include the following acknowledgment:

"This work was supported within the National Institutes of Health (NIH) Pragmatic Trials Collaboratory through cooperative agreement U24 AT009676 from the National Center for Complementary and Integrative Health (NCCIH), the National Cancer Institute (NCI), the National Heart, Lung, and Blood Institute (NHLBI), the National Institute of Allergy and Infectious Diseases (NIAID), the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), the National Institute of Minority Health and Health Disparities (NIMHD), the National Institute of Neurological Disorders and Stroke (NINDS), the National Institute of Nursing Research (NINR), the National Institute on Aging (NIA), the NIH Office of Behavioral and Social Sciences Research (OBSSR), and the NIH Office of Disease Prevention (ODP), and through cooperative agreement [UG3, UH3, and/or R01 grant number] from the [Institute, Center, or Office providing funding or oversight]. [If supplemental funding was provided for specific activities, acknowledge the Institute, Center, or

Office providing the support here.] The content is solely the responsibility of the authors and does not necessarily represent the official views of the [Institute, Center, or Office providing funding or oversight] or the NCCIH, NCI, NIA, NIAMS, NHLBI, NIAID, NIMHD, NINDS, NINR, OBSSR, or ODP, or the NIH."

4. Manuscripts that cite **multiple sources of support** (for example, a project supported by the Coordinating Center and one or more NIH Institutes, Centers, or Offices) should list funding sources in declining order of proportional support for the given project.

5. Before issuing a press release concerning results, presentations, or publications derived from this research, authors should notify the relevant NIH Institute, Center, or Office in advance to allow for coordination.

C. Preferred Publication Language for Posters, Slides, and Other Summary Formats

An abbreviated version of the publication language may be used in poster presentations, slides, and other summary reports, as described below.

1. Poster presentations, slide presentations, and other summary reports **derived from the work of one or more Core Working Groups or the Coordinating Center** should include the following publication:

   "This work was supported within the NIH Pragmatic Trials Collaboratory under award number U24 AT009676 from multiple NIH Institutes, Centers, and Offices. [If supplemental funding was provided for specific activities, acknowledge the Institute, Center, or Office providing the support here.] The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH."

2. Poster presentations, slide presentations, and other summary reports **derived from one or more NIH Collaboratory Trials**:

   a. Poster presentations, slide presentations, and other summary reports derived from **BackInAction, BeatPain Utah, FM TIPS, GRACE, NOHARM, or OPTIMUM** should include the following publication:

      "This work was supported within the National Institutes of Health (NIH) Pragmatic Trials Collaboratory through the NIH HEAL Initiative under award number [UG3, UH3, and/or R01 grant number]

administered by the [Institute, Center, or Office providing oversight]. This work also received logistical and technical support from the PRISM Resource Coordinating Center under award number U24 AT010961 from the NIH through the NIH HEAL Initiative, and from the NIH Pragmatic Trials Collaboratory Coordinating Center under award number U24 AT009676 from multiple NIH Institutes, Centers, and Offices. The content is solely the responsibility of the authors and does not necessarily represent the official views of the [Institute, Center, or Office providing oversight] or the NIH or its HEAL Initiative."

b. Poster presentations, slide presentations, and other summary reports derived from any other **NIH Collaboratory Trial** should include the following acknowledgment:

"This work was supported within the NIH Pragmatic Trials Collaboratory by cooperative agreement [UG3, UH3, and/or R01 grant number] from the [Institute, Center, or Office providing funding or oversight]. This work also received logistical and technical support from the program's Coordinating Center through cooperative agreement U24 AT009676 from multiple NIH Institutes, Centers, and Offices. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH."

3. Poster presentations, slide presentations, and other summary reports supported by both the Coordinating Center or Core Working Groups and one or more NIH Collaboratory Trials:

a. Poster presentations, slide presentations, and other summary reports supported by the **Coordinating Center or Core Working Groups and BackInAction, BeatPain Utah, FM TIPS, GRACE, NOHARM, or OPTIMUM** should include the following acknowledgment:

"This work was supported within the National Institutes of Health (NIH) Pragmatic Trials Collaboratory through cooperative agreement U24 AT009676 from multiple NIH Institutes, Centers, and Offices, and by the NIH through the NIH HEAL Initiative under award number [UG3, UH3, and/or R01 grant number] from the [Institute, Center, or Office providing funding or oversight]. This work was also supported by the NIH through the NIH HEAL Initiative under award number U24 AT010961. [If supplemental funding was provided for specific activities, acknowledge the Institute, Center, or Office providing the support here.] The content is solely the responsibility of the authors

and does not necessarily represent the official views of the NIH or its HEAL Initiative."

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4. Poster presentations, slide presentations, and other summary reports that cite **multiple sources of support** (for example, a project supported by the Coordinating Center and one or more NIH Institutes, Centers, or Offices) should list funding sources in declining order of proportional support for the given project.

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NIH Collaboratory Trial Publications

(See reverse side for Coordinating Center and Core publications)

The NIH Collaboratory Trials are supported by and receive administrative oversight from individual NIH Institutes, Centers, or Offices. The Coordinating Center provides logistical and technical support for all NIH Collaboratory Trials. For NIH Collaboratory Trial publications, please complete these steps, as required by our policies and funding.

Before Publication

STEP 01

Choose option A, B, or C for the funding acknowledgment.

Option A: Your work is supported by one or more of the following NIH Collaboratory Trials: BackInAction, BeatPain Utah, FM-TIPS, GRACE, NOHARM, or OPTIMUM.

Use the following language: "This work was supported within the National Institutes of Health (NIH) Pragmatic Trials Collaboratory through the NIH HEAL Initiative under award number [UG3, UH3, and/or R01 grant number] administered by the [Institute, Center, or Office providing oversight]. This work also received logistical and technical support from the PRISM Resource Coordinating Center under award number U24 AT010961 from the NIH through the NIH HEAL Initiative, and from the NIH Pragmatic Trials Collaboratory Coordinating Center under award number U24 AT009676 from the National Center for Complementary and Integrative Health (NCCIH), the National Cancer Institute (NCI), the National Heart, Lung, and Blood Institute (NHLBI), the National Institute of Allergy and Infectious Diseases (NIAID), the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), the National Institute of Minority Health and Health Disparities (NIMHD), the National Institute of Neurological Disorders and Stroke (NINDS), the National Institute of Nursing Research (NINR), the National Institute on Aging (NIA), the NIH Office of Behavioral and Social Sciences Research (OBSSR), and the NIH Office of Disease Prevention (ODP). The content is solely the responsibility of the authors and does not necessarily represent the official views of [Institute, Center, or Office providing funding or oversight] or the NCCIH, NCI, NIA, NIAMS, NHLBI, NIAID, NIMHD, NINDS, NINR, OBSSR, or ODP, or the NIH or its HEAL Initiative. "

Option B: Your work is supported by one or more NIH Collaboratory Trials, but *not including* BackInAction, BeatPain Utah, FM-TIPS, GRACE, NOHARM, or OPTIMUM.

Use the following language: "This work was supported within the National Institutes of Health (NIH) Pragmatic Trials Collaboratory by cooperative agreement [UG3, UH3, and/or R01 grant number] from the [Institute, Center, or Office providing funding or oversight]. This work also received logistical and technical support from the NIH Pragmatic Trials Collaboratory Coordinating Center under award number U24 AT009676 from the National Center for Complementary and Integrative Health (NCCIH), the National Cancer Institute (NCI), the National Heart, Lung, and Blood Institute (NHLBI), the National Institute of Allergy and Infectious Diseases (NIAID), the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), the National Institute of Minority Health and Health Disparities (NIMHD), the National Institute of Neurological Disorders and Stroke (NINDS), the National Institute of Nursing Research (NINR), the National Institute on Aging (NIA), the NIH Office of Behavioral and Social Sciences Research (OBSSR), and the NIH Office of Disease Prevention (ODP). The content is solely the responsibility of the authors and does not necessarily represent the official views of [Institute, Center, or Office providing funding or oversight] or the NCCIH, NCI, NIA, NIAMS, NHLBI, NIAID, NIMHD, NINDS, NINR, OBSSR, or ODP, or the NIH."

Option C: Your work has multiple sources of support.

For work with multiple sources of support—such as a collaboration between an NIH Collaboratory Trial and the Coordinating Center or a Core Working Group, supplemental funding for specific activities, or support from outside the NIH Collaboratory—email us at nih-collaboratory@duke.edu. We're here to help!

STEP 02

Does your work include a description of another NIH Collaboratory Trial?

If yes, please allow the principal investigator of the other trial to review your work. This courtesy review will be limited to the factual accuracy of your description of their work. Allow at least 2 weeks in advance of your initial journal submission.

Coordinating Center staff can facilitate this process and convey draft manuscripts to NIH Collaboratory Trial investigators for their confidential review. Email us at nih-collaboratory@duke.edu and include "Manuscript Review" in the subject heading.

STEP 03

Notify the Coordinating Center.

It's easy! Email us at nih-collaboratory@duke.edu. Please allow 1 week for us to review your acknowledgment statement. Coordinating Center staff and the publications committee are also available to provide advice, suggestions, and help with dissemination, as needed.

After Publication

STEP 01

Let us know your work has been published.

Email us at nih-collaboratory@duke.edu. We track and report on publications as part of the NIH Collaboratory grants. We also want to share and promote your work!

STEP 02

Ensure your work meets applicable NIH public access requirements, such as inclusion in PubMed Central.

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NIH Collaboratory Coordinating Center and Core Publications

(See reverse side for NIH Collaboratory Trial publications)

For Coordinating Center and Core Working Group publications, please complete these steps, as required by our policies and funding.

Before Publication

STEP 01

Choose option A or B for your funding acknowledgment.

Option A: Some or all of your work is supported by the Coordinating Center or a Core Working Group.

Include the following language: "This work was supported within the National Institutes of Health (NIH) Pragmatic Trials Collaboratory through cooperative agreement U24 AT009676 from the National Center for Complementary and Integrative Health (NCCIH), the National Cancer Institute (NCI), the National Heart, Lung, and Blood Institute (NHLBI), the National Institute of Allergy and Infectious Diseases (NIAID), the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), the National Institute of Minority Health and Health Disparities (NIMHD), the National Institute of Neurological Disorders and Stroke (NINDS), the National Institute of Nursing Research (NINR), the National Institute on Aging (NIA), the NIH Office of Behavioral and Social Sciences Research (OBSSR), and the NIH Office of Disease Prevention (ODP). [If supplemental funding was provided for specific activities, acknowledge the Institute, Center, or Office providing the support here.] The content is solely the responsibility of the authors and does not necessarily represent the official views of the NCCIH, NCI, NIA, NIAMS, NHLBI, NIAID, NIMHD, NINDS, NINR, OBSSR, or ODP, or the NIH."

Option B: Your work has multiple sources of support in addition to the Coordinating Center or a Core Working Group.

For work with multiple sources of support in addition to the Coordinating Center or a Core Working Group—such as a collaboration between an NIH Collaboratory Trial and the Coordinating Center or a Core Working Group, supplemental funding for specific activities, or support from outside the NIH Collaboratory—email us at nih-collaboratory@duke.edu. We're here to help!

After Publication

STEP 01

Let us know your work has been published.

Email us at nih-collaboratory@duke.edu.

We track and report on publications as part of the NIH Collaboratory grants. We also want to share and promote your work!

STEP 02

Ensure your work meets applicable NIH public access requirements, such as inclusion in PubMed Central.

NIH PRAGMATIC TRIALS COLLABORATORY
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NIH Pragmatic Trials Collaboratory Data and Resource Sharing Policy

Introduction

The NIH Collaboratory Steering Committee recognizes that data and resource sharing promotes many goals of the NIH research endeavor. It is particularly important for unique data and tools that cannot be readily replicated. Data and resource sharing allows scientists to expedite the translation of research results into knowledge, products, and procedures to improve human health.

There are many reasons to share data and resources from these NIH-supported studies. Sharing reinforces open scientific inquiry, encourages diversity of analysis and opinion, promotes new research, makes possible the testing of new or alternative hypotheses and methods of analysis, supports studies on data collection methods and measurement, facilitates the education of new researchers, enables the exploration of topics not envisioned by the initial investigators, and permits the creation of new datasets when data from multiple sources are combined.

The NIH Collaboratory Steering Committee agrees that data and resources should be made as widely and freely available as possible while safeguarding the privacy of participants, and protecting confidential and proprietary data, and therefore adopts the following policy regarding data and resource sharing:

Data Sharing

1. Trials started before 2023 ***are encouraged to*** share research data. For trials started after 2023, NIH Collaboratory investigators ***are required to*** share, at a minimum, the scientific data supporting a publication by the time of publication, whether online or in print. Per the 2023 NIH Data Management and Sharing Policy, scientific data are defined as "the recorded factual material commonly accepted in the scientific community as of sufficient quality to validate and replicate research findings regardless of whether the data are used to support scholarly publications." The repository must meet FAIR Principles for scientific data management and stewardship and all NIH policy requirements, including that the data be shared at the end of the award, whether the research results were published or not.

2. The NIH Collaboratory Steering Committee recognizes that sharing data derived from clinical care in studies performed in partnership with health care systems may, under some situations, require precautions in addition to those regarding patient confidentiality, to protect specific interests of collaborating health care systems, facilities or providers. Precautions such as allowing data sharing in more supervised or restricted settings, such as access to researchers who agree to limited pre-approved research goals, may be appropriate to address these needs in implementing this data sharing policy.

Version: November 12, 2024

Justifiable reasons for limiting the sharing of data should be described in the Data Monitoring and Sharing Plan.

3. Consistent with NIH policy and guidance, NIH Collaboratory investigators will choose the least restrictive method for sharing of research data that provides appropriate protection for participant privacy, health system privacy, and scientific integrity.

4. NIH Collaboratory investigators will work with NIH to implement this data sharing policy, to ensure the appropriate administrative processes and technical infrastructure are in place to support timely data sharing for the Collaboratory.

Resource Sharing

As part of the NIH Pragmatic Trials Collaboratory's commitment to sharing information garnered from publicly funded research, all NIH Collaboratory Trials are expected to share resources, such as protocols, phenotypes, videos, training materials, consent documents, and recruitment materials. Elements of a final data and resource sharing package should include the items listed in the Closeout Data and Resource Sharing Checklist. If an element will not be included in the data and resource sharing package, a brief explanation for the omission is required. Resources can be housed in the NIH Collaboratory Knowledge Repository, in a public repository (eg, GitHub), or on a study website. All NIH Collaboratory Trial resources will be collated on the Data and Resource Sharing page of the Living Textbook.

The CC will consider updates and modifications to this policy as needed, to be determined through consultation with the Steering Committee and NIH. The NIH Collaboratory agrees to adopt and implement the resource, data, and software sharing plans as outlined in the RFA.

NIH PRAGMATIC TRIALS COLLABORATORY
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Data and Resource Sharing Informational Document

Table of Contents

Purpose

This document is meant to provide background and information to assist clinical investigators in developing data sharing plans and is to be used along with the accompanying Data Sharing Plan Development Worksheet. This document contains information on the NIH Pragmatic Trials Collaboratory Data and Resource Sharing Policy; data sharing requirements for NIH funded trial; data sharing requirements for medical journals; data sharing repositories, mechanisms and platforms; and examples from NIH Collaboratory Trials.

If you have questions, feedback or suggestions regarding data sharing, please contact us at nih-collaboratory@dm.duke.edu.

Data Sharing Considerations

As described in the NIH Pragmatic Trials Collaboratory Data and Resource Sharing Policy, sharing research data collected in NIH Collaboratory Trials is essential to several core objectives of the program, including:

- Maximizing the public health impact of the significant NIH investment
- Accelerating the pace of learning throughout the US healthcare system
- Increasing participation in research and learning by a wide range of partners, including healthcare systems, healthcare providers, and patients/consumers

The ethical responsibility to share data generated by publicly funded research must be balanced against the need to protect patient privacy and scientific integrity.

Because NIH Collaboratory Trials typically rely on data collected through normal health care delivery, sharing data from those trials will be guided by some considerations not typically encountered in more traditional clinical trials. For example, individual participant consent may be waived in accordance with the federal regulations for the Protection of Human Subjects (45 CFR part 46) in some NIH Collaboratory Trials that rely on data extracted from health systems' electronic medical records or administrative data. Special considerations in developing data sharing for pragmatic trials involving health system data are discussed in the Living Textbook Chapter "Data Sharing and Embedded Research."

Data Sharing Requirements for the NIH, HEAL Initiative, and Medical Journals

Please note that these policies are current as of the date of this document. Refer to the individual websites for the latest information and full requirements.

2023 NIH Data Management and Sharing Policy

The goal of the **Final NIH Policy for Data Management and Sharing** is to "maximize the appropriate sharing of scientific data." This Policy applies to all research, funded or conducted in whole or in part by NIH, that results in the generation of scientific data. The policy is applicable to research applications for grants, contracts, or cooperative agreements submitted after January 25, 2023, or other transactions executed after January 25, 2023.

The Data Management and Sharing Policy requires

- "Submission of a Data Management and Sharing Plan outlining how scientific data and any accompanying metadata will be managed and shared, taking into account any potential restrictions or limitations.
- Compliance with the awardee's plan as approved by the NIH Institute, Center, or Office."
- Shared scientific data should be made accessible as soon as possible, and no later than the time of an associated publication, or the end of performance period, whichever comes first.

Importantly, costs associated with data management and data sharing may be allowable under the budget for the proposed project. According to the policy, "plans should explain how scientific data generated by research projects will be managed and which of these scientific data and accompanying metadata will be shared."

Shared data should be of sufficient quality to validate and replicate research findings, regardless of whether the data are used to support scholarly publications. The policy "does not create a uniform requirement to share all scientific data" in order to preserve "necessary flexibility," but makes several key suggestions including that:

1. Any limitations on subsequent uses of data should be communicated to sharing platforms; and
2. Access to scientific data should be "controlled, even if **de-identified and lacking explicit limitations** on subsequent use" and the policy "strongly encourages the use of **established repositories** to the extent possible."

Nothing in the policy is intended to prevent sharing practices "consistent with consent practices, established norms, and applicable law" including open sharing to speed scientific progress.

For an example, see the Intramural Data Management and Sharing Template.

HEAL Public Access and Data Sharing

NIH HEAL Initiative–generated findings must be available publicly upon publication, and award recipients and their collaborators are required to acknowledge NIH HEAL Initiative support in the acknowledgement sections of any relevant publication.

Underlying Primary Data for the publications will be made broadly available through a HEAL-compliant data repository, which include Vivli, NIMH Data Archive (NDA), and ICPSR (Inter-university Consortium for Political and Social Research) (Table 4). All HEAL projects may contact their HEAL Data Steward for assistance.

The goal of the **HEAL Public Access and Data Sharing** policy is to ensure that "underlying primary data should be made as widely and freely available as possible while safeguarding the privacy of participants and protecting confidential and propriety data." Just like the Collaboratory policy, it defines "underlying primary data" as those used to support publications. Although not "proscriptive," it suggests that primary data should be made "broadly available through an appropriate data repository…" It states that an "appropriate" data sharing plan includes that data should be de-identified (as defined by HIPAA), but that de-

identified data that "**contain sensitive information**" be additionally deposited in **controlled-access repositories**. There is no definition included for sensitive information, but the goal of the requirement was to give an additional layer of protection for potentially stigmatizing information.

Medical Journal Data Sharing Requirements

The International Council of Medical Journal Editors (ICMJE) requires that 7 key elements be addressed in the data sharing statement:

1. "Will individual participant data be available (including data dictionaries)?
2. What data in particular will be shared?
3. What other documents will be available?
4. When will data be available (start and end dates)?
5. With whom will data be shared?
6. For what types of analyses will data be shared?
7. By what mechanism will the data be made available?"

From: International Council of Medical Journal Editors' Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals.

Table 1 summarizes data sharing requirements of select academic journals and publishers to give researchers an idea of what may be required for publication.

Table 1. Data Sharing Requirements of Select Academic Journals and Publishers

Journal/Publisher	Requirements	Recommended Repository
BMJ	Requires data from clinical trials to be made available upon request and requires a data sharing statement.	For clinical data, BMJ recommends controlled access repositories, such as clinicalstudydatarequest.com, the YODA project, or Vivli.
Elsevier	Encourages submission of a data paper, uploading data to a repository, or a data sharing statement stating why data can't be shared.	
Nature	Authors are required to make materials, data, code, and associated protocols promptly available to readers without undue qualifications. Restrictions on the availability of data must be disclosed upon submission.	Unstructured repositories like figshare and Dryad if no structured public repositories exist.
NEJM	Data sharing statement	Aligned with ICJME
PLOS	Data sharing statement	Dryad
Wiley	Data sharing statement	Mendeley Data

Examples from NIH Collaboratory Trials

NIH Collaboratory Trial investigators explored the risks to providers and health systems of sharing data. In Table 2 we describe the risks, the steps taken to mitigate the risks, and the data sharing structure that will be used for each of these pragmatic trials.

Table 2. NIH Pragmatic Trials Collaboratory Data Sharing Plans*

Study name	Risks to providers or health systems	Sharing structure	Steps to mitigate risks to providers or health systems
ABATE Active Bathing to Eliminate Infection	Data regarding infection rates could be used for inappropriate comparisons of facilities or with public reports. Detailed information regarding facilities and utilization patterns could reveal proprietary business information.	Private enclave managed by study team	Potential users may propose specific queries. Only query results (not individual data) will be shared.
ICD-Pieces Improving Chronic Disease management with Pieces	Data regarding patterns of care could be used for biased or inappropriate comparisons across facilities or health systems. Given different specifications, comparison to publicly reported quality measures would be misleading.	Private archive managed by NIDDK	Patient-level data will be de-identified and stored in aggregate database. Identifiers for healthcare system, primary practice and patients will be removed. Use of aggregate dataset will be governed by authorized agreements with NIDDK.
LIRE Lumbar Image Reporting with Epidemiology	Data regarding treatment patterns and resource use could be used for inappropriate or biased comparisons across health systems and could reveal proprietary health system business information.	Private archive managed by study team	Patient-level datasets will de-identified by health systems, clinics, providers, and patients. Investigators will authorize release to specific users for specific purposes.
PPACT Pain Program for Active Coping and Training	Data on opioid prescribing patterns could be misused for inappropriate comparisons of providers or facilities.	Public archive of a modified dataset	Public-use dataset will not include facility or health system identifiers, characteristics, or prescribing/referral practices of individual providers, or patient-level data on race or ethnicity.
SPOT Suicide Prevention Outreach Trial	Data on suicide attempt rates could be used for biased or inappropriate comparisons of suicide attempts or suicide mortality across health systems.	Public archive of a modified dataset	Public-use dataset will not include indicator for health system.

Table 2. NIH Pragmatic Trials Collaboratory Data Sharing Plans*			
Study name	**Risks to providers or health systems**	**Sharing structure**	**Steps to mitigate risks to providers or health systems**
STOP CRC Strategies and Opportunities to Stop Colon Cancer in Priority Populations	Data on screening rates could be misused for inappropriate or biased comparisons of performance across clinics or inaccurate comparisons with public quality measures.	Private archive managed by study team	De-identified patient-level data will be available, with permissions and data use agreements in place. Data use agreements will limit to specific research uses and require destruction after authorized analyses are completed.
TiME Time to Reduce Mortality in End- Stage Renal Disease	Data regarding mortality could be misused for inappropriate or biased comparisons of facilities or healthcare systems. Detailed data regarding patterns of care could reveal proprietary business information.	Private archive managed by NIDDK	De-identified patient-level data that are aggregated across provider organizations will be stored at the NIDDK Central Repository. Facility identifiers, dialysis provider organization identifiers, and data elements that are unique to one of the dialysis providers will be removed. Data will be made available through formal request and a data use agreement between the requestor and the NIDDK.
TSOS Trauma Survivors Outcomes and Support	Data regarding baseline patient characteristics and study outcomes could be used for biased or inappropriate comparisons of care in participating facilities.	Private archive managed by study team	De-identified patient level data will be provided, with priority given to research that will affect trauma care systems nationwide and Collaboratory investigators.

*Assumes HIPAA-compliant patient de-identification for all patients and a data use agreement where appropriate.

Table from: Simon G, et al. Data Sharing and Embedded Research: Data Sharing Solutions for Embedded Research. In: *Rethinking Clinical Trials: A Living Textbook of Pragmatic Clinical Trials*. Bethesda, MD: NIH Pragmatic Trials Collaboratory. Available at: https://rethinkingclinicaltrials.org/chapters/dissemination/data-share-top/data-sharing-solutions-for-embedded-research/. Updated April 12, 2024. DOI: 10.28929/070.

Data Sharing Mechanisms

In Table 3, we describe different technical structures for data sharing and considerations that may assist researchers in selecting the appropriate mechanism for their trial. For more details, see the Living Textbook Chapter on Data Sharing.

Table 3. Technical Structures for Data Sharing From Least Restrictive (and Least Expensive) to Most Restrictive (and Most Expensive)				
Structure	**Description**	**Additional elements**	**Resource needs**	**Example**
Public archive	Analyzable data can be obtained by any user for any use No restriction on the kinds of research questions new users can address	May impose restrictions like prohibitions against re-identification or access to small cell counts May de-identify certain elements, such as study site or demographics, or present sensitive data as an aggregate summary variable	Initial development and annotation Maintenance and access costs	Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project (HCUP)
Private archive	Analyzable data can be obtained by authorized users Honest broker or the original owner of the data decides which uses to authorize Requires binding agreement by recipient regarding protection and use of transferred data	As noted for public archive	As noted for public archive Evaluation of requests Execution of data sharing, data use, data transfer, and other agreements, including agreements covering data with full identifiers Monitoring of compliance with agreements, and response to breach of agreements	Yale University Open Data Access (YODA) Project Centers for Medicaid and Medicare (CMS) Limited Data Sets National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) Central Repository
Public enclave	Any user may query the data, but not take possession of it. Only aggregate results may be removed from the enclave No restriction on the kinds of questions users can address	May impose restrictions like prohibitions against re-identification, passing the data to other users, or access to small cell counts May de-identify certain elements, such as study site or demographics	Initial development and annotation Ongoing curation and governance Creation and maintenance of informatics support for analyses, including software licenses and computational capabilities, and file storage Personnel needed to ensure data quality, etc.	Centers for Medicare and Medicaid Services (CMS) Virtual Research Data Center (VRDC)
Private enclave	Similar to public enclave with regard to provisions for analyzing data without taking possession of it Honest broker or the original owner of the data decides which uses to authorize	Moderated by an honest broker or by representatives of the study and/ or site (either queries or results)	As noted for public enclave Additional resources to evaluate requests and supervise the conduct of approved studies	Food and Drug Administration (FDA) Sentinel Distributed Data Set

Table from: Simon G, et al. Data Sharing and Embedded Research: Data Sharing Solutions for Embedded Research. In: *Rethinking Clinical Trials: A Living Textbook of Pragmatic Clinical Trials*. Bethesda, MD: NIH Pragmatic Trials Collaboratory. Available at: https://rethinkingclinicaltrials.org/chapters/dissemination/data-share-top/data-sharing-solutions-for-embedded-research/. Updated April 12, 2024. DOI: 10.28929/070.

HEAL Data Sharing Repositories

For studies that are part of the HEAL Initiative, 6 principles were considered for data sharing repositories:

- Persistence
- FAIR alignment
- Suitable for study data
- Data Governance
- Resources (cost)
- Future expansion plans

PRISM-specific data concerns included that data from PCTs may come from the EHR, insurance claims, and/or patient-reported outcomes. As there are data access and security issues with data from these sources, potential repositories needed to have an option to release de-identified, aggregated, or more detailed versions of the data. The 4 repositories approved for PRISM trials are FigShare, the NIMH Data Archives (NIDA Data Share), DbGap, and Inter-University Consortium for Political and Social Research (ICPSR) (Table 4).

Table 4. Data Repository Options for PRISM Studies

Platform	Persistence	FAIR alignment	Suitability for study data	Data governance	Cost
ICPSR ICPSR is an organization of member institutions working together to acquire and preserve social science data, provide open and equitable access to these data, promote effective data use.	Regularly updated, large existing community.	• High level of data/metadata curation and assistance • Each study is uniquely identified with a study ID (ICPSR XXXXX) • Study-level and variable-level metadata exist, as does dataset-level metadata • Each study has a detailed, accessible landing page via HTTPS • API access to metadata, long-term potential for access to data	Houses some clinical data	Similar levels of access control mediated by review board; benefits of DbGaP security without much of the "red tape"	No monetary cost to submit data
NIMH Data Archive (NDA) National Institute of Mental Health Data Archive provides infrastructure for sharing research data, tools, methods, and analyses enabling collaborative science and discovery.	Periodically updated. Long-term support is weakest of 3 repositories.	• Each study is uniquely identified, with a study ID • Study-level and variable-level metadata exist, as does dataset-level metadata • Each study has a detailed, accessible landing page via HTTPS • No API exists for these data or metadata • Data dictionaries can be downloaded from study landing pages (Excel, csv, some PDF)	Most closely suited to PRISM studies	Must complete data share agreement; unclear what levels of access control are provided	Free
Figshare A domain agnostic data repository	Publisher model requires an SLA statement guaranteeing 10 y of persistent availability	• All research is allocated a Digital Object Identifier (DOI), ensuring a persistent unique identifier for each dataset • Study-level metadata is publicly available • API integration • Variable-level metadata possible but not required	Domain agnostic; accept any data in any file format (strength and weakness)	All content can be downloaded by anyone, with no need to log in; would require de-identification, but there is support for how to work with human PHI	Free
dbGap NIH repository for genotypes and phenotypes	Regularly updated, large existing community, supported by NCBI. Most likely to be around in 15-20 y.	• Each study is uniquely identified, with a study ID (phsXXXXX.vX.pX) • Study-level and variable-level metadata exist, as does dataset-level metadata • Each study has a detailed, accessible landing page via HTTPS • No API exists for these data, however there is a public FTP server organized by studies in which data dictionaries, etc. can be downloaded	Houses data from human studies (typically epidemiological); not a very natural fit for clinical trial data without omics	Access to (meta)data through public and private means; most secure of 3 options. Barriers to DbGaP access can be both a feature and a bug.	No monetary cost to submit data. Can be labor intensive to submit but lots of guidance materials.

There are many other public and private data sharing platforms to choose from, and some will fit some trials more than others. In Table 5, we list and briefly describe some of them for informational purposes. Note that this list is not comprehensive nor is the NIH Collaboratory mandating use of one of these platforms. This list represents possible platforms for consideration.

Table 5. Other Data Sharing Platforms	
Platform	**Description**
BioLINCC	Biologic Specimen and Data Repository Information Coordinating Center
clinicalstudydatarequest.com	Platform for sharing patient-level data
Dryad	A curated resource that makes the data underlying scientific publications discoverable, freely usable, and citable; provides a general purpose home for different data types
FAIRsharing	General data repository
GitHub	Large code hosting platform; private, public, open source
HCUP	Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project
Mendeley Data	Certified, free-to-use repository that hosts open data from all disciplines, whatever its format (eg, raw and processed data, tables, codes, and software)
NIH Data Sharing Repositories	NIH supported data repositories that make data accessible for re- use. Most accept submissions of appropriate data from NIH- funded investigators (and others), but some restrict data submission to only those researchers involved in a specific network.
OSF	General data repository
re3data.org	Catalogues of registered and certified data repositories
Sentinel Distributed Data Set	Food and Drug Administration (FDA) Sentinel initiative (claims data)
Vivli	Global Clinical Research Data Sharing Platform
VRDC	Centers for Medicare and Medicaid Services (CMS) Virtual Research Data Center
YODA Project	A controlled access repository
Zenodo	General data repository

Examples of Data Sharing Statements

As previously described, the ICMJE requires that 7 key elements be addressed in the data sharing statement. Below are example statements that were used to fulfill these requirements.

Suicide Prevention Outreach Trial (SPOT) Data Sharing Statement

"A deidentified version of the analytic dataset will be made available at the time of the initial publication of primary study findings. Consistent with policies of the NIH Collaboratory, all resources (intervention materials, specifications, computer code, etc.) will be shared at or before the publication of study results."

From: Simon GE, Beck A, Rossom R, et al. 2016. Population-based outreach versus care as usual to prevent suicide attempt: study protocol for a randomized controlled trial. *Trials*. 17(1):452. doi:10.1186/s13063-016-1566-z.

NIH Pragmatic Trials Collaboratory Data Sharing Statement

Links to the de-identified data set as well as resources, such as the study protocol, consent documents, phenotypes, and the data dictionary can be found at https://rethinkingclinicaltrials.org/data-and-resource-sharing/.

Special Considerations Regarding Use of Health System Data

The NIH policy recognizes that data may need to be modified prior to sharing to protect participant's privacy. Data may need to be redacted to strip identifiers, and data use agreements requiring confidentiality may be required. It may be appropriate under certain circumstances to limit access to sensitive data under stricter controls such as those possible through a data enclave.

Given that the NIH Collaboratory Trials rely on data extracted from health systems' electronic medical records or administrative data, it is important to distinguish between research data and the original health system data from which research data were extracted. Each NIH Collaboratory Trial is allowed to create and/or use specific health information through either an explicit informed consent process and/or a waiver of consent granted by one or more supervising institutional review boards. While NIH Collaboratory Trial personnel may have access to a wide range of original health system data (electronic health records, insurance claims, etc.), trials are only allowed to use and store data elements specifically authorized for research use—either by participant consent or by formal waiver of consent by the responsible institutional review board(s).

Investigators are not expected to share or give access to original health system data in electronic health records or other administrative data systems. Rather, they are expected to give access only to the research data on which their analyses are based and conclusions drawn. For example: An NIH Collaboratory Trial may be authorized by participant consent or waiver of consent to examine electronic health records and insurance claims data to assess adherence to a specific class of medications for each trial participant. Computing specific measures of medication adherence may require trial personnel to access all available information regarding medications ordered and/or prescriptions filled. In accord with the consent limits, however, investigators would only retain and analyze specified data elements. In most cases, the detailed original data regarding all medications ordered and/or prescriptions filled would not be retained by investigators nor be subject to expectations or requirements for data sharing.

It is recognized that sharing data derived from clinical care in studies performed in partnership with health care systems may, under some situations, require additional precautions to protect specific interests of collaborating health care systems, facilities or providers. Precautions such as allowing data sharing through a restricted data enclave in which access is limited to researchers who agree to limited pre-approved research goals may be appropriate to address these needs in developing data sharing practices.

Resource Sharing

A major objective of the NIH Collaboratory is to disseminate to the broader community new information learned from pragmatic clinical research. As part of the NIH Collaboratory's commitment to sharing, all NIH Collaboratory Trials are expected to share resources, such as protocols, phenotypes, videos, training materials, consent documents, and recruitment materials. At the end of their trial, investigators will be expected to share the resources on the Closeout Data and Resource Sharing Checklist, which includes the following:

Publications/Dissemination

- Link to protocol paper
- Link to main outcome paper
- Link to other trial-related publications
- Materials used to communicate overall trial results to participants (eg, lay summary)

Study Tools

- Final version of the protocol, including summary of changes
- Consent documents or consent process
- Tools for sites (eg, toolkits, checklists, instruction sheets, clinician-facing materials)
- Participant-facing materials (eg, videos, flyers, handouts)
- Computable phenotypes for outcome measures
- Computable phenotypes for the inclusion/exclusion criteria
- Code for generating variables in the analytic dataset from standard sources
- Datasets and documentation
- Annotated data collection forms
- Link to public use dataset
- Data dictionary (proc contents) for public use dataset

If an element will not be included in the data sharing package, a brief explanation for the omission is required. Resources can be housed in the NIH Collaboratory Knowledge Repository, in a repository, or on a study website. All resources will be collated on the Data and Resource Sharing page of the Living Textbook. To request posting of materials to the Knowledge Repository, contact nih-collaboratory@dm.duke.edu .

NIH PRAGMATIC TRIALS COLLABORATORY
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Onboarding Data and Resource Sharing Questionnaire

Table of Contents

Data and Resource Sharing Questionnaire

This questionnaire is a worksheet to guide NIH Collaboratory Trials in developing data sharing plans that meet program requirements (see below checklist). This questionnaire is to be used as part of the onboarding process and can used for planning purposes by other researchers who need to share data.

Instructions/guidance are provided in italics. Please provide responses in the answer column.

Data Sharing Questionnaire **1. Study information**	
Question	**Answer**
What is the trial name and acronym?	
Who is completing this questionnaire?	
Date of questionnaire completion?	
Please provide a link to the trial's ClinicalTrials.gov registration.	

Prepared by: NIH Collaboratory Coordinating Center
Version: March 26, 2024

2. Data elements and sharing						
*NIH Pragmatic Trials Collaboratory investigators will each **share, at a minimum, a final research dataset** upon which the accepted primary pragmatic trial publication is based (from the NIH Collaboratory Data Sharing Policy; see Data Sharing Information Document for additional information from NIH Pragmatic Trials Collaboratory, NIH, and medical journal data sharing policies).*						
2a. Please describe all data collected/used for this study. Select all that apply and fill out each column as applicable.						
Data	**Y/N**	**If Y, brief description of data**	**Identifiable? If so, what IDs?**	**Can it be shared without restriction?**	**Can it be shared with restriction?**	**Describe restrictions** (eg, IDs stripped, aggregated info only, etc) **or reason data cannot be shared**
• Individual Level Data						
• Primary data collection through informed consent						
• Primary data collection through waiver of informed consent						
• Secondary data use – data collected by researchers of an earlier study						
• Secondary data use – administrative data obtained from a covered entity (eg, claims and assessment data from CMS; electronic health records from healthcare providers, etc)						
• Other						
• Provider Level Data						
• Other Data (eg, state policy, market level, Census)						

2b. Please describe the analytic dataset that will be released	
Will individuals be identifiable? _____Yes _____No _____ N/A	Comments/explanation:
Level of dataset: _____Individual _____Provider _____Other	Brief description of dataset:
If not identifiable, can individuals be differentiated? (eg, includes a study-generated ID so that multiple events/observations can be attributed to a unique study participant) _____ Yes _____ No	Comments/explanation:
Will providers be identifiable? _____Yes _____No _____ N/A	If not identifiable, can providers be differentiated? _____ Yes _____No
Can the primary analyses be replicated using the released data? _____ Yes _____ No	If no, why not? (eg, aggregated data, missing elements, etc)
What value will the data have for other researchers?	

3. What precautions/risks need to be considered?	
The NIH Collaboratory Steering Committee recognizes that sharing data derived from clinical care in studies performed in partnership with healthcare systems may, under some situations, ***require precautions in addition to those regarding patient confidentiality****, to protect specific interests of collaborating healthcare systems, facilities, or providers. Precautions such as allowing data sharing in more supervised or restricted settings, such as access to researchers who agree to limited pre-approved research goals, may be appropriate to address these needs (from the NIH Collaboratory Data Sharing Policy).*	
Question	**Answer**
What precautions are needed other than those regarding patient confidentiality?	
Have your research partners expressed concerns about how the data will be shared (enclave, repository, etc)?	
What are the risks to providers and health systems if a less restrictive mechanism is used? (See Data Sharing Information Document for examples from NIH Collaboratory Trials.)	

4. How will the data be shared?	
*Consistent with NIH policy and guidance, NIH Pragmatic Trials Collaboratory investigators will choose the **least restrictive method for sharing of research data** that provides appropriate protection for participant privacy, health system privacy, and scientific integrity (from the NIH Collaboratory Data Sharing Policy).*	
Question	**Answer**
What is the least restrictive mechanism you can use for sharing data? (See Data Sharing Information Document for details about these mechanisms.) • Public archive (least restrictive) • Public enclave • Private archive • Private enclave (most restrictive)	
What specific platform will be used? (See Data Sharing Information Document for example data sharing platforms.)	

5. Preparing for data sharing	
Question	**Answer**
When will you share data? Prior to or after publication?	
Please write a draft data sharing statement. (See Data Sharing Information Document for example statements.)	
Do you foresee any obstacles regarding data and resource sharing?	

6. What resources will be shared?

*As part of the NIH Pragmatic Trials Collaboratory's commitment to sharing, all NIH Collaboratory Trials are expected to share data **and resources, such as protocols, phenotypes, videos, training materials, consent documents, and recruitment materials**. We recommend that elements of a final data sharing package include the items listed below. If an element will not be included in the data sharing package, please provide a brief explanation for the omission. Resources can be housed in the NIH Collaboratory Knowledge Repository (KR), on a repository (ie, GitHub), or on a study website. We will link to the materials from the Living Textbook. To request posting of materials to the KR, contact nih-collaboratory@dm.duke.edu.*

Item	**Will you publish?** Yes, No, N/A **If No, justify**	**Where publish** (mark all that apply)		**When publish** (mark all that apply)		
		NIH KR	Other (specify)	Per manuscript*	Start of study	End of study
Final version of protocol						
Consent documents/process						
Computable phenotypes for outcome measures						
Computable phenotypes for inclusion/exclusion criteria						
Code for generating variables in the analytic dataset from standard sources						
Study questionnaires						
Annotated data collection forms						
Data dictionary (proc contents) for public use dataset						
Data dictionary (proc contents) for all data used in study with annotation regarding limitations on sharing each element						
Code for generating the tables present in a particular manuscript*						
Instructions on how to obtain data that were unable to be released (eg, CMS data files)†						
Tools for sites (eg, toolkits, checklists, instruction sheets, clinician-facing materials)						
Participant-facing materials (eg, videos, flyers, handouts)						
Other						

*For example, PROVEN developed a process of submitting supplemental material for each manuscript published. They store the information in Brown's Digital Repository with a manuscript-specific URL that is published within the manuscript. They include the code that generated the manuscript's tables.
†For example, the PROVEN team refers the reader to www.resdac.org for the use of CMS data files and lets them know the file types and years used for its study since they cannot release those data.

NIH PRAGMATIC TRIALS COLLABORATORY
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Data and Resource Sharing Checklist

Background

All NIH Collaboratory Trials will be expected to review this checklist as part of the onboarding process so they understand what will be expected. They will complete the checklist at closeout.

As part of the NIH Pragmatic Trials Collaboratory's commitment to sharing, all of its trials are expected to share data and resources, such as protocols, phenotypes, videos, training materials, consent documents, and recruitment materials. We recommend that elements of a final data sharing package include the items listed in the checklist below. If an element will not be included in the data sharing package, please provide a brief explanation for the omission. Resources can be housed in the NIH Collaboratory Knowledge Repository (KR), on a repository (eg, GitHub), or on a study website. We will link to the materials from the Living Textbook on each trial's webpage and through a separate Data and Resource Sharing section. To request posting of materials to the KR, contact nih-collaboratory@dm.duke.edu.

Note: There will **not** be a dedicated space on the NIH Collaboratory website for posting analytic datasets; rather, we will post a hyperlink to the data sharing repository chosen by each trial. In the Data Sharing Information Document, the EHR Core provides a partial list of existing data sharing platforms. The accompanying Data Sharing Information Document also contains information on data sharing requirements for the NIH Pragmatic Trials Collaboratory, NIH, and medical journals; information on data sharing mechanisms and platforms; and examples from NIH Collaboratory Trials.

Data and Resource Sharing Checklist for Plan Development – Part 1

Data and Resource Sharing Checklist
1. Trial information
Trial name and acronym:
Checklist completed by:
Date:
Link to ClinicalTrials.gov registration:
Link to trial website:

Data and Resource Sharing Checklist for Plan Development – Part 2

Data and Resource Sharing Checklist		
2. Resource location		
Item	**Provide hyperlink or indicate if item will be stored in the KR**	**If item will not be shared, please provide a brief explanation for the omission**
Publications/Dissemination		
Link to protocol paper		
Link to main outcome paper		
Link to other trial-related publications		
Materials used to communicate overall trial results to participants (eg, lay summary)		
Study tools		
Final version of the protocol, including summary of changes		
Consent documents or consent process		
Tools for sites (eg, toolkits, checklists, instruction sheets, clinician-facing materials)		
Participant-facing materials (eg, videos, flyers, handouts)		
Computable phenotypes for outcome measures		
Computable phenotypes for the inclusion/exclusion criteria		
Code for generating variables in the analytic dataset from standard sources		
Datasets and documentation		
Annotated data collection forms		
Link to public use dataset		
Data dictionary (proc contents) for public use dataset		
Other resources		

NIH PRAGMATIC TRIALS COLLABORATORY
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Closeout Data and Resource Sharing Checklist

Purpose

As part of the NIH Pragmatic Trials Collaboratory's commitment to sharing, all Collaboratory trials are expected to share data and resources, such as protocols, phenotypes, videos, training materials, consent documents, and recruitment materials. We recommend that elements of a final data sharing package include the items listed in the checklist below. If an element will not be included in the data sharing package, please provide a brief explanation for the omission. Resources can be housed in the NIH Collaboratory Knowledge Repository (KR), in a repository (i.e., GitHub), or on a study website. We will link to the materials from the Living Textbook. To request posting of materials to the KR, contact nih-collaboratory@dm.duke.edu.

Note: There will **not** be a dedicated space on the NIH Collaboratory website for posting analytic datasets; rather, we will post a hyperlink to the data sharing repository chosen by each trial. In the Data Sharing Information Document, the EHR Core provides a partial list of existing data sharing platforms. The accompanying Data Sharing Information Document also contains information on data sharing requirements for the NIH Pragmatic Trials Collaboratory, NIH, and medical journals; information on data sharing mechanisms and platforms; and examples from Collaboratory Trials.

Data and Resource Sharing Checklist

All NIH Pragmatic Trials Collaboratory Trials are expected to complete this checklist at closeout. The information provided in the checklist will be published in the Living Textbook on each Collaboratory Trial's page and on a Data and Resource Sharing page.

Data and Resource Sharing Checklist		
1. Trial information		
Trial name and acronym:		
Checklist completed by:		
Date:		
Link to ClinicalTrials.gov registration:		
Link to trial website:		
2. Resource location		
Item	**Provide hyperlink or indicate if item will be stored in the KR**	**If item will not be shared, please provide a brief explanation for the omission**
Publications/Dissemination		
Link to protocol paper		
Link to main outcome paper		
Link to other trial-related publications		
Materials used to communicate overall trial results to participants (eg, lay summary)		
Study tools		
Final version of the protocol, including summary of changes		
Consent documents or consent process		
Tools for sites (eg, toolkits, checklists, instruction sheets, clinician-facing materials)		
Participant-facing materials (eg, videos, flyers, handouts)		
Computable phenotypes for outcome measures		
Computable phenotypes for the inclusion/exclusion criteria		
Code for generating variables in the analytic dataset from standard sources		

Datasets and documentation		
Annotated data collection forms		
Link to public use dataset		
Data dictionary (proc contents) for public use dataset		
Other resources		

STUDY SNAPSHOTS

NIH PRAGMATIC TRIALS COLLABORATORY

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Adapting and Implementing a Nurse Care Management Model to Care for Rural Patients With Chronic Pain (AIM-CP)

Principal Investigators
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Kushang V. Patel, PhD, MPH

Sponsoring Institution
University of Washington

Collaborators
- WWAMI (Washington, Wyoming, Alaska, Montana, and Idaho) region Practice and Research Network
- Mecklenburg Area Partnership for Primary Care Research in rural North Carolina

NIH Institutes Providing Funding or Oversight
National Institute of Nursing Research (NINR)

Program Official
Karen Kehl, PhD, RN, FPCN (NINR)

Project Scientist
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ClinicalTrials.gov Identifier
NCT06407115

ABSTRACT

People living in rural communities experience higher rates of chronic pain and poorer health outcomes because of pain. The 46 million Americans who live in rural areas frequently lack access to evidence-based, nonpharmacologic treatments for chronic pain. A critical need exists to implement effective, comprehensive programs for pain management that include nonpharmacologic treatment options. Nurse care management (NCM) has been used successfully to enhance care for individuals with other chronic conditions or at high risk of complications. Using a type 1 hybrid effectiveness-implementation design, the AIM-CP study team will adapt, pilot, and implement an NCM model that includes care coordination, cognitive behavioral therapy (CBT), and referral to a remotely delivered exercise program for rural patients with chronic pain. Each partnering healthcare system will identify appropriate healthcare professionals to be trained as care managers. For the CBT component, care managers will be trained to engage patients in a remotely delivered CBT program. For exercise, the study will offer the remotely delivered Enhance Fitness program, an evidence-based, 16-week program that includes aerobic and strength training exercise. In the planning phase, the study team will engage patients, clinicians, and care managers from 2 healthcare systems serving rural patients in a learning collaborative to pilot the NCM model. The study team will also adapt infrastructure and workflows to implement the intervention and engage the partnering healthcare systems in developing relationships with community partners and identifying care managers. In the implementation phase, the study team will conduct a randomized controlled trial of the adapted NCM model vs usual care for rural-dwelling patients with chronic pain. The research partners include 6 healthcare systems from 2 practice-based research networks: the WWAMI (Washington, Wyoming, Alaska, Montana, and Idaho) region Practice and Research Network and the Mecklenburg Area Partnership for Primary Care Research in rural North Carolina. The primary outcome is pain interference as measured by the Pain, Enjoyment of Life and General Activity (PEG) scale. Secondary outcomes include physical function, sleep, pain catastrophizing, depression, anxiety, treatment satisfaction, substance use disorder, pain medication use/dosage including opioids, and healthcare utilization. The study team will explore whether disparities exist by examining heterogeneity in treatment effect via subgroup analyses by age, gender, race/ethnicity, and health insurance. They will use the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework to assess implementation outcomes and qualitative interviews conducted with a subset of patients to evaluate experiences with the intervention. If successful, AIM-CP will have a transformative effect on chronic pain management in rural areas by expanding access to evidence-based, nonpharmacologic treatments through an innovative NCM model.

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
Shortage of nurses in rural areas	Flexibility in working with local primary care systems, allowing them to select which healthcare providers will deliver the intervention
Lack of access to evidence-based exercise programs in rural areas	Helping rural healthcare systems connect to exercise providers in nonrural areas, and engaging a variety of exercise providers to develop referral pathways

"The biggest advice I have for investigators planning a pragmatic trial is to listen to and talk with people at the ground level. Talk with practices, talk with community organizations, talk with patients from the very beginning. Be flexible and think about what core elements you want to retain in your intervention and what things you can change to adapt to the needs of the community." — Dr. Sebastian Tong

SELECTED PUBLICATIONS & PRESENTATIONS

- Video Interview: NIH HEAL Initiative Turns Attention to Pragmatic Trials in Rural Communities (2024)
- Presentation: Presentation to the NIH Collaboratory Steering Committee (2023)

See the complete set of AIM-CP resources.

NIH PRAGMATIC TRIALS COLLABORATORY
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Personalized Auricular Point Acupressure for Chronic Pain Self-Management in Rural Populations (APA-SM)

Principal Investigators
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Jane Bolin, PhD, JD, RN; and Hulin Wu, PhD, MS

Sponsoring Institution
University of Texas Health Science Center at Houston

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- UTHealth Houston School of Public Health
- UNT Health Fort Worth School of Nursing
- Texas A&M University School of Public Health

NIH Institutes Providing Oversight
- National Center for Complementary and Integrative Health (NCCIH)
- National Institute of Neurological Disorders and Stroke (NINDS)

Program Official
Beda Jean François, PhD (NCCIH)

Project Scientist
Lanay Mudd, PhD (NCCIH)

ClinicalTrials.gov Identifier
NCT07179016

ABSTRACT

Despite the availability of a range of therapeutic approaches, chronic musculoskeletal pain persists at a high rate. Prior research supports the use of auricular point acupressure to reduce pain intensity and pain interference and improve physical function. Individuals in rural communities often have limited resources or must travel long distances to access evidence-based specialty pain care. To maximize self-management of pain, the study team developed and tested the APA-SM program, which includes a smartphone app to enable patients to self-administer auricular point acupressure. The app includes short demonstration videos with English- and Spanish-language versions and ecological momentary assessments to measure real-world outcomes, with participants being able to monitor their progress as part of an innovative behavior change strategy. In the APA-SM study, the team will conduct a hybrid implementation-effectiveness trial of the APA-SM program, guided by the Reach, Effectiveness, Adoption, Implementation, and Maintenance framework, in diverse healthcare systems serving rural communities in Texas and South Carolina. In the planning phase, the study team planned and evaluated the APA-SM program's integration into rural healthcare systems and communities. In the implementation phase, the study team will conduct a pragmatic, randomized clinical trial to evaluate the clinical effectiveness of the 4-week APA-SM program. The trial will compare 3 groups: self-guided APA-SM with remote training, APA-SM plus in-person training, and an education control. The primary outcome is a composite score of pain intensity and interference in daily life and function, and the secondary outcomes include the NIH HEAL Initiative's pain common data elements and analgesic use, for up to 6 months of follow-up. The study team will also evaluate implementation outcomes, cost-effectiveness, and predictive factors for APA-SM treatment response. A 2-phase design in the implementation phase will include an initiation phase (providing support for buy-in) and a maintenance phase (with no support).

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
Potential for data bandwidth to be a barrier for some patients in rural areas	Based on the pilot study, study team will provide supplementary paper-based materials reflecting app content specific to the patient's pain location and ear point placements for ease of use, especially for those with data bandwidth access challenges
Concern that study-provided smartphones and smartphone app may have user agreements that would limit participants' rights, and that the service provider may conduct passive data collection	Confirmed that there are no user agreements associated with the smartphones and app, and that the service provider does not conduct passive data collection
Feasibility of implementation and measurement of implementation outcomes	Included an expert in implementation science on the study team, and collaborated with rural community partners and community health workers to ensure study conduct will be feasible in the UH3 implementation phase

"Our advice to investigators for future pragmatic trials is to ensure sufficient time in the planning phase to create, develop, and sustain collaborative partnerships, facilitate trust, conduct focus group interviews with partners and pilot the intervention, address challenges and barriers, and review budget and scopes of work." — Dr. Jennifer Kawi

SELECTED PUBLICATIONS & PRESENTATIONS

- Presentation: NIH Pragmatic Trials Collaboratory Onboarding Meeting (2024)
- Video Interview: Transforming Rural Chronic Pain Care: Pilot Study on a Smartphone App-Based Auricular Point Acupressure Self-Management Program

See the complete set of APA-SM resources.

NIH PRAGMATIC TRIALS COLLABORATORY

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Advancing Rural Back Pain Outcomes Through Rehabilitation Telehealth (ARBOR-Telehealth)

Principal Investigators
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Kevin McLaughlin, DPT

Sponsoring Institution
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Collaborator
TidalHealth (Salisbury, Maryland)

NIH Institute Providing Funding or Oversight
National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)

Program Official
Charles Washabaugh, PhD (NIAMS)

Project Scientist
Peter Murray, PhD (National Center for Complementary and Integrative Health [NCCIH])

ClinicalTrials.gov Identifier
NCT06471920

ABSTRACT

For patients with chronic low back pain, physical therapy is a cost-effective method for improving pain and disability. Physical therapy also reduces the need for advanced imaging, injections, surgery, and opioid medications. Yet only 7% to 13% of patients with low back pain, including those with chronic low back pain, receive physical therapy. Patients report significant barriers to accessing physical therapy, including transportation, provider availability, and missed work time. Access is especially limited in rural communities, where there are approximately 40% fewer physical therapists per capita than in metropolitan areas. Patients in rural communities typically must travel longer distances to receive physical therapy, which can impose higher transportation costs and require more time away from work. Access barriers in rural communities likely contribute to the greater rates of low back pain–related disability and opioid consumption in these communities compared with metropolitan areas. Policy changes during the COVID-19 public health emergency allowed physical therapists to begin providing care remotely, referred to as "telerehabilitation." Telerehabilitation has the potential to improve access to physical therapy in rural communities and may serve as a means of improving outcomes for patients with chronic low back pain. ARBOR-Telehealth is a randomized clinical trial of the effectiveness of a risk-informed telerehabilitation strategy to reduce opioid use and low back pain–related disability and improve physical function and health-related quality of life among patients with chronic low back pain. The trial will enroll patients with chronic low back pain who present to primary care clinics that serve rural communities. Eligible patients will be randomly assigned to either an educational control group or to 1 of 3 risk-informed telerehabilitation interventions: a low-risk group receiving remote therapeutic monitoring; a medium-risk group receiving physical therapy telehealth visits; or a high-risk group receiving psychologically informed physical therapy telehealth visits. The primary effectiveness outcomes are the differences in change in low back pain–related disability and opioid use after 8 weeks. The study team will explore implementation outcomes using a mixed-methods approach consisting of electronic surveys and semistructured interviews with patients, physical therapists, practice managers, and outpatient services administrators focused on the perceived quality and impact of the intervention on barriers to care.

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
A relatively small number of physical therapists will provide care to an anticipated large number of study participants, which introduces the possibility of correlations in study outcomes.	The study team worked closely with the Biostatistics and Study Design Core to reconsider the statistical analysis plan in light of the study being an individually randomized group treatment trial rather than an individually randomized trial.

"If I had any advice for investigators considering doing a pragmatic clinical trial, it would be, 'Just do it.' Have crucial conversations with people in your research team, people in the healthcare systems, patients, and providers. By really getting into the healthcare system, you understand the opportunities from the front door to the boardroom." — Dr. Richard Skolasky

SELECTED PUBLICATIONS & PRESENTATIONS

- Presentation: NIH Pragmatic Trials Collaboratory Onboarding Meeting (2023)
- Video Interview: NIH HEAL Initiative Turns Attention to Pragmatic Trials in Rural Communities (2024)
- Article (Study Design): ARBOR-Telehealth Study: An Examination of Telerehabilitation to Improve Function and Reduce Opioid Use in Persons With Chronic Low Back Pain in Rural Communities - Protocol of a Pragmatic, Individually Randomised Group Treatment Trial (2025)

See the complete set of ARBOR-Telehealth resources.

NIH PRAGMATIC TRIALS COLLABORATORY
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BEATPAIN Utah

Nonpharmacologic Pain Management in Federally Qualified Health Center Primary Care Clinics (BeatPain Utah)

Principal Investigator
Julie Fritz, PhD, PT

Sponsoring Institution
University of Utah

Collaborator
Association for Utah Community Health

NIH Institute Providing Oversight
National Institute of Nursing Research (NINR)

Program Official
Karen Kehl, PhD, RN, FPCN (NINR)

Project Scientist
Nana Martinson, MPH (National Center for Complementary and Integrative Health)

ClinicalTrials.gov Identifier
NCT04923334

ABSTRACT

Chronic pain is a growing concern for society, contributing substantially to the ongoing opioid epidemic. Back pain is the most common chronic pain diagnosis and is the most common reason for prescribing opioids. Clinical practice guidelines and opioid prescribing recommendations make it clear that nonpharmacologic pain treatments are preferable to opioids for patients with back pain, yet overprescribing of opioids to individuals with back pain persists. Primary care providers serving rural and low-income communities face specific challenges to providing nonpharmacologic pain care. Nonpharmacologic care providers are often absent from these communities, and even if present may be inaccessible to patients with limited resources. Many rural and low-income communities are served by federally qualified health centers (FQHCs). FQHCs often serve communities at the forefront of the opioid crisis but too often lack options to provide accessible nonpharmacologic alternatives to the patients they serve.

BeatPain Utah is an embedded pragmatic clinical trial that will compare the effectiveness of nonpharmacologic intervention strategies for patients with back pain seeking care in FQHCs throughout the state of Utah. The strategies evaluated are designed to overcome the barriers specific to rural and low-income communities served by FQHC clinics through the innovative use of e-referral and telehealth resources. The BeatPain Utah interventions include:

- A telehealth strategy that provides a brief pain teleconsult along with phone-based physical therapy.
- An adaptive strategy that provides the brief pain teleconsult first, followed by phone-based physical therapy among patients who are nonresponsive to treatment.

The study will also evaluate implementation outcomes to inform future efforts to scale effective strategies into other low-resource health care settings.

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
Choosing analysis procedures that will best account for therapist effects in the study	The study team met internally to modify the statistical analysis and reporting plan to manage this concern. The NIH Collaboratory's Biostatistics and Study Design Core Working Group devoted 2 meetings to helping the study team with solutions for this concern.
Working with FQHC primary care clinics that have been particularly stressed by the demands of the COVID-19 public health emergency in low-resource settings	The study team adapted some of its engagement procedures and in remains in regular communication with study sites to balance advancing the project with the demands that clinics are facing related to COVID-19, including both clinical services and retaining clinical personnel.

"Accelerating the real-world applicability of our research is particularly critical in this area of clinical research. To address the needs of populations that need resources—and they need them now—a pragmatic trial that focuses on real-world solutions was a particularly attractive option." — Dr. Julie Fritz

PRESENTATIONS & ABSTRACTS

- PCT Grand Rounds Presentation: BeatPain Utah: Partnering With Community Health Centers Within a Socio-Technical Framework (2023)
- Presentation: Presentation to the NIH Pragmatic Trials Collaboratory Steering Committee (2023)
- Article (Study Design): BeatPain Utah: Study Protocol for a Pragmatic Randomised Trial Examining Telehealth Strategies to Provide Non-pharmacologic Pain Care for Persons With Chronic Low Back Pain Receiving Care in Federally Qualified Health Centers (2022)
- Article: Use of Implementation Mapping in the Planning of a Hybrid Type 1 Pragmatic Clinical Trial: The BeatPain Utah Study (2024)
- PCT Grand Rounds Presentation: Integrating the BeatPain Study With PRaCTICe, a New Network Research Hub of the CARE for Health Initiative (2025)

Access the complete set of BeatPain Utah resources.

NIH PRAGMATIC TRIALS COLLABORATORY
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Behavioral Economic and Staffing Strategies to Increase Adoption of the ABCDEF Bundle in the ICU (BEST-ICU)

Principal Investigators
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Sponsoring Institution
University of Nebraska Medical Center

Collaborators
- Nebraska Medical Center
- Ohio State University Wexner Medical Center
- University of Iowa Hospitals and Clinics

NIH Institutes Providing Funding or Oversight
National Heart, Lung, and Blood Institute (NHLBI); National Institute of Nursing Research (NINR)

Program Official
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Project Scientist
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ClinicalTrials.gov Identifier
NCT06184945

ABSTRACT

Survivors of critical illness frequently experience profound health impairments brought about or exacerbated by outdated mechanical ventilation and symptom management practices in the intensive care unit (ICU) and by known racial and socioeconomic disparities. This morbidity is potentially preventable through use of the ABCDEF bundle, a multicomponent, evidence-based intervention that improves team-based care in the ICU. Although the ABCDEF bundle has consistently been proven safe and effective, its adoption and performance remain poor nationwide. The BEST-ICU trial is evaluating 2 strategies grounded in behavioral economic theory and implementation science to increase ABCDEF bundle adoption. The strategies target a variety of ICU team members and known behavioral determinants of bundle performance. In the trial's planning phase, the study team worked with the NIH Pragmatic Trials Collaboratory Coordinating Center and community partners to enhance and finalize the implementation strategies and research methods. In the implementation phase, the study team is conducting a pragmatic, stepped-wedge, cluster randomized, hybrid type 3 effectiveness-implementation trial. The participating sites include 6 matched pairs of 12 ICUs in 3 hospitals (providing care for approximately 8100 patients on mechanical ventilation). The study team will randomly assign the ICUs within each matched pair to receive either a real-time audit and feedback dashboard using data from the electronic health record, or a registered nurse implementation facilitator. The trial will compare the effectiveness of the 2 strategies on ABCDEF bundle adoption (the primary outcome) and several clinical outcomes, including duration of mechanical ventilation; ICU, hospital, and 30-day mortality; ICU and hospital length of stay; days with acute brain dysfunction; discharge disposition; use of psychoactive medications and physical therapy; and 30-day hospital readmission. The study team will also identify and describe key stakeholders' experiences with and perspectives on the acceptability of the implementation strategies and their impact on workload. The long-term goal of BEST-ICU is to develop pragmatic, sustainable strategies to increase the delivery of evidence-based practices that improve care for critically ill adults across a variety of healthcare systems, particularly those serving populations with known health disparities, such as safety net hospitals.

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
Challenges associated with using a stepped-wedge design	Frequent consultation with the Biostatistics and Study Design Core helped to hone the randomization strategy and the statistical analysis plan
Complexity of creating a real-time audit and feedback dashboard built on multiple EHR systems	Recruitment of a multidisciplinary team, especially the participation of nurse informaticists, has been critical to building and implementing the dashboard

"Having access to leaders in the field for all the different aspects of pragmatic clinical trials has provided real benefit in terms of saving us months of work, and their help has been invaluable." — Dr. Michele Balas

"Being part of the NIH Collaboratory has been incredibly important for our project. There has been a lot of important input, especially with regard to our randomization scheme. We've really taken it in and made the most of it, and it's going to make a more valid, more reproducible study." — Dr. Ed Vasilevskis

SELECTED PUBLICATIONS & PRESENTATIONS

- Presentation: NIH Pragmatic Trials Collaboratory Onboarding Meeting (2023)
- PCT Grand Rounds Presentation: Behavioral Economic and Staffing Strategies To Increase Adoption of the ABCDEF Bundle in the Intensive Care Unit (BEST-ICU): Protocol, Challenges, and Major Updates (2025)
- Project Website: BEST-ICU Clinical Trial
- Article (Study Design): Behavioral Economic and Staffing Strategies to Increase Adoption of the ABCDEF Bundle in the Intensive Care Unit (BEST ICU): Study Protocol for a Multi-site Stepped-Wedge Cluster Randomized Controlled Trial in the USA

See the complete set of BEST-ICU resources.

NIH PRAGMATIC TRIALS COLLABORATORY

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Coordinated Care Pain Management Technology Implementation (CARNATION)

Principal Investigators
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Sponsoring Institution
Kaiser Foundation Research Institute

Collaborators
- OCHIN, Inc; and community health centers in its network
- RAND

NIH Institute Providing Oversight
National Institute of Neurological Disorders and Stroke (NINDS)

Program Official
Rebecca Hommer, MD (NINDS)

Project Scientist
Anthony Domenichiello, PhD (NINDS)

ABSTRACT

Chronic musculoskeletal pain conditions—common, disabling, costly public health problems—disproportionately impact persons of lower socioeconomic status and are a primary driver of medical care. Current chronic pain care guidelines recommend multimodal, integrative pain management (IPM) involving nonopioid pharmacological options along with nonpharmacological therapies (physical interventions, psychological approaches, and complementary and integrative healthcare). Community health centers serving lower-income patients face substantial time and resource constraints in ensuring that patients receive guideline-concordant IPM services. Recent expansion of state Medicaid reimbursement for nonopioid pain management services and Medicare coverage for pain care management could help connect patients in community health centers (most of whom are publicly insured or uninsured) with IPM-congruent services. However, staff of community health centers lack the health information technology infrastructure necessary to track and coordinate such services for their patients, as well as the support needed to use such tools systematically. Integrating electronic health record (EHR) technologies, including Compass Rose and other enabling technologies, care management applications recently activated in the shared OCHIN Epic platform support care coordination needed for IPM-congruent care. However, integrating such EHR tools into care processes at community health centers involves complex clinic-wide practice changes requiring implementation support. Effective strategies for providing such support are needed. To identify and optimize such strategies, we will partner with this national community health center network to test a multicomponent implementation support intervention designed to enable community health centers' systematic use of EHR technologies including Compass Rose for coordinating primary care–based, IPM-congruent pain care. This hybrid type 3 effectiveness-implementation randomized trial will (1) engage key advisors to tailor existing EHR technologies to optimize their facilitation of IPM-congruent care and refine the implementation support intervention components; (2) test the intervention package's impact on community health centers' use of the tailored health information technology tools and on patient pain-related outcomes; and (3) conduct formative evaluation and budget impact analyses to understand and explain intervention Reach, Effectiveness, Adoption, Implementation, and Maintenance (REACH). The study will generate urgently needed evidence on how to make IPM care available in community health centers, where limited resources present barriers to the delivery and coordination of such care. Results will provide empirically based guidance on how to optimize health information technology infrastructure and provide related support for its uptake to enhance the primary care–based delivery of coordinated multidisciplinary pain care in community health center populations.

SELECTED PUBLICATIONS & PRESENTATIONS

- Presentation: NIH Collaboratory Onboarding Meeting (2025)

See the complete set of CARNATION resources.

NIH PRAGMATIC TRIALS COLLABORATORY
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Chat for Heart Health

Using AI Text Messaging to Improve the American Heart Association's Life's Essential 8 Health Behaviors (Chat 4 Heart Health)

Principal Investigators
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Sponsoring Institution
University of Colorado Denver

Collaborators
- Denver Health and Hospital Authority
- Salud Family Health Centers
- STRIDE Community Health Center

NIH Institute Providing Funding or Oversight
National Heart, Lung, and Blood Institute (NHLBI)

Program Official
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Project Scientist
Nicole Redmond, MD, PhD, MPH (NHLBI)

ClinicalTrials.gov Identifier
NCT06324981

ABSTRACT

The goal of Chat 4 Heart Health is to improve control of risk factors for cardiovascular disease using a multilevel intervention that leverages mobile phone–based text messaging integrated within healthcare systems to improve adherence to the American Heart Association's Life's Essential 8 (LE8). The LE8 health factors are eating better, being more active, quitting tobacco, getting healthy sleep, managing weight, controlling cholesterol, managing blood sugar, and managing blood pressure. When unmanaged, these lifestyle factors lead to common coexisting chronic conditions like hypertension and diabetes, as well as greater morbidity, mortality, and healthcare costs. Populations that experience health disparities (including minoritized ethnic groups, patients with limited English proficiency, and patients with lower income) are disproportionately affected by cardiovascular disease, have worse disease control, and experience greater sequelae. Self-management of chronic disease by patients has strong evidence of benefit. It includes self-care, lifestyle changes, taking medications as prescribed, and managing exacerbations of chronic conditions. Text messaging interventions have improved health behaviors, including physical activity and medication adherence. Incorporating a behavioral "nudge," a small change in choice architecture that alters behavior, into text messages may further augment its impact. However, text messaging interventions have typically not been delivered to large samples, have not focused on populations that experience health disparities, and have not leveraged healthcare systems' electronic health record (EHR) data to personalize content and maximize the scale, reach, and impact of the intervention. Using a pragmatic trial with patient-level randomization, Chat 4 Heart Health is testing the comparative effectiveness of 3 text messaging delivery strategies: (1) generic text messages; (2) interactive artificial intelligence (AI)–based chatbot text messaging that uses evidenced-based communication strategies with attention to patient context and sociocultural factors that influence self-management; and (3) interactive AI-based chatbot text messaging plus proactive pharmacist management. Chat 4 Heart Health will enroll approximately 2200 patients from clinics in 3 healthcare systems that care for large populations that experience health disparities: Denver Health and Hospital Authority, Salud Family Health Centers, and STRIDE Community Health Center. The study team will use EHR data from the partnering healthcare systems to identify eligible patients, deliver the intervention, and assess patient-centered outcomes. The study's findings will provide evidence regarding the best population-based strategy for universal delivery to engage all patient populations experiencing health disparities in self-management to improve LE8 adherence. The intervention will be delivered in real-world settings to augment routine clinical care and improve access to care. The study team will incorporate lessons learned from one of the partnering healthcare systems into adaptations for the other healthcare systems in the study.

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
Impacts of a new rule from the Federal Communications Commission on the planned implementation of the trial's text messaging strategy, including additional barriers to participant enrollment	Consulted with the Biostatistics and Study Design Core to consider the analytic implications of a smaller sample size; and consulted with the Health Equity Core to develop strategies for ensuring all participants can trust the text messaging process
Partnership with 2 new healthcare delivery systems brought challenges associated with accessing and using their EHR systems to identify eligible patients	Worked closely with healthcare system partners to set up security measures and establish protocols to address concerns about data sharing; and used information from the Coordinating Center about onboarding new healthcare system partners and ensuring compliance with HIPAA and data sharing requirements

"Our hope is that one of these arms will improve cardiovascular health. Given the ubiquity of text messaging in everyday life, our hope is that one of these study arms will improve cardiovascular health and can be a generalizable intervention that's low cost and can be widely disseminated." — Dr. Michael Ho

"Being part of the NIH Collaboratory is very helpful for us, primarily because of the network of people who are using similar designs and facing similar challenges. The biggest lesson we've had this year is, try not to take on too much. We have a lot of questions we can explore, but we're focusing on what is the most critical question we can try to answer." — Dr. Ed Vasilevskis

SELECTED PUBLICATIONS & PRESENTATIONS

- Presentation: NIH Pragmatic Trials Collaboratory Onboarding Meeting (2023)
- Video Interview: Chat 4 Heart Health Transitions to Implementation Phase (2024)
- PCT Grand Rounds Presentation: Texting for Behavior Change: Lessons Learned Across 2 Interventions to Improve Chronic Care Management (2025)

See the complete set of Chat 4 Heart Health resources.

NIH PRAGMATIC TRIALS COLLABORATORY
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Equitable Primary Care for Pain Care (EquiP PC)

Principal Investigators
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Rodger Kessler, PhD

Sponsoring Institution
University of Washington

NIH Institute Providing Oversight
National Institute of Neurological Disorders and Stroke (NINDS)

Program Official
Rebecca Hommer, MD (NINDS)

Project Scientist
Anthony Domenichiello, PhD (NINDS)

ABSTRACT

Chronic pain affects about 25% of adults in the United States, with nearly half seeking care in primary care settings. While integrating behavioral health into primary care has been shown to improve outcomes for mental and physical health conditions, it has not been widely used for chronic pain management. This multisite, 3-arm, pragmatic, cluster randomized trial will test the effectiveness of an adapted behavioral health integration toolkit to improve chronic pain care. The trial will compare (1) the toolkit combined with digital therapeutic apps, (2) the toolkit alone, and (3) usual care across 27 primary care practices within health systems and research networks serving underserved populations, including Black, Indigenous, and Hispanic communities, as well as those with low income. The intervention includes a guided approach to engage in a practice-centric effort to target and improve integrated behavioral health for patients with chronic pain, training behavioral health providers in chronic pain care, selecting evidence-based apps for home use, and engaging a community advisory board of patients, providers, and health system leaders. The study will assess outcomes such as reduced pain interference, improved integrated behavioral health, implementation success, and equitable access. The goal is to expand access to high-quality, team-based chronic pain care in primary care settings and reduce disparities in treatment and outcomes.

SELECTED PUBLICATIONS & PRESENTATIONS

- Presentation: NIH Collaboratory Onboarding Presentation (2025)

See the complete set of EquiP PC resources.

NIH PRAGMATIC TRIALS COLLABORATORY
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FM-TIPS
Fibromyalgia TENS In Physical Therapy Study

Fibromyalgia TENS in Physical Therapy Study (FM-TIPS)

Principal Investigators
Kathleen Sluka, PT, PhD; and Leslie Crofford, MD

Sponsoring Institution
University of Iowa

Collaborators
- Advanced Physical Therapy and Sports Medicine
- Big Stone Physical Therapy
- Genesis Healthcare Systems
- Kepros Physical Therapy and Performance
- Rock Valley Physical Therapy
- University of Illinois Chicago

Study Website
FM-TIPS

NIH Institute Providing Oversight
National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)

Program Official
Charles Washabaugh, PhD (NIAMS)

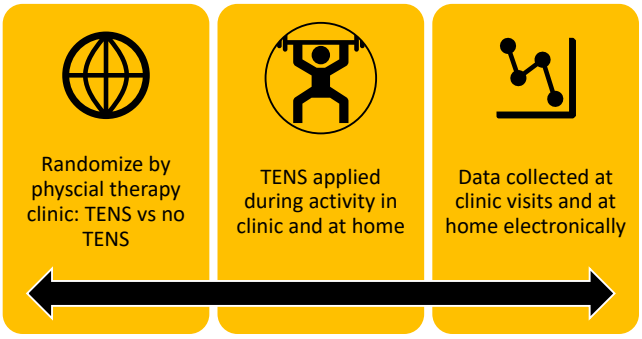
Project Scientist
Joe Bonner, PhD (National Institute of Child Health and Human Development/National Center for Medical Rehabilitation Research)

ClinicalTrials.gov Identifier
NCT04683042

ABSTRACT

Fibromyalgia is a chronic pain condition characterized by widespread musculoskeletal pain, tenderness, and stiffness associated with fatigue and sleep disturbance. The goal of reducing opioid use in patients with chronic pain requires that proven nonpharmacologic treatments are applied in clinical practice. A recently completed trial conclusively demonstrated the efficacy of transcutaneous electrical nerve stimulator (TENS) for reducing musculoskeletal pain. While physical therapists are trained in the use of TENS, it is underused in clinical practice. FM-TIPS is an embedded pragmatic trial comparing the effectiveness of physical therapy with or without the addition of TENS for patients with fibromyalgia within physical therapy clinics. The aims of the trial are to demonstrate the feasibility of adding TENS to the treatment of patients with fibromyalgia in a real-world practice setting and to determine if the addition of TENS reduces pain, increases adherence to physical therapy, and allows patients to reach their specific functional goals with less medication use.

FM-TIPS will address the critical need for strategies that implement effective nonpharmacologic treatments for fibromyalgia. Successful completion of this trial will provide generalizable effectiveness data for referring providers, physical therapists, and insurers and will inform future pragmatic trials of nonpharmacologic treatments conducted in physical therapy practices.



WHAT WE'VE LEARNED SO FAR

Challenge	Solution
In order to deliver the FM-TIPS intervention, physical therapy clinicians needed to receive clinical research certification (eg, CITI training), which was a time-consuming step.	The study team worked with the IRB to find options for online training and webinars for clinicians to help streamline the required certification.
The process for collecting patient-reported outcomes (PROs) had to be adjusted to accommodate a transition of the primary outcome to a home test.	The study team met with the Patient-Centered Outcomes Core to find a way to validate the test for movement-evoked pain (the primary outcome) to be conducted online at home by the participant.
Making adjustments due to the onset of the COVID-19 pandemic affected the timing of contracts and the partnership of one healthcare system.	The study team developed a COVID-19 response plan for potential pauses in enrollment or use of telehealth by clinicians.
Incorporating the core domain elements (CDE) for the NIH HEAL Initiative led to changes in data extraction.	The study team collected more PRO measures instead of extracting from the electronic health record.

"We want to make it easy for the clinician to choose nonpharmacologic strategies for treating pain that improve both symptom and function in patients with fibromyalgia."

PRESENTATIONS & ABSTRACTS

- Presentation: Presentation to the NIH Pragmatic Trials Collaboratory Steering Committee (2023)
- Living Textbook case study: Interim Reassessment of Sample Size in Cluster Randomized Trials
- Article (Study Design): The Fibromyalgia Transcutaneous Electrical Nerve Stimulation in Physical Therapy Study Protocol: A Multisite Embedded Pragmatic Trial (2022)
- Interview with FM-TIPS PIs (2020)
- Article: Community Engagement Strategies Improve Recruitment and Enrollment in a Pragmatic Clinical Trial (2025)
- Presentation: FM-TIPS Community Engagement Methods for Recruitment (2025)

Access the complete set of FM-TIPS resources.

NIH PRAGMATIC TRIALS COLLABORATORY
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GUIDING GOOD CHOICES

Guiding Good Choices for Health (GGC4H)

Principal Investigators
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Sponsoring Institution
University of Washington

Collaborators
- Kaiser Permanente
- Henry Ford Health System

NIH Institute Providing Oversight
National Center for Complementary and Integrative Health (NCCIH)

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Project Scientist
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ClinicalTrials.gov Identifier
NCT04040153

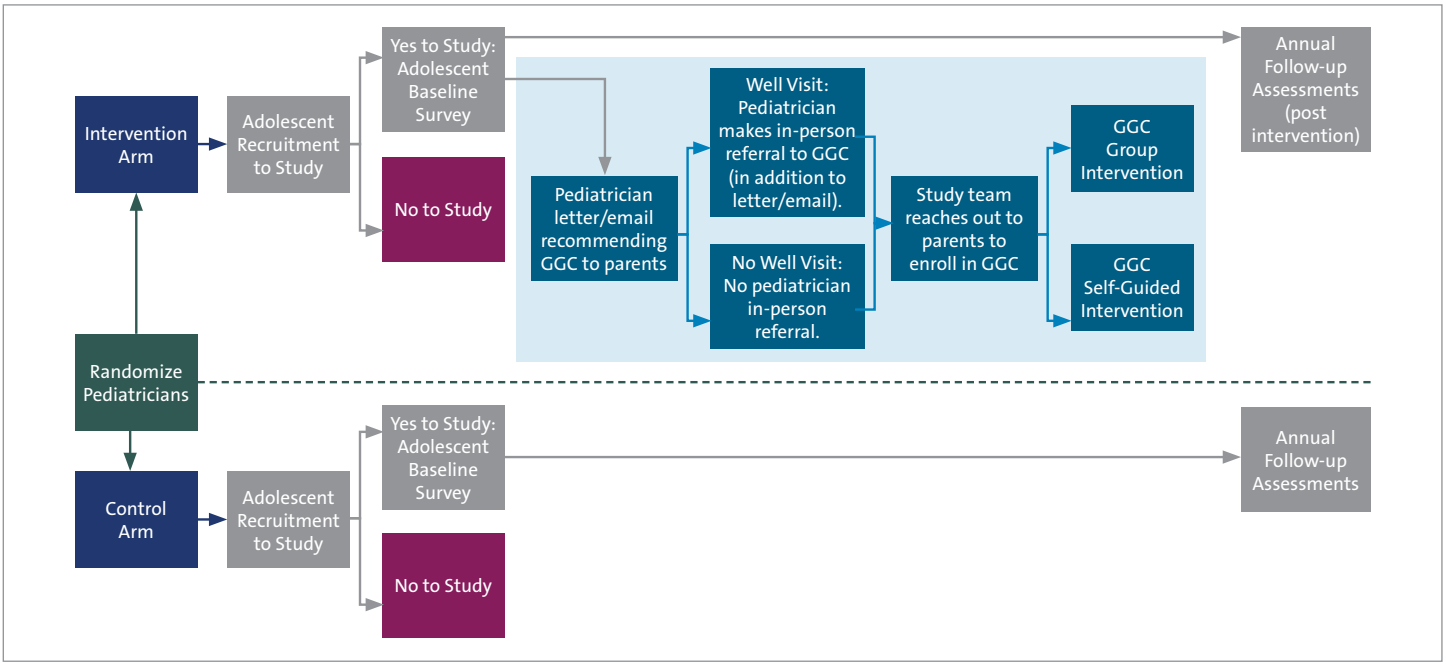
ABSTRACT

Fifty percent of all adolescents will use some form of illicit drugs before the end of high school, and 20% to 25% will meet criteria for depression, while many others will engage in health-compromising behaviors like delinquency and violence—with consequences for their long-term health. Evidence-based parenting interventions shown to prevent these behavioral health concerns could improve adolescent health trajectories if implemented widely in pediatric primary care. The American Academy of Pediatrics' Bright Futures recommends that pediatricians offer developmentally tailored anticipatory guidance to all parents to support their children's healthy development, but programs providing guidance are not offered universally.

The Guiding Good Choices for Health (GGC4H) trial is a cluster randomized trial that will use the RE-AIM framework to test the feasibility and effectiveness of implementing Guiding Good Choices (GGC)—a universal evidence-based anticipatory guidance curriculum for parents of early adolescents—in 3 large, integrated healthcare systems serving socioeconomically diverse families. In prior community trials, GGC has been shown to prevent adolescent substance use (alcohol, tobacco, and marijuana), depressive symptoms, and delinquent behavior. This study offers an opportunity to test GGC effectiveness with respect to improving adolescent behavioral health outcomes when implemented at scale in pediatric primary care within a pragmatic trial.

GUIDING GOOD CHOICES SESSIONS	
Session 1	Getting Started: **How to Prevent Drug Use in Your Family**
Session 2	Setting Guidelines: **How to Develop Healthy Beliefs and Clear Standards**
Session 3	Avoiding Trouble: **How to Say No to Drugs** (with children in attendance)
Session 4	Managing Conflict: **How to Control and Express Your Anger Constructively**
Session 5	Involving Everyone: **How to Strengthen Family Bonds**

GGC4H Effectiveness Design



WHAT WE'VE LEARNED SO FAR

Challenge	Solution
The COVID-19 public health emergency led to fewer well visits, and in-person GGC was not possible.	The team sent a pediatrician-/clinic-endorsed letter to eligible families inviting them to enroll in a newly developed virtual synchronous modality. Approximately 500 families enrolled. There was strong implementation fidelity when GGC was delivered virtually.
The pragmatic GGC implementation plan results in partial cross-nesting of intervention participants, which threatens valid statistical inference.	The study's biostatisticians came up with a modelling approach that resolved statistical concerns and, in a simulation study, showed strong power, nominal alpha levels, and adequate coverage.
The study design needs to address the study's 2 important goals: whether pediatrician recommendation to enroll in GGC increases uptake over historical levels found in community settings, and whether GGC can achieve practice-wide reductions in adolescent substance use initiation.	The cluster randomized design addresses questions of efficacy. GGC will be offered to all parents in the intervention arm, regardless of whether their adolescents are participants, to provide information about GGC uptake among parents outside the artificial context of a research study, as well as among those who consented to the study.

"We have complementary strengths across our site leaders and a collegial team. These features have helped us hit the ground running in this fast-paced trial."

SELECTED PUBLICATIONS & PRESENTATIONS

- Article (Study Design): Parent-Focused Prevention of Adolescent Health Risk Behavior: Study Protocol for a Multisite Cluster-Randomized Trial Implemented in Pediatric Primary Care
- Article: Pilot Implementation of Guiando Buenas Decisiones, an Evidence-Based Parenting Program for Spanish-Speaking Families, in Pediatric Primary Care in a Large, U.S. Health System: A Qualitative Interview Study (2024)
- Article: Implementation Fidelity of a Virtual Adaptation of the Guiding Good Choices Program

Access the complete set of GGC4H resources.

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

GRACE TRIAL

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

Principal Investigators
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Sponsoring Institution
University of Illinois Chicago

Collaborators
- University of Illinois Hospital and Health Sciences System
- University of Florida Health
- Duke University Health System
- Johns Hopkins University
- Emory University

NIH Institute Providing Oversight
National Center for Complementary and Integrative Health (NCCIH)

Program Official
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Project Scientist
Nana Martinson, MPH (NCCIH)

ClinicalTrials.gov Identifier
NCT04906447

ABSTRACT

Nearly 100 people die every day in the United States from a prescription opioid overdose. This crisis is caused in part by an overreliance on opioids to treat individuals experiencing chronic pain. Acute or chronic pain is a constant companion to more than 100,000 people living with sickle cell disease in the United States and millions more worldwide. Pain is a hallmark of sickle cell disease and results in almost 200,000 annual emergency department admissions and is a leading cause of hospitalization. It is known that the use of complementary and integrative therapies to reduce pain and opioid use has the potential to enable patients with sickle cell disease to better cope with their pain, yet few studies have evaluated the effectiveness of such therapies, and none have assessed how to implement them across multiple healthcare systems and patient populations.

To address this gap, GRACE is a pragmatic trial conducted across 3 large healthcare systems that will assess the effects of guided relaxation and acupuncture treatments for people with sickle cell disease. GRACE has 3 priorities:

- Evaluate the effectiveness of guided relaxation and acupuncture to improve pain control.
- Determine the most appropriate and effective treatment sequence for any given patient based on their unique characteristics.
- Describe the processes and structures required to implement guided relaxation and acupuncture within healthcare systems.

The intervention phase involved 3 arms (guided relaxation, acupuncture, and usual care) and followed a quantitative adaptive design that responded to patients' characteristics and evolving pain status. GRACE used the Consolidated Framework for Implementation Research to plan, execute, and evaluate the associated implementation processes.

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
Potential responses to the Patient Health Questionnaire (PHQ)-9 item about suicidal ideation	The study made support available for any patients who may report having suicidal thoughts.
Change in study design due to patient stakeholder input	The study team consulted with the NIH Collaboratory's Biostatistics and Study Design Core Working Group to come up with new design and power considerations.

"If we can better manage pain, we can impact the quality of life and change the possibilities for patients with sickle cell disease. They can have a plan for activities and have a more productive work situation. Pain management can change so many things in their lives." — Dr. Ardith Doorenbos

"I think we will get the most realistic findings of how these therapeutic interventions work, whereas in more classic trials they're going to end up with such a group of selected patients that it may not be as generalizable as a pragmatic clinical trial." — Dr. Robert Molokie

PRESENTATIONS & ABSTRACTS

- Article: Acupuncture for Chronic Pain in Adults With Sickle Cell Disease: A Mixed-Methods Pilot Study (2021)
- Video Interview: GRACE Trial Seeks More Options for Sickle Cell Pain (2021)
- Presentation: Presentation to the NIH Collaboratory Steering Committee (2021)
- Article (Study Design): Hybrid Effectiveness-Implementation Trial of Guided Relaxation and Acupuncture for Chronic Sickle Cell Disease Pain (GRACE): A Protocol (2023)
- Article: Monitoring and Responding to Signals of Suicidal Ideation in Pragmatic Clinical Trials: Lessons From the GRACE Trial for Chronic Sickle Cell Disease Pain (2023)
- Article: Developing an Implementation Blueprint for the NIH HEAL Initiative GRACE Trial: Perspectives on Acupuncture and Guided Relaxation for Chronic Sickle Cell Disease Pain
- Article: Barriers and Facilitators to Integrating Acupuncture Into the U.S. Health Care System: A Scoping Review
- Article: Pre-implementation Barriers and Facilitators to Integrating Complementary and Integrative Health Interventions Into Clinic Workflow: The GRACE Trial, NIH Pragmatic Trials Collaboratory

NIH PRAGMATIC TRIALS COLLABORATORY
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I CAN DO SURGICAL ACP

Improving Completion, Accuracy, and Dissemination of Surgical Advanced Care Planning (I CAN DO Surgical ACP)

Principal Investigators
Elizabeth Wick, MD; Genevieve Melton-Meaux, MD, PhD; Rebecca Sudore, MD

Sponsoring Institution
University of California, San Francisco

Collaborators
- University of California, San Francisco
- University of California, Irvine
- University of Minnesota (clinical site of M Health Fairview, a collaboration of the University of Minnesota Medical School, University of Minnesota Physicians, and Fairview Health Services)

NIH Institute Providing Funding or Oversight
National Institute on Aging (NIA)

Program Official
Barbara Radziszewska, PHD, MPH (NIA)

Project Scientist
Marcel Salive, MD, MPH (NIA)

ClinicalTrials.gov Identifier
NCT06090552

ABSTRACT

Nearly 20 million older adults in the United States undergo major elective surgical procedures, yet a small proportion receive advance care planning (ACP). There are few examples of effective integration of ACP into the presurgical phase, despite ACP being included in national quality metrics and society guidelines for surgical care of older adults. Most efforts have focused on improving surgeons' use of ACP, but the barriers are significant, including varying levels of familiarity and comfort with conducting ACP conversations, lack of dedicated time during the presurgical care episode for these often delicate conversations, and lack of appropriate patient-facing ACP tools to help patients and caregivers make complex decisions about surgical treatment. To overcome these barriers, researchers created and tested PREPARE For Your Care (PREPARE), a patient-facing, interactive, online program that prepares people for complex medical decision-making and communication. PREPARE increases ACP engagement and patient and clinician empowerment to discuss ACP, but its use has not been extended to presurgical settings, where time and resources to conduct ACP are limited. The I CAN DO Surgical ACP trial will test 3 strategies of delivering PREPARE to presurgical populations in 3 large healthcare systems. The study will randomly assign patients aged 65 years or older, or with serious illness, who have been referred for major elective surgery to 1 of 3 study arms. Arm 1 will include a letter about ACP, the PREPARE advance directive, and access to the PREPARE website. Arm 2 will include the elements of Arm 1, plus reminder text messages or phone calls. Arm 3 will include the elements of Arms 1 and 2, plus a healthcare navigator to assist with ACP documentation and patient engagement. Using mixed methods, the study team will assess patients' and surgical care teams' experience with surgery ACP. In a qualitative component of the trial, the study team will use natural language processing and data mining to evaluate the content of ACP notes and assess their thematic completeness. The study team hypothesizes that incorporating PREPARE into the electronic health record–based presurgical workflow for older adults and adding automated reminders will empower patients and surgical teams to engage in ACP discussions.

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
Ensuring that the intervention is tailored to diverse languages in each healthcare system	Translating materials into the 5 most common languages at each site; and seeking to identify a bilingual healthcare navigator at each site
Unique, preexisting healthcare system workflows related to ACP	Allowing flexibility in documentation at 1 site in a healthcare system with less ACP functionality in the EHR, and documenting the site's ACP process metrics in a parallel REDCap database at the site

"The biggest challenge of our study has been working in 3 healthcare systems with an intervention based on the EHR. Each EHR is a little different, and the teams are structured differently and report differently. Things that seem simple can't necessarily be mirrored from healthcare system to healthcare system. So it's been amazing to see what our site PIs have enabled at our sites to get us where we are." — Dr. Elizabeth Wick

SELECTED PUBLICATIONS & PRESENTATIONS

- Presentation: NIH Pragmatic Trials Collaboratory Onboarding Meeting (2023)
- Video Interview: I CAN DO Surgical ACP Seeks to Open the Door to Team-Based Surgical Care (2024)
- Article (Study Design): I CAN DO Surgical ACP (Improving Completion, Accuracy and Dissemination of Surgical Advanced Care Planning): A Protocol for a Multisite, Single-Blinded, Pragmatic Randomised Controlled Trial to Improve ACP Completion in Older Adults in the Presurgical Setting

See the complete set of I CAN DO Surgical ACP resources.

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

IMPACt LBP
LOW BACK PAIN

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

Principal Investigators
Christine Goertz, DC, PhD; Adam Goode, PT, DPT, PhD; Jon Lurie, MD, MS; Hrishikesh Chakraborty, DrPH

Sponsoring Institution
Duke University

Collaborators
- Dartmouth-Hitchcock Medical Center
- Duke University Health System
- University of Iowa

NIH Institute Providing Oversight
National Center for Complementary and Integrative Health (NCCIH)

Program Official
Peter Murray, PhD (NCCIH)

ClinicalTrials.gov Identifier
NCT05626049

ABSTRACT

Low back pain is the leading musculoskeletal pain condition and a key source of medical costs and disability. An estimated 20% of adults in the United States have low back pain; 50% to 80% report having a significant episode in their lifetime, and 23% experience disabling pain. Low back pain affects more than 31 million people in the United States at any given time, has increased threefold in prevalence in a 10-year period, and results in $100 billion to $200 billion per year in total healthcare costs. Low back pain is one of the leading causes of ambulatory care visits to physicians. These visits often result in treatments such as opioids that can lead to more harm than benefit. In 2017, the American College of Physicians (ACP) guideline for low back pain recommended patients receive nonpharmacological interventions as a first-line treatment.

One solution that has been described in the literature but not yet tested is the primary spine practitioner (PSP) model. The PSP model involves multidisciplinary collaborative care that includes doctors of chiropractic and physical therapists—clinicians who have specific expertise in the treatment of musculoskeletal conditions—as first-line providers for low back pain. These clinicians routinely employ many of the nonpharmacological approaches recommended by the ACP guideline, including spinal manipulation and exercise.

IMPACt-LBP is a pragmatic, multisite, 2-arm cluster randomized trial that will evaluate the effect of first-contact patient referral to physical therapists and doctors of chiropractic. This study aims to determine if initial contact with these PSP clinicians will improve physical function, decrease pain, decrease opioid prescriptions, improve patient satisfaction, and decrease costs and utilization of health care services in patients with a primary complaint of low back pain, when compared with usual medical care.

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
Several critical data elements, including patient-reported outcomes (PROs) and external PSP care, are not routinely captured within healthcare system electronic health records (EHRs).	The study team considered several alternative data collection strategies, ultimately opting to use electronic PRO survey data as the source of information about external PSP visits. Future study teams should carefully consider the availability of the data points of interest within the EHR; specifically, collaborate closely with each site, generate metrics for data availability for the population of interest, and engage in a realistic consideration of how that might or might not be extended.
The PROs used for this study (ie, PROMIS) are common but are not routinely captured in the EHRs used by the study's participating healthcare systems.	The study team developed a data capture system in REDcap to collect these measures, with use of the EHR as a backup source. The Cores helped greatly with the selection of secondary outcome measures. The study team sought consultation on outcome harmonization and participant burden. Future study teams should evaluate current PRO instruments within the EHR and, if possible, completion compliance rates. Consider a primary or backup data capture system for primary outcomes.

"We proactively worked with existing systems to design the protocol to fit into existing clinical workflows and avoid barriers. The study plan and protocol has been well received. However, we are not surprised that barriers did not appear during the planning phase, and we anticipate that new barriers will emerge as we move into implementation." — Dr. Christine Goertz

"Our original plan was to seek a full waiver of consent. However, after review with the Ethics and Regulatory Core, we shifted to a waiver of documentation of consent for data collection and a waiver of consent for deidentified EHR data extraction. These were approved without issue by the central IRB. 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." — Dr. Christine Goertz

SELECTED PUBLICATIONS & PRESENTATIONS

- Video Interview: Update on the IMPACt-LBP Demonstration Project (2022)
- Presentation: Presentation to the NIH Pragmatic Trials Collaboratory Steering Committee (2023)
- PCT Grand Rounds Presentation: Implementing New Care Pathways for Low Back Pain in Academic Healthcare Systems: Early Lessons from IMPACt-LBP (2023)
- Article (Study Design): Implementation of the American College of Physicians Guideline for Low Back Pain (IMPACt-LBP): Protocol for a Healthcare Systems Embedded Multisite Pragmatic Cluster-Randomised Trial (2025)

Access the complete set of IMPACt-LBP resources.

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

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

Principal Investigators
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Sponsoring Institution
University of Utah

Collaborators
- Community health centers in Utah
- Association for Utah Community Health

NIH Institute Providing Oversight
National Cancer Institute (NCI)

Program Official
Sallie J. Weaver, PhD, MHS (NCI)

Project Scientist
Paul Han, MD, MA, MPH (NCI)

ABSTRACT

Annual lung cancer screening by low-dose computed tomography is recommended by the US Preventive Services Task Force. Despite evidence of effectiveness and the USPSTF recommendations, implementation of lung cancer screening in clinical practice has been exceedingly limited, with only 6.5% of eligible individuals screened in 2020, and there are significant disparities in screening related to race/ethnicity and socioeconomic status. The LungSMART study team plans to conduct a 2-phase trial with a sequential, multiple assignment, randomized trial (SMART) design in community health centers in Utah. Utah has 14 community health center systems with approximately 50 primary care clinics. Each of the Utah community health centers is a federally qualified health center providing comprehensive primary care to more than 160,000 patients annually. Patients in Utah community health centers are 52% Latino, 8% Native American, 40% best served in a language other than English, 55% below the federal poverty level, and 43% uninsured, and 41% of the clinics are in rural areas. Phase 1 of LungSMART will compare a variety of text messaging strategies to increase patients' completion of an eligibility assessment for lung cancer screening. Phase 2 of LungSMART will test telehealth interventions designed to address logistical barriers and hesitancy around completing lung cancer screening among referred patients. LungSMART leverages smartphone/internet technologies when available, and also supports patients whose only telehealth connectivity is a cellphone. A centralized "hub" enables eligibility assessment, shared decision-making with clinical decision support, screening referral, and screening logistics assistance at scale to address numerous social determinants of health that affect low-resource settings and historically marginalized populations. All study procedures and interventions will be conducted in English or Spanish based on the patient's preferred language. In sum, LungSMART will be conducted in a real-world context across multiple independent healthcare delivery systems and will provide a critical evidence base for the large-scale implementation of interventions designed to reduce disparities in lung cancer screening in community health centers and other low-resource settings nationwide.

SELECTED PUBLICATIONS & PRESENTATIONS

- Presentation: NIH Collaboratory Onboarding Presentation (2024)

See the complete set of LungSMART resources.

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Maternal OutcoMes (MOMs) Program: Testing Integrated Maternal Care Model Approaches to Reduce Risk of Severe Maternal Morbidity (MOMs Chat & Care Study)

Principal Investigator
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Program Official
Nadra Tyus, DrPH, MPH (NINR)

Sponsoring Institution
Feinstein Institutes for Medical Research at Northwell Health

ClinicalTrials.gov Identifier
NCT06335381

NIH Institute Providing Funding or Oversight
National Institute of Nursing Research (NINR)

ABSTRACT

There is a maternal health crisis in the United States that disproportionately affects Black women. Black women are twice as likely to experience severe maternal morbidity—"unexpected outcomes of labor and delivery that result in significant short- or long-term consequences to a birthing person's health"—than non-Hispanic White women. Preventing preeclampsia, increasing or maintaining engagement in healthy behaviors such as physical activity, and addressing health-related social needs can enhance receipt of timely, appropriate care and reduce risk for severe maternal morbidity. The Maternal OutcoMes (MOMs) Program at Northwell Health is an effective integrated care approach that identifies and supports high-risk patients immediately after delivery. In preliminary analysis of data from 2500 participants, the program significantly reduced risk for severe maternal morbidity–related hospital admissions at 30 days by 77% among Black participants. These preliminary findings are promising, but the long-term effectiveness of the program and the feasibility and effectiveness of extending it to the prenatal period have yet to be established. The purpose of MOMs Chat & Care Study is to test the effectiveness of the MOMs approach at 2 levels of intensity designed to facilitate timely, appropriate care to reduce risk for severe maternal morbidity. The research team will identify Black and Hispanic pregnant patients with an Obstetrics Comorbidity Index score of 2 or greater and/or a history of preeclampsia in the electronic health record, and they will randomly assign 674 patients to 1 of 2 study arms: MOMs High-Touch or MOMs Low-Touch. MOMs High-Touch will consist of close clinical and behavioral health monitoring via chatbot technology and navigation to timely care and services throughout the prenatal and postpartum periods; 12 biweekly self-management support calls during the prenatal period; and 5 biweekly postpartum clinical check-in calls with navigation by the MOMs team up to 6 weeks postpartum. MOMs Low-Touch will also include clinical and behavioral health monitoring via the chatbot along with navigation to services by the MOMs team as needed and 5 biweekly postpartum clinical check-in calls with navigation. The study arms will be compared on the incidence of severe maternal morbidity at labor and delivery, the incidence of severe maternal morbidity–related hospitalizations at 1 month and 1 year postpartum, time to preeclampsia diagnosis and initiation of treatment, change in perceived social support domains, and physical activity trajectories. Findings from the MOMs Chat & Care Study will help to determine how to feasibly implement an effective and sustainable integrated care approach to reduce risk for severe maternal morbidity.

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
Recruitment	Working closely with the healthcare system, consulting the literature, and speaking with other maternal health researchers to get recommendations on how to improve recruitment/enrollment

"Communicate with your partners, advisers, key informants, community members, patients, and community organizations early on. This work involves close partnerships and trust. It is a lot easier when you have taken the time to engage with your partners, to understand what their pain points are, and to understand the ways there can be bidirectional benefit and relationships." — Dr. Stephanie Fitzpatrick

SELECTED PUBLICATIONS & PRESENTATIONS

- Video Interview: MOMs Chat & Care Study Aims to Address Crisis of Black Maternal Morbidity (2024)
- Article (Study Design): MOMs Chat & Care Study: Rationale and Design of a Pragmatic Randomized Clinical Trial to Prevent Severe Maternal Morbidity Among Black Birthing People

See the complete set of MOMs Chat & Care Study resources.

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

Nonpharmacologic Options in Postoperative Hospital-Based and Rehabilitation Pain Management (NOHARM)

Principal Investigators
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Sponsoring Institution
Mayo Clinic Rochester, MN

Collaborators
- Mayo Clinic Rochester
- Mayo Clinic Florida
- Mayo Clinic Arizona
- Mayo Clinic Upper Midwest Health System

NIH Institute Providing Oversight
National Institute on Aging (NIA)

Program Official
Marcel Salive, MD (NIA)

Project Scientist
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ClinicalTrials.gov Identifier
NCT04570371

ABSTRACT

Prescriptions for narcotic pain relief after surgery result in unintended prolonged opioid use for hundreds of thousands of Americans. That trend fuels an excess supply of opioids that can lead to dependence, addiction, diversion, and overdoses on a national scale. Nonpharmacologic pain care is effective and recommended by guidelines for perioperative pain while offering a more favorable risk-benefit ratio. However, nonpharmacologic pain care is rarely used as first- or second-line therapy after surgery. Patient and clinician decision support interventions are effective in encouraging patient-centered and guideline-concordant care, but these strategies have not been tested pragmatically as a bundle in everyday postoperative pain care.

The NOHARM trial will test an EHR-embedded, bundled intervention comprised of patient- and clinician-facing decision support components that enable patients to integrate nonpharmacologic pain care into their perioperative management. NOHARM will employ a stepped-wedge, cluster randomized pragmatic clinical trial design. Clusters throughout the Mayo Clinic Enterprise spanning 6 institutions in 4 states will participate. The NOHARM trial will evaluate whether pain and function, assessed with PROMIS tools, can be improved while honoring patient values and deemphasizing opioids in pain management.

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
Accurately identifying and assigning the intervention to eligible patients within the electronic health record (EHR) in an automated way	The study implemented appropriate ordering, referring, and prescribing (ORP) codes for automatic assignment.
Helping clinic staff know which patients are enrolled in the NOHARM trial	The study added a banner in the Epic system to help clinical teams easily identify NOHARM patients.
Identifying and accounting for the number and variability of clusters based on size, geography, and median pain burden of the patient population	The team worked with the Biostatistics and Study Design Core to plan a "constrained randomization" design, which will help with managing varied cluster sizes, geographic locations, and practice volumes as part of the stepped-wedge, cluster randomized trial.
Modifying the primary outcome measure due to incomplete ascertainment	The team determined that pain interference and physical function measures would be co-primary endpoints at 1, 2, and 3 months.

"We are excited to bring our novel use of the EHR as a critical and central intervention component and to bring that approach to the Collaboratory so we can both teach and learn."

SELECTED PUBLICATIONS & PRESENTATIONS

- Presentation: Presentation to the NIH Pragmatic Trials Collaboratory Steering Committee (2023)
- Article (Study Design): Non-pharmacological Options in Postoperative Hospital-Based and Rehabilitation Pain Management (NOHARM): Protocol for a Stepped-Wedge Cluster-Randomized Pragmatic Clinical Trial (2022)
- Article: Patients' Peri-Operative Experiences With Non-Pharmacologic Pain Care Techniques: A Secondary Qualitative Analysis of the NOHARM Trial (2025)
- PCT Grand Rounds Presentation: Learning While Sprinting: A One-Year Retrospective from the NOHARM Pragmatic Trial (2020)

Access the complete set of NOHARM resources.

NIH PRAGMATIC TRIALS COLLABORATORY
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Optimum
Optimizing Pain Treatment in Medical Settings Using Mindfulness

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

Principal Investigator
Natalia Morone, MD, MS

Sponsoring Institution
Boston Medical Center

Collaborators
- Boston Medical Center
- University of Pittsburgh Medical Center
- Piedmont Health Services, in partnership with the University of North Carolina at Chapel Hill

NIH Institute Providing Oversight
National Center for Complementary and Integrative Health (NCCIH)

Program Official
Beda Jean-Francois, PhD (NCCIH)

Project Scientist
Luke Stoeckel, PhD (National Institute on Aging)

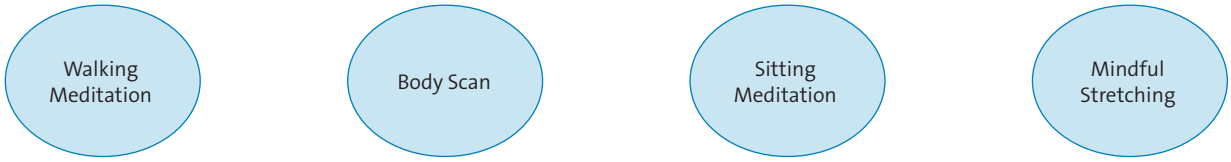
ClinicalTrials.gov Identifier
NCT04129450

ABSTRACT

Chronic low back pain is one of the most common conditions treated in primary care settings, yet treatment remains unsatisfactory for many patients. The opioid crisis has underscored the urgency of alleviating patients' chronic low back pain with effective therapies, including evidence-based nonpharmacologic approaches. Mindfulness is effective for the treatment of chronic low back pain but remains underutilized as it has not been regularly integrated into the outpatient clinical setting.

Mindfulness-based stress reduction is now recommended by the American College of Physicians for initial treatment of chronic low back pain. The primary goal of OPTIMUM is to determine the impact of a group-based mindfulness intervention under usual care circumstances. The implementation phase will integrate mindfulness-based stress reduction, delivered online, in a primary care setting with 450 patients 18 years of age or older who have chronic low back pain, comparing mindfulness plus usual care versus usual care alone. Among the hypotheses are that, compared with usual care, patients receiving the intervention will have improved pain intensity, pain interference, and improved psychological function at the completion of the program and at 6 and 12 months, and that patients will be less likely to start and more likely to reduce or stop an opioid prescription for chronic low back pain compared with those receiving usual care. Another aim of the trial is to evaluate the use of, satisfaction with, and integration of this innovative intervention delivered in a real-world setting.

Program principles: Four methods of mindfulness meditation



Program protocol: Use evidence-based protocol from large clinical trial of mindfulness-based stress reduction for chronic low back pain

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
The global COVID-19 pandemic thrust remote healthcare into the spotlight. Delivering the mindfulness intervention remotely (via Zoom) was challenging because of potential technical difficulties, mostly related to unstable network connections and familiarizing participants with Zoom.	A dedicated team provided technical support throughout the pilot intervention. The team decided to call participants in advance to help minimize the likelihood of technical problems during each session. This solution allowed the team to troubleshoot internet issues.
With a new way of delivering mindfulness, there were challenges in keeping the participants actively participating and engaged during the sessions.	The mindfulness instructors worked efficiently to create interactions that encouraged session completion. The technical support helped make this possible by assuring good visibility, among other elements, between the instructors and the participants.
Asking participants to attend and commit to multiple remote sessions for a period of time added a layer of complexity to the overall scheduling challenge.	The study team created spreadsheets to track patients' availability and determine the best day and time to deliver the mindfulness intervention. Conducting sessions in the late afternoon or early evening was the most feasible solution across sites.

"We need to demonstrate to patients, clinicians, and administrators how mindfulness can be woven into primary care and what the results are when delivered in a real-world setting."

SELECTED PUBLICATIONS & PRESENTATIONS

- Article (Study Design): The Design and Methods of the OPTIMUM Study: A Multisite Pragmatic Randomized Clinical Trial of a Telehealth Group Mindfulness Program for Persons With Chronic Low Back Pain (2021)
- Presentation: Presentation to the NIH Pragmatic Trials Collaboratory Steering Committee (2023)
- Article: Characterizing Interprofessional Collaboration and Referral to Mindfulness-Based Stress Reduction Programs (2022)
- Article: The Hidden Complexity of Virtual Mindfulness–Based Group Medical Visits: Comfort, Challenge, and the Influence of Social Determinants of Health (2025)

Access the complete set of OPTIMUM resources.

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

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

Principal Investigators
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Sponsoring Institution
Center for Veterans Research and Education

Collaborators
- Minneapolis VA Health Care System
- University of Minnesota
- University of Iowa

NIH Institute Providing Funding or Oversight
National Institute of Nursing Research (NINR)

Program Official
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Project Scientist
Nana Martinson, MPH (National Center for Complementary and Integrative Health [NCCIH])

ClinicalTrials.gov Identifier
NCT06568250

ABSTRACT

The Veterans Administration (VA) has become a leader in complementary and integrative health through its Whole Health initiative. Yet there remain many barriers, especially for patients with pain in rural communities. The RAMP trial aims to overcome these barriers. The study team is working with partners in the community and the VA, including rural patients, to develop an innovative, evidence-based telehealth intervention, the RAMP program, that brings together multiple evidence-based complementary and integrative health self-management strategies to address rural veterans' biophysical, psychological, and social needs. The RAMP program consists of 9 weekly group sessions, which include prerecorded, expert-led education videos, mind-body skills training and practice, and group discussions led by a trained facilitator. Program content covers pain education, mindfulness, pain-specific exercises, and cognitive behavioral strategies. In the trial's planning phase, the study team identified and developed new community partnerships and used mixed-methods data collection from patients, community partners, and VA healthcare system leaders and staff, guided by the RE-AIM/PRISM framework, to understand key factors that may affect long-term adoption of the intervention. A pilot study with 40 rural VA patients with chronic pain assessed the feasibility of delivering the RAMP program in terms of recruitment and engagement, intervention fidelity and adherence, data collection, and other metrics. The pilot also assessed the extent to which the program met veterans' pain self-management needs, as well as areas for refinement and optimization. Pilot results demonstrated that RAMP is feasible and acceptable to rural veterans with chronic pain and helped identify optimization strategies to enhance future program engagement. In the trial's implementation phase, the study team will conduct a randomized, multicenter, hybrid type 2 effectiveness-implementation pragmatic clinical trial of the RAMP program vs usual care among 500 rural patients in the VA healthcare system. The primary effectiveness outcome is pain interference at 3 and 6 months. Secondary outcomes include opioid use and the NIH HEAL Initiative's core pain domains. The study team will continue to work with patient, community, and healthcare system partners identified during the planning phase to evaluate the implementation strategies used in the trial and adapt these strategies to scale up RAMP within the VA healthcare system. This will include mixed-methods assessments of research partners' and trial participants' views of implementation-related barriers and facilitators, resource needs, and other domains; co-creation of additional plausible strategies for overcoming implementation barriers; and budget impact analyses using models informed by research partners' views to inform future decision-making.

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
Developing relationships with representatives of community organizations on a short, grant-driven timeline	Leveraged networks of existing collaborators, such as veteran patient experts, who were able to facilitate contacts between the study team and community partners
Administrative challenges, including loss of the lead facilitator, VA hiring challenges associated with a new national human resources process, and a federal government shutdown	Working with study partners at the University of Minnesota to hire in positions that do not need access to VA data
Projected cuts in the VA workforce, which may affect future implementation	Address the topic in upcoming stakeholder interviewers with VA leadership and staff

"The big goal is to alleviate suffering for people with chronic pain and to get more tools and resources to rural-dwelling veterans. This is a population that is particularly vulnerable to not having access to pain self-management and complementary and integrative health approaches, and they are at higher risk for potentially risky prescribing around chronic pain." — Dr. Katherine Hadlandsmyth

"Develop strong relationships with your healthcare system partners early. We were fortunate to have longstanding relationships with our healthcare system partners, and we've been working closely with them to understand how we can develop an intervention that is really meaningful to them." — Dr. Diana Burgess

"Really listen to the people you're trying to affect—the patients. We've benefited from previous studies where we collected qualitative data that informed what we're doing now. So listen, but listen in a systematic way. Qualitative research is a great way to do that." — Dr. Roni Evans

SELECTED PUBLICATIONS & PRESENTATIONS

- Presentation: NIH Pragmatic Trials Collaboratory Onboarding Meeting (2023)
- Video Interview: NIH HEAL Initiative Turns Attention to Pragmatic Trials in Rural Communities (2024)
- Article: Reaching Rural Veterans: Applying Mind-Body Skills for Pain Using a Whole Health Telehealth Intervention: The RAMP PIlot Study (2025)

See the complete set of RAMP resources.

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

Self-Testing for Cervical Cancer in Priority Populations (The STEP-2 Trial)

Principal Investigators
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Sponsoring Institution
University of Washington

NIH Institute Providing Oversight
National Cancer Institute (NCI)

Program Official
Veronica Chollette, RN, MS (NCI)

Project Scientist
Aubrey Villalobos, DrPH, MEd (NCI)

Collaborators
- University of Chicago
- Kaiser Permanente Northwest Center for Health Research
- Kaiser Permanente Washington Health Research Institute
- Virginia Garcia Memorial Health Center (Oregon)
- Healthpoint Community Health Center (Washington)
- CareOregon
- Molina Healthcare
- Community Health Plan of Washington

ABSTRACT

The 29.3 million patients receiving care in US federally qualified health centers (FQHCs) have much lower cervical cancer screening rates than national averages. Self-sampling for human papillomavirus (HPV) is an evidence-based cervical cancer screening method with high potential to reduce screening barriers. Self-sampling kits can be distributed at clinics or mailed to patients' homes. The STEP-2 trial aims to leverage FQHC-Medicaid partnerships to adapt and evaluate 2 programs to integrate HPV self-sampling into FQHCs. In the planning phase, the study team will use community-engaged research and stakeholder input to adapt and pilot test 2 multilevel interventions in 2 FQHCs for distributing HPV self-sampling kits: in-clinic distribution and in-clinic plus mailed distribution. In the implementaiton phase, the study team will conduct a cluster randomized pragmatic trial in 42 FQHC clinics in Oregon and Washington to evaluate the comparative effectiveness and cost-effectiveness of the interventions. The mailed component will be administered by 3 Medicaid health plans. The primary outcome is the proportion of eligible patients who complete screening. The 2 primary comparisons will be usual care vs in-clinic distribution and in-clinic distribution vs in-clinic plus mail distribution. To minimize bias, each comparison will include distinct but overlapping patient populations. A cost-effectiveness analysis will compare in-clinic distribution vs usual care and in-clinic plus mail distribution vs in-clinic distribution alone. The study team will use the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework and the Practical Implementation Sustainability Model (PRISM) to evaluate the implementation strategies through mixed methods. The STEP-2 trial will be the first in the United States to determine the effectiveness and cost-effectiveness of HPV self-sampling for increasing cervical cancer screening in FQHC settings. Results of the study will inform broad-scale implementation of HPV self-sampling across FQHCs and other safety net clinics in the United States to reduce disparities in cervical cancer screening.

SELECTED PUBLICATIONS & PRESENTATIONS

- Presentation: NIH Collaboratory Onboarding Presentation (2025)

See the complete set of STEP-2 resources.

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

Remote Tai Chi for Knee Osteoarthritis: An Embedded Pragmatic Trial (TAICHIKNEE)

Principal Investigators
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Sponsoring Institution
Tufts Medicine/Tufts Medical Center

Collaborators
- Boston Medical Center
- UCLA Health
- Cleveland Clinic Ohio
- Cleveland Clinic Florida

NIH Institutes Providing Funding or Oversight
National Center for Complementary and Integrative Health (NCCIH)

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Project Scientists
Lanay Mudd, PhD (NCCIH); Qilu Yu, PhD (NCCIH)

ClinicalTrials.gov Identifier
NCT06384898

ABSTRACT

Symptomatic knee osteoarthritis affects more than 33 million people in the United States and is a leading cause of disability and growing medical costs. There is a critical shortage of treatment options for people with knee osteoarthritis, especially because comorbid conditions that complicate treatment selection are highly prevalent in this older adult population. Tai chi, a multidimensional practice that integrates physical, psychosocial, and behavioral components, provides clinically significant improvements in chronic knee osteoarthritis pain. The American College of Rheumatology clinical practice guidelines strongly recommend tai chi as an intervention for knee osteoarthritis. Recent studies conducted during the pandemic suggest that remotely delivered tai chi is a promising and scalable strategy for knee osteoarthritis pain. However, critical gaps remain as to the real-world effectiveness of remotely delivered tai chi for knee osteoarthritis and its implementation across multiple healthcare systems. TAICHIKNEE is an embedded, pragmatic, randomized trial comparing the effects of a 3-month, twice-weekly, remotely delivered, web-based tai chi intervention vs routine care across 5 healthcare systems in 6 geographic regions. The trial will enroll 480 patients who have a clinical diagnosis of knee osteoarthritis. Participants will be evaluated at baseline and 3 months, with additional follow-up at 6 and 12 months. The researchers hypothesize that implementation of remotely delivered tai chi is feasible across the 5 healthcare systems and that tai chi, compared with routine care, will improve physical health (including knee pain and function), mental health, and healthcare utilization. TAICHIKNEE is the first rigorous multisite, embedded, pragmatic trial of a remotely delivered tai chi mind-body program in multiple healthcare systems using web-based technology and designed to improve patient-centered outcomes of knee osteoarthritis. The results of the trial will inform widespread adoption of mind-body approaches for knee osteoarthritis across healthcare systems and lay the groundwork for future trials comparing the effectiveness of different implementation strategies.

WHAT WE'VE LEARNED SO FAR

Challenge	Solution
Although tai chi is widely recognized, many clinicians and patients have limited experience practicing or recommending it.	The team created brief instructional videos and plain-language educational materials to increase understanding and acceptance of tai chi as a therapeutic option for knee osteoarthritis.
Establishing a centralized IRB for multisite planning-phase interviews was complex.	In consultation with the Coordinating Center and program officer, each site used its own IRB during the UG3 planning phase, streamlining approvals and avoiding delays.
Ensuring adequate representation in UG3 planning-phase interviews and engagement activities	The study team monitored participant sociodemographic characteristics midway through the interview process and adjusted recruitment strategies to improve representation of populations reflective of the target patient population. Similar monitoring will occur during trial recruitment, with attention to reaching participants across participating healthcare systems with varying sociodemographic characteristics.
Ensuring timely recruitment across 5 healthcare systems while accounting for site-specific workflows and competing clinical demands	The study team established clear site-specific recruitment targets and expectations, implemented standardized training for recruitment procedures, and conducted centralized remote monitoring of enrollment metrics. Regular progress reviews and targeted outreach to sites requiring additional support helped maintain enrollment efficiency across all systems.
Maintaining consistent intervention delivery and participant engagement during the trial	The study team leveraged the decentralized design by implementing standardized intervention protocols, providing cross-site training, and conducting ongoing remote fidelity monitoring. Regular progress tracking and targeted outreach support consistent intervention delivery, maintained intervention fidelity, and sustained participant engagement across all sites.

"An impact we hope to see from our trial is that tai chi moves into healthcare systems. Tai chi is usually available in the community and in-person, group-based classes, and we're moving it into the healthcare system and making it remote or video-based. We hope that makes it easier for healthcare systems to deliver it as an intervention." — Dr. Eric Roseen

"A key recommendation for investigators is to adopt comprehensive outcome measures. For this study, we want to see if tai chi can impact knee function and pain specifically, as well as improve patients' overall health. We are also including a pain interference measure to evaluate impacts on physical, emotional, and quality-of-life outcomes, as well as socioeconomic factors." — Dr. Chenchen Wang

SELECTED PUBLICATIONS & PRESENTATIONS

- Presentation: NIH Pragmatic Trials Collaboratory Onboarding Meeting (2023)
- Video Interview: Update on the TAICHIKNEE Trial (2024)

See the complete set of TAICHIKNEE resources.

TRIAL OUTCOMES

JAMA Network Open

Original Investigation | Public Health

Sequenced Care Pathway vs Pain Navigator Pathway for Veterans With Low Back Pain

The AIM-Back Cluster Randomized Clinical Trial

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Abstract

IMPORTANCE Low back pain (LBP) is a leading cause of disability, and there is limited evidence from clinical practice to support the effectiveness of alternative care models.

OBJECTIVE To compare a sequenced care pathway (SCP) with a pain navigator pathway (PNP) for patients with LBP.

DESIGN, SETTING, AND PARTICIPANTS In this embedded cluster randomized clinical trial, 19 primary care clinics in the Veterans Health Administration were randomized to deliver 1 of 2 multimodal guideline-supported care pathways, with primary outcomes assessed in their electronic health records (EHRs) at 3 months. Between February 8, 2021 (first enrolled), and January 31, 2024 (last enrolled), 1817 participants were referred by primary care clinicians and attended an initial AIM-Back trial visit. A subset of 799 participants consented to complete additional questionnaires for secondary analyses (March 8, 2021 [first survey collected], to January 10, 2025 [final secondary outcome collected by survey]).

INTERVENTIONS The SCP included pain education and modulation, physical activity coaching, risk stratification, and psychologically informed physical therapy. The PNP included shared decision-making and facilitated referrals to nondrug treatments.

MAIN OUTCOMES AND MEASURES Pain interference and physical function were coprimary outcomes, assessed with the Patient-Reported Outcomes Measurement Information Systems 4-item Short Forms (PROMIS-SF; potential score range for pain interference, 41.6-75.6, where lower scores indicated less interference with daily activities due to pain; and potential score range for physical function, 22.5-57.0, where higher scores indicated higher physical functioning during daily activities). Secondary EHR outcomes included sleep disturbance and National Institutes of Health pain intensity, and survey outcomes included the coprimary outcomes and additional measures of pain, function, and quality of life. Analysis was performed in the intent-to-treat population.

RESULTS There were 1817 enrolled participants (SCP, 811; PNP, 1006; mean [SD] age, 53.0 [15.7] years; 1597 men [87.9%]). At 3 months, 461 of 811 patients (56.8%) in the SCP group and 537 of 1006 (53.4%) in the PNP group had analyzable primary outcomes. The estimated baseline mean PROMIS-SF score was 63.2 points (97.5% CI, 62.7-63.6 points) for pain interference and 37.1 points (97.5% CI, 36.7-37.4 points) for physical function. The 3-month mean PROMIS-SF score for pain interference was 60.5 points (97.5% CI, 59.7-61.3 points) in the SCP group and 61.1 points (97.5% CI, 60.4-61.8 points) in the PNP group. The 3-month mean PROMIS-SF score for physical function was 39.1 points (97.5% CI, 38.4-39.7 points) in the SCP group and 38.5 points (97.5% CI, 37.8-39.1 points)

(continued)

Key Points

Question Is a sequenced care pathway superior to a pain navigation care pathway for improving pain interference and physical function outcomes for individuals seeking primary care for low back pain?

Findings In this cluster randomized clinical trial investigating the effectiveness of different nondrug care pathways in 1817 participants, the 3-month differences in improvements (sequenced care vs navigated care) in pain interference (−0.6 points) and physical function (0.6 points) were not statistically significant.

Meaning This trial suggests no advantage of a sequenced care pathway vs a care pathway that navigates individuals with low back pain to commonly used nondrug treatments (eg, physical therapy, yoga, tai chi, chiropractic, or acupuncture).

+ Visual Abstract

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

Abstract (continued)

in the PNP group. There was no SCP superiority, with estimated 3-month differences of −0.6 points (97.5% CI, −1.6 to 0.4 points) for pain interference and 0.6 points (97.5% CI, −0.3 to 1.5 points) for physical function. There were no pathway differences in secondary outcomes.

CONCLUSION AND RELEVANCE In this cluster randomized trial, the SCP was not superior for the primary outcomes of pain interference and physical function. Future research should consider designs that optimize pathway adherence, assess the effectiveness in other settings, and investigate patient-level factors indicative of a favorable response to the SCP or PNP.

TRIAL REGISTRATION ClinicalTrials.gov Identifier: NCT04411420

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Introduction

Globally, the individual and societal burden of chronic low back pain (LBP) is substantial, and reducing this burden is a top health care priority.[1,2] Specific to the Improving Veteran Access to Integrated Management of Back Pain (AIM-Back) trial, chronic LBP is a leading cause of disability among US veterans. Nondrug treatments for acute and chronic LBP have been endorsed by multiple entities, including the Centers for Disease Control and Prevention,[3] National Academy of Medicine,[4] and World Health Organization.[5] Although these practice guidelines support nondrug treatment of LBP, there remains an urgent need for effectiveness studies.[6]

Collectively, these factors motivated the AIM-Back trial,[7] conducted as part of the US Department of Veterans Affairs–US Department of Defense–National Institutes of Health (NIH) Pain Management Collaboratory.[8] AIM-Back differentiated itself from existing clinical trials included in a 2025 Cochrane Review by investigating the effectiveness of 2 alternate care models: a sequenced care pathway (SCP) and a pain navigator pathway (PNP).[9] Both pathways were multimodal and shared a goal of increasing access to guideline-supported clinical practices. The SCP included in-person and telehealth visits for pain education and modulation, physical activity coaching, risk stratification, and psychologically informed physical therapy, while the PNP, delivered via telehealth, included shared decision-making and facilitated referral to nondrug treatments. Because the SCP involved structured delivery of guideline-supported treatments, we hypothesized that it would have superior 3-month pain interference and physical function outcomes compared with the PNP.

Methods

Study Design

The AIM-Back trial was a cluster randomized, practice-embedded (ie, care delivered by clinical staff and data collected during routine visits) clinical trial conducted in 19 clinics in the Veterans Health Administration (VHA) (see trial protocol and statistical analysis plan in Supplement 1). We adhered to the 2025 Consolidated Standards of Reporting Trials (CONSORT) reporting guideline and the CONSORT Extension reporting guideline for cluster randomized trials[10,11] to report clearly and completely on the design, conduct, analysis, and interpretation of AIM-Back. The trial started enrollment on February 8, 2021, and ended enrollment on January 31, 2024. Clinics ended enrollment when recruitment goals were exceeded or at the end of the trial recruitment period. Additional study details and rationale for care pathways have been published previously.[7,12,13] The study received approval from the Duke Health institutional review board and the Durham Veterans Affairs Health Care System institutional review board. Participating clinics had agreed to deliver their

assigned pathway as standard care; thus, individual-level consent was not required for trial enrollment. AIM-Back had no study-related harms.

Patient and Public Involvement and Protocol Changes

The care pathways were reviewed and modified based on input from a veteran research engagement panel as well as other partners.[14] Trials results were reported to this panel for guidance on future LBP care initiatives. AIM-Back updated its data analysis plan prior to completing enrollment.[15]

Participants

Veterans aged 18 years or older and seeking outpatient care for LBP in a participating primary care clinic were eligible for referral to AIM-Back. Referring clinicians received training on eligibility criteria to ensure consistency. Clinicians were instructed not to refer patients receiving or referred for hospice or palliative care or lacking a telephone number. For the primary analysis intent-to-treat population, referred patients were identified as enrolled participants in the program if they attended the initial AIM-Back visit (baseline) for the clinic-randomized pathway. At the time of AIM-Back referral, veterans were asked if they would be willing to be contacted to complete additional surveys outside the electronic health record (EHR) collection; oral informed consent was provided for these surveys. These data were collected to provide supplemental outcomes and longer-term follow-up beyond 3 months.

Randomization and Masking

Clinics were recruited by members of the AIM-Back research team (T.A.L., A.C., and T.L.C.) in 2 blocks from February 1 to September 1, 2020, and from March 1 to December 1, 2021. Clinics were eligible to participate in AIM-Back if they agreed to provide clinical personnel to deliver either of the care pathways, did not share clinicians, and had seen between 800 and 5000 unique patients who received a diagnosis of LBP in the previous year.[7] The lead biostatistician (C.J.C.) used a covariate-constrained randomization[16] in 2 blocks, with 10 clinics in the first block (randomized September 2020) and 9 clinics in the second block (randomized December 2021). See eAppendix 1 in Supplement 2 for a description of the randomization covariates. Randomized clinics were paired for staggered training and deployment of the randomized pathways by members of the implementation team (T.A.L., C.F., A.C., C.B.S., C.E.C., and T.L.C.). Treating clinicians, study staff members supporting program implementation, and statisticians were not blinded to randomization to allow for cleaning data, pulling variables specific to a given pathway, and developing reports to monitor pathway data quality during the trial. Survey assessors were blinded to care pathway randomization when contacting veterans by telephone for data collection.

Procedures

During onboarding, clinics were presented with virtual synchronous training modules, a training manual, access to an informational webpage that hosted resources for implementation, and patient flyers for marketing the program. Clinicians were instructed on how to inform their patients about the pathway during their usual clinical care. Throughout the trial, efforts to engage primary care clinicians included sending weekly emails with enrollment goal updates, joining monthly calls to troubleshoot implementation, and performing site visits at facilities that were behind enrollment targets to further engage in-clinic partners.[12,17]

Care Pathways

The SCP's core components were pain modulation, physical activity instruction, risk stratification, and psychologically informed physical therapy, if indicated. The SCP provided physical therapy services locally and training in behavioral activation and pain coping skills via telephone (eTable 1 in Supplement 2). The PNP's core components were shared decision-making, care coordination, and facilitation of referrals to nondrug services. The PNP involved a health care navigator trained by

AIM-Back team members in the current recommended treatment guidelines for LBP (eTable 1 in Supplement 2). The PNP involved remote delivery, with most interactions (≥98%) occurring by telephone. Clinicians who served as pain navigators included 10 physical therapists, 4 nurses, 2 chiropractors, and 1 each for occupational therapy, pain medicine, and whole health coach.

Data Sources

The AIM-Back trial had data entered through 2 sources: (1) the computerized patient record system, the VHA Health Care System EHR in AIM-Back–specific templates by clinicians, and extracted from the Corporate Data Warehouse (CDW), and (2) REDCap[18] by blinded AIM-Back research staff for the consented subset via telephone survey. Patient-reported outcomes were collected using AIM-Back–specific EHR templates. These outcomes were documented by clinicians at baseline and during subsequent clinical care visits. All outcome data collection occurred during routine appointments, with no additional visits scheduled solely for data collection.

Primary Outcomes

Patient-Reported Outcomes Measurement Information Systems 4-item Short Forms (PROMIS-SF) scores for pain interference and physical function (potential score range for pain interference, 41.6-75.6, where lower scores indicated less interference with daily activities due to pain; and potential score range for physical function, 22.5-57.0, where higher scores indicated higher physical functioning during daily activities) were collected by clinicians at baseline and 3-month follow-up. For veterans who did not have 3-month PROMIS-SF outcomes scores in the EHR, the PROMIS-SF data from surveys were used if available within the appropriate time window[15] (eFigure 1 in Supplement 2).

Secondary Outcomes

PROMIS-SF sleep disturbance scores and NIH pain intensity were collected in the EHR as secondary outcomes. The 12-month opioid outcomes extracted from pharmacy refill data in CDW will be presented in a separate article focusing on health care utilization. For those consenting to surveys, PROMIS-SF outcomes (pain interference, physical function, and sleep disturbance), pain intensity (PEG [pain intensity, interference with enjoyment of life, and interference with general activity]), pain catastrophizing (2 items from the NIH Task Force), self-efficacy (PSEQ-2 [Pain Self-Efficacy Questionnaire–2]), quality of life (EQ-5D-5L [EuroQoL 5-dimension 5-level]), depressed mood (PHQ-2 [Patient Health Questionnaire–2]), and alcohol use (AUDIT-C [Alcohol Use Disorders Identification Test–Consumption screener for problem drinking]) were collected at baseline and 3-, 6-, and 12-month follow-up. See eTable 2 in Supplement 2 for additional details.

Covariates

Demographic characteristics (age, sex, and race and ethnicity [Black or African American, Hispanic, White, multiracial or other race or ethnicity (American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander)]) and Care Assessment Need (CAN) scores prior to referral date (closest) were extracted from the CDW. The CAN score,[19] a comorbidity measure, is a risk percentile based on the estimated risk for hospital admission or death within 1 year calculated weekly for all eligible veterans (range, 0 [lowest risk] to 99 [highest risk]). Chronic pain status was operationally defined by 2 items from the Graded Chronic Pain Scale Revised questionnaire[20] collected in the EHR. Race and ethnicity data were collected for the following reasons: (1) we were interested in assessing the representativeness by age, sex, and race and ethnicity for those enrolled in the trial versus those seeking care at the clinic (these data are part of a different publication investigating representativeness of those enrolled in the AIM-Back trial); (2) randomization occurred at the group level, so this information was needed to assess cluster balance after randomization, especially given the geographic distribution of participating clinics; and (3) these variables were included a priori in our primary analysis as proxy measures of sociodemographic status.

Statistical Analysis

Oversight was provided by a data safety monitoring board convened by the NIH. Additional details on our analysis are provided in eAppendix 1 in Supplement 1.

With 16 clinics (8 PNP, 8 SCP), 105 patients per clinic with baseline pathway visits (1680 patients), and a type I error of 2.5% (to account for coprimary outcomes), we had 90% power to detect medium to large standardized Cohen *d* effect size differences from 0.30 to 0.50 in the primary outcomes across the range of assumed intraclass correlations coefficients (ICCs) from 0.01 to 0.05 (to account for clustering of outcome within clinics).[19] Assuming SDs of 8 and 10, respectively, these medium to large effect size differences translate to differences of 2.4 to 5.0 points for either PROMIS-SF pain interference or physical function between arms. Sample size calculations were based on the net difference between arms across baseline and 3-month follow-up,[21] with 0.50 correlation assumed over time, 20% attrition rate, and adjustment for the randomization covariates. With 53 patients per clinic participating in the survey study (n = 848; approximately 50% of those participating in AIM-Back pathway), we had 90% power to detect effect size differences from 0.33 to 0.55 for both primary outcomes.

Analyses were conducted on an intent-to-treat basis; participants were assigned to the randomized pathway of the clinic to which the referring clinician was assigned. Analyses were conducted separately for EHR-measured and survey-measured outcomes; to facilitate pathway comparison, survey outcomes were analyzed only from the survey participants who were also enrolled in the trial (n = 799). All analyses were conducted with SAS software, version 9.4 (SAS Institute Inc) or R software, version 4.4.0 (R Project for Statistical Computing).

Hierarchical linear mixed-effects models were used for all outcomes, with patients nested within clinics and baseline and follow-up outcomes in the response vector.[22] The fixed effects in the model included follow-up time indicators and treatment-by-time interaction indicators, as well as the clinic-level randomization covariates and prespecified patient-level covariates (age, sex, race and ethnicity, chronic pain status, and CAN score). This model assumes that study arms have equal baseline mean values. Mean or mode imputation by clinic was conducted for missing CAN score and race and ethnicity, as appropriate.[23,24] Random effects for clinics and clinics by time were included to account for clustering of patients within the clinic and an unstructured covariance for the patient-level covariance structure. Estimated treatment mean values and differences at follow-up times with associated 97.5% CIs for coprimary outcomes and 95% CIs for secondary outcomes and *P* values are presented. Sensitivity analyses were conducted among enrolled participants (n = 1817) to investigate (1) treatment difference using all time points (both EHR and survey; range, 1-8 per patient), (2) missing data, and (3) referral bias. Statistical tests were 2-sided. For coprimary outcomes, $P < .025$ was considered statistically significant; for secondary outcomes, $P < .05$ considered statistically significant

Results

The study enrolled 1817 participants (mean [SD] age, 53.0 [15.7] years; 1597 men [87.9%] and 220 women [12.1%]; 541 Black or African American [29.8%], 95% Hispanic [5.2%], 1208 White [66.5%], and 68 other race or ethnicity or multiracial [3.7%]) (**Table 1**). Nineteen clinics agreed to participate in AIM-Back and were randomized (10 PNP; 9 SCP) between February 2020 and December 2021. Two clinics, 1 in each arm, withdrew prior to launching AIM-Back and were excluded from all analyses (**Figure 1**A). A mean (SD) of 13.7 (8.2) clinicians per clinic were identified during recruitment. Patients with LBP across clinics over the 6-month period prior to clinic enrollment had a mean (SD) age of 61.3 (2.0) years, a mean (SD) pain intensity of 4.2 (0.7) (range, 0-10, where higher scores indicate greater pain), and mean (SD) rates of any opioid use of 17.7% (5.9%) (Table 1).

Between February 1, 2021, and January 18, 2024, there were 2767 veterans referred (1481 PNP; 1286 SCP) to the AIM-Back pathways (Figure 1A). Of those referred, 1817 (65.7%) enrolled, with 1006 of 1481 (67.9%) in the PNP group and 811 of 1286 (63.1%) in the SCP group. Of the 2767 referrals, 2153 (77.8%) agreed to be contacted for surveys, and 1045 veterans consented, with 996

completing baseline surveys, 799 (399 PNP; 400 SCP) of whom were enrolled in the trial (Figure 1B). Baseline characteristics of enrolled survey participants[25] are summarized in eTable 3 in Supplement 2.

Adherence metrics for the SCP group are reported in **Table 2**,[26] and adherence metrics for the PNP group are reported in **Table 3**. Overall, 582 of 1006 veterans (57.9%) in the PNP group and 532 of 811 (65.6%) in the SCP group completed the 6-week follow-up session, and 472 (46.9%) in the PNP group and 425 (52.4%) in the SCP group completed the 3-month follow-up visit. There were 252 veterans (154 PNP; 98 SCP) without 3-month EHR outcome data who had survey data collected in the appropriate window, which increased the yield to 537 of 1006 veterans (53.4%) in the PNP group and 461 of 811 veterans (56.8%) in the SCP group with analyzable primary outcomes at 3 months (Figure 1A; eFigure 1 in Supplement 2). There were no differences in baseline characteristics between those providing 3-month EHR outcome and those that did not (eTable 4 in Supplement 2). Among the 799 enrolled participants consenting to telephone surveys, follow-up rates were 87.2% (348 of 399) in the PNP group and 85.0% (340 of 400) in the SCP group at 3 months, 81.0% (323 of 399) in the PNP group and 84.3% (337 of 400) in the SCP group at 6 months, and 76.7% (306 of 399) in the PNP group and 77.0% (308 of 400 in the SCP group) at 12 months (Figure 1B).

Table 1. Characteristics of Clinics and Enrolled Participants at Baseline

Characteristic	Overall	PNP	SCP
Clinic characteristics			
Clinics, No.	17	9	8
Clinic type, No. (%)			
Main medical center	8 (47.1)	5 (55.6)	3 (37.5)
Community	9 (52.9)	4 (44.4)	5 (62.5)
No. of clinicians, mean (SD)	13.7 (8.2)	13.6 (7.1)	13.9 (9.7)
Age of patients with LBP, mean (SD)[a]	61.3 (2.0)	61.4 (2.0)	61.1 (2.1)
Pain intensity (range, 0-10), mean (SD)[a]	4.2 (0.7)	4.2 (0.8)	4.2 (0.5)
Opioid use, mean (SD), %[a,b]	17.7 (5.9)	18.2 (7.6)	17.1 (3.3)
Patient characteristics[c]			
Patients, No.	1817	1006	811
Age, mean (SD), y	53.0 (15.7)	52.7 (15.9)	53.4 (15.4)
Age categories, No. (%)			
<50 y	766 (42.2)	435 (43.2)	331 (40.8)
50-64 y	562 (30.9)	296 (29.4)	266 (32.8)
65-74 y	330 (18.2)	192 (19.1)	138 (17.0)
≥75 y	159 (8.8)	83 (8.3)	76 (9.4)
Sex, No. (%)			
Female	220 (12.1)	110 (10.9)	110 (13.6)
Male	1597 (87.9)	896 (89.1)	701 (86.4)
Race, No. (%)[d]			
Black or African American	541 (29.8)	233 (23.2)	308 (38.0)
Other or multiracial[e]	68 (3.7)	44 (4.4)	24 (3.0)
White	1208 (66.5)	729 (72.5)	479 (59.1)
Hispanic ethnicity, No. (%)[d]	95 (5.2)	59 (5.9)	36 (4.4)
High-impact chronic pain, No. (%)	1194 (65.7)	660 (65.6)	534 (65.8)
Chronic LBP, No. (%)[f]	1672 (92.0)	921 (91.6)	751 (92.6)
Opioid use, No. (%)	179 (9.9)	109 (10.8)	70 (8.6)
Chronic opioid use, No. (%)	64 (3.5)	36 (3.6)	28 (3.5)
Benzodiazepine use, No. (%)	89 (4.9)	48 (4.8)	41 (5.1)
Chronic benzodiazepine use, No. (%)	38 (2.1)	16 (1.6)	22 (2.7)
1-y CAN Score, mean (SD)	46.1 (30.1)	47.3 (30.7)	44.6 (29.3)
PTSD, No. (%)	425 (23.4)	215 (21.4)	210 (25.9)
Area Deprivation Index, mean (SD)	57.7 (22.9)	58.4 (23.4)	56.8 (22.3)

Abbreviations: CAN, Care Assessment Need; LBP, low back pain; PNP, pain navigator pathway; PTSD, posttraumatic stress disorder; SCP, sequenced care pathway.

[a] Assessed patients with LBP were seen at participating clinics in 6 months prior to clinic enrollment.

[b] Clinic-level percentage at time of enrollment.

[c] Missing characteristics imputed by site: 1-year CAN Score (mean), 51 missing (41 PNP, 10 SCP); race and ethnicity (mode), 36 missing (27 PNP, 9 SCP).

[d] Information on race and ethnicity was collected from the electronic health record, which was entered by clinical staff during a routine visit.

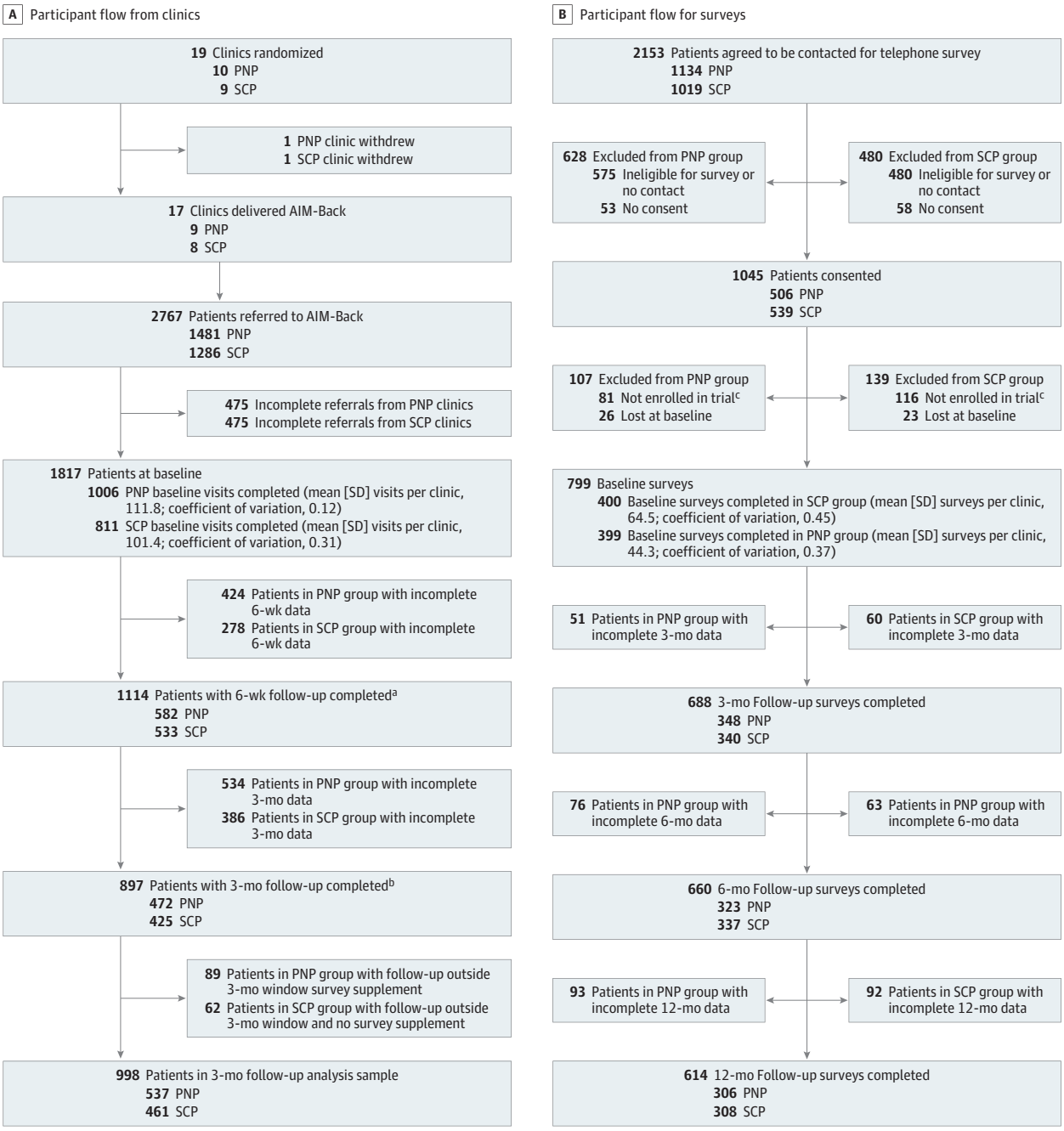
[e] Other races included American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander.

[f] Chronicity as defined by the National Institutes of Health.

Primary Outcomes

There were no differences between pathways in the primary PROMIS-SF outcomes at 3 months (n = 1817); the estimated differences were −0.6 points (97.5% CI, −1.6 to 0.4 points; *P* = .17) for the SCP vs PNP for pain interference and 0.6 points (97.5% CI, −0.3 to 1.5 points; *P* = .14) for physical function (**Figure 2**). The estimated baseline mean pain interference PROMIS-SF score was 63.2

Figure 1. Participant Flow Diagrams



A, Participant flow from clinics in Improving Veteran Access to Integrated Management of Back Pain (AIM-Back) trial. B, Participant flow for survey participants in AIM-Back trial.

[a] There were 35 veterans in the pain navigator pathway (PNP) arm with multiple 6-week follow-up visits (32 with 2 visits, 3 with 3 visits) and 18 veterans in the sequenced care pathway (SCP) arm with multiple 6-week follow-up visits (17 with 2 visits, 1 with 3 visits).

[b] There were 8 veterans with two 3-month follow-up visits in the PNP arm and 1 veteran with two 3-month follow-up visits in the SCP arm.

[c] These veterans completed surveys for the trial but did not receive the clinical intervention.

points (97.5% CI, 62.7-63.6 points) in the SCP and PNP groups, with 3-month mean values of 60.5 points (97.5% CI, 59.7-61.3 points) in the SCP group and 61.1 points (97.5% CI, 60.4-61.8 points) in the PNP group. The estimated baseline mean for physical function was 37.1 points (97.5% CI, 36.7-37.4 points) in the SCP and PNP groups, with 3-month mean values of 39.1 points (97.5% CI, 38.4-39.7 points) in the SCP group and 38.5 points (97.5% CI, 37.8-39.1 points) in the PNP group. The ICC was 0.0 for pain interference (could not estimate random effect for clinic and time) and 0.008 for physical function. The within-group difference was −2.6 points (97.5% CI, −3.3 to −1.9 points) for pain interference and 2.0 points (97.5% CI, 1.3-2.7 points) for physical function for the SCP group, and it was for pain interference was −2.1 points (97.5% CI, −2.7 to −1.4 points) for pain interference and 1.4 points (97.5% CI, 0.7-2.0 points) for physical function for the PNP group. These differences translate to effect size differences in the moderate range (0.4-0.5) for SCP and small to moderate range (0.3-0.4) for PNP. Results of sensitivity analyses using all time points, multiple imputation, and adjusting for referral bias were similar to the primary analysis (eFigures 2a, 2b, 3, and 4 in Supplement 2).

Secondary Outcomes

There were no differences between pathways in EHR-collected secondary outcomes at 3 months; the estimated differences were −0.6 points (95% CI, −1.8 to 0.6 points) for sleep disturbance and −0.3 (95% CI, −0.7 to 0.04) for NIH pain intensity (eFigure 5 in Supplement 2). Among survey participants (n = 799), there were no differences between pathways in PROMIS-SF pain interference or physical function (Figure 2) or in any other secondary survey outcomes at follow-up time points (eTable 5 in Supplement 2).

Discussion

We hypothesized greater effects of the SCP because of its structured delivery of guideline-supported treatments.[7] However, the SCP was not superior to the PNP for the 3-month coprimary outcomes, nor at any additional follow-up times. Participants in both pathways experienced improvements in

Table 2. Adherence Metrics for Delivery of Sequenced Care Pathway[a]

Session and adherence metric	Value
Initial visit	
Visit attended, No. (%)	811 (100)
≥1 Pain modulation (massage, manual therapy, TENS) and/or pain neuroscience education sessions completed, No./total No. (%)	745/811 (91.9)
Physical activity coaching	
Visits (remote delivery), mean (SD), No.	2.4 (1.9)
Participants with ≥1 visits, No./total No. (%)	625/811 (77.1)
6-wk Follow-up[b]	
Visits attended, No./total No. (%)	532/811 (65.6)
≥1 Pain modulation and/or pain neuroscience education sessions completed, No./total No. (%)	336/532 (63.2)
STarT Back screening[c] as medium or high risk, No./total No. (%)	377/532 (70.9)
Psychologically informed practice[d]	
Visit (remote delivery), mean (SD), No.	1.9 (2.0)
Participants with ≥1 visits, No./total No. (%)	218/377 (57.8)
3-mo Follow-up[e]	
Visits attended, No./total No. (%)	425/811 (52.4)

Abbreviations: STarT Back, Subgroups of Targeted Treatment for Back Pain; TENS, transcutaneous electrical nerve stimulation.

[a] Mean (SD) number of physical therapy sessions for those with at least 1 session: 3.1 (1.5); mean (SD) number of psychologically informed practice sessions for those with at least 1 PiP: 3.3 (1.6).

[b] There were 18 patients with multiple 6-week follow-up visits in the sequenced care pathway arm (17 with 2 visits, 1 with 3 visits).

[c] Evaluated using the STarT Back tool.[26]

[d] Psychologically informed practice sessions for 377 veterans stratified to high or medium risk; there were an additional 7 veterans with missing 6-week follow-up (n = 6) or stratified to low risk (n = 1) that received at least 1 psychologically informed practice call.

[e] There was 1 veteran with two 3-month follow-up visits.

the lower range of clinical importance for the primary outcome measures.[27,28] The 2025 Cochrane review of LBP care models including 48 trials (only 14 from the US) found small but not clinically relevant differences favoring alternative care models (eg, management of care processes or use of information technology).[6] AIM-Back is one of the first trials to our knowledge to eschew usual care as a comparator and, as such, provides foundational data on comparative effectiveness. AIM-Back investigated 2 care models in an "A vs B" trial (ie, 2 different treatment approaches), a design that is lacking in the literature but is vital for informing health systems on different care delivery options.[29] The SCP has the advantage of limiting variability in care, while its primary disadvantage is that it disrupts existing clinical workflows. The PNP has the advantage of offering a patient-centered approach through its flexibility in care options but the disadvantage of needing numerous nondrug options to refer for services. AIM-Back findings indicate that navigator options in the PNP had comparable outcomes with those of the structured approach in the SCP and may be viable for testing effectiveness for other common pain conditions.

Table 3. Adherence Metrics for Delivery of Pain Navigator Pathway

Session and adherence metric	No. with metric/total No. eligible (%)
Initial (baseline)	
Visits, Total No.	1006 (100)
≥1 Referrals issued to a service	955/1006 (94.9)
Multiple referrals to a service	423/955 (44.3)
Referral type[a]	
PT, chiropractic, or acupuncture[b]	842/955 (84.5)
PT	527/955 (55.1)
Chiropractic	356/955 (37.3)
Acupuncture	284/955 (29.7)
Yoga or tai chi	137/955 (14.3)
Multidisciplinary pain clinic	62/955 (6.5)
Other (eg, pain school, massage therapy, whole health)	161/955 (16.8)
6-wk Follow-up[c]	
Visits	582/1006 (57.9)
≥1 Referrals issued to a service	413/582 (70.8)
Multiple referrals to a service	142/413 (34.3)
Referral type[a]	
PT, chiropractic, or acupuncture[b]	341/413 (82.5)
PT	210/413 (50.8)
Chiropractic	126/413 (30.5)
Acupuncture	108/413 (26.2)
Yoga or tai chi	44/413 (10.7)
Multidisciplinary pain clinic	13/413 (3.1)
Other (eg, pain school, massage therapy, whole health)	78/413 (18.9)
3-mo Follow-up[d]	
Visits	472/1006 (46.9)
Self-reported receipt of pain navigator recommended services (VA or non-VA)	381/472 (80.7)
Multiple services received	192/381 (50.4)
Service type	
PT, chiropractic, or acupuncture[b]	347/381 (91.2)
PT	229/381 (60.1)
Chiropractic	158/381 (41.5)
Acupuncture	86/381 (22.7)
Yoga or tai chi	33/381 (8.9)
Multidisciplinary pain clinic referral	27/381 (7.1)
Other	63/381 (16.5)

Abbreviations: PT, physical therapy; VA, Department of Veterans Affairs.

[a] Less than 5% of patients with referrals to cognitive behavioral therapy, counseling, or biofeedback; recreation therapy; occupational therapy; exercise program; or MOVE! Weight Management Program.

[b] Top 3 services referred by pain navigators across clinics.

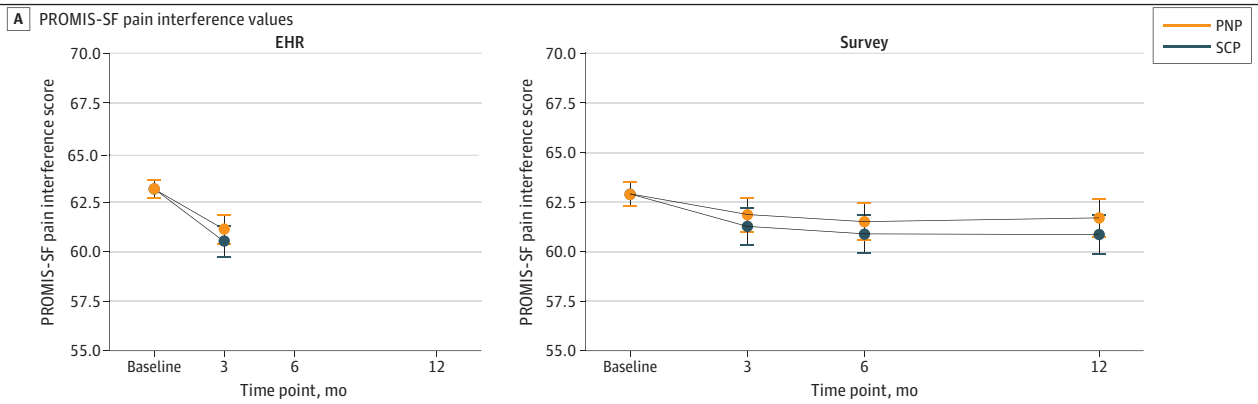
[c] There were 35 veterans with multiple 6-week follow-up visits in pain navigator pathway arm (32 with 2 visits, 3 with 3 visits).

[d] There were 8 veterans with two 3-month follow-up visits.

Strengths and Limitations

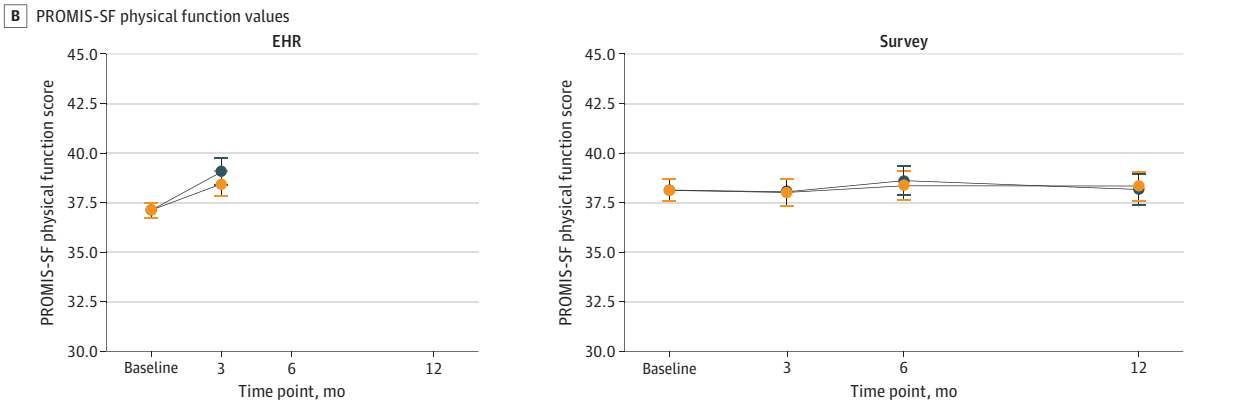
The AIM-Back trial has some strengths, such as covariate-constrained randomization and pragmatic elements, including broad enrollment criteria, recruitment from a diverse group of clinical sites, high uptake of the clinical pathways, use of existing clinical staff to deliver the care pathways, and inclusion of survey participants to gather additional data. The trial also has some limitations. A primary limitation was low follow-up rates for the primary outcomes. This was likely a reflection of capturing data during routine care, as participants consenting to survey completion followed up at much higher rates (≥85% at 3 months). Despite the lower follow-up rate, we have confidence in the credibility of AIM-Back findings for several reasons. First, participants with or without EHR follow-up data were similar. Second, our power calculations assumed a loss to follow-up rate of 20% and

Figure 2. Line Graphs of Pain Interference and Physical Function Patient-Reported Outcomes Measurement Information Systems 4-item Short Forms (PROMIS-SF) Outcomes



No. at risk	Baseline	3 mo
SCP	63.2 (97.5% CI, 62.7 to 63.6)	60.5 (97.5% CI, 59.7 to 61.3)
PNP	63.2 (97.5% CI, 62.7 to 63.6)	61.1 (97.5% CI, 60.4 to 61.8)
Difference		-0.6 (97.5% CI, -1.6 to 0.4); *P* = .17

No. at risk	Baseline	3 mo	6 mo	12 mo
SCP	62.9 (97.5% CI, 62.3 to 63.5)	61.3 (97.5% CI, 60.4 to 62.2)	60.9 (97.5% CI, 59.9 to 61.8)	60.9 (97.5% CI, 59.9 to 61.8)
PNP	62.9 (97.5% CI, 62.3 to 63.5)	61.9 (97.5% CI, 61.0 to 62.7)	61.5 (97.5% CI, 60.6 to 62.4)	61.7 (97.5% CI, 60.8 to 62.6)
Difference		-0.6 (97.5% CI, -1.8 to 0.6)	-0.6 (97.5% CI, -1.9 to 0.7)	-0.8 (97.5% CI, -2.1 to 0.5)



No. at risk	Baseline	3 mo
SCP	37.1 (97.5% CI, 36.7 to 37.4)	39.1 (97.5% CI, 38.4 to 39.7)
PNP	37.1 (97.5% CI 36.7 to 37.4)	38.5 (97.5% CI, 37.8 to 39.1)
Difference		0.6 (97.5% CI, -0.3 to 1.5); *P* = .14

No. at risk	Baseline	3 mo	6 mo	12 mo
SCP	38.1 (97.5% CI, 37.6 to 38.7)	38.0 (97.5% CI, 37.4 to 38.7)	38.6 (97.5% CI, 37.9 to 39.3)	38.2 (97.5% CI, 37.4 to 38.9)
PNP	38.1 (97.5% CI, 37.6 to 38.7)	38.0 (97.5% CI, 37.3 to 38.7)	38.4 (97.5% CI, 37.6 to 39.1)	38.3 (97.5% CI, 37.6 to 39.1)
Difference		0.0 (97.5% CI, -0.7 to 0.8)	0.2 (97.5% CI, -0.6 to 1.1)	-0.2 (97.5% CI, -1.1 to 0.8)

Estimated mean values and mean difference at follow-up time points for PROMIS-SF pain interference (A) and PROMIS-SF physical function (B) outcomes for electronic health record (EHR) data from enrolled participants (primary; n = 1817) and survey participants (n = 799) from hierarchical linear mixed-effects models. The observed range of values for PROMIS-SF pain interference scores was from 41.6 to 75.6; the observed range of values for PROMIS-SF physical function scores was from 22.9 to 56.9. Error bars indicate 97.5% CIs.

enrolling 1680 participants across 16 clinics; we enrolled 1817 across 17 clinics with a loss to follow-up rate of 45%. In our power calculation, we assumed larger ICCs and SDs than observed, which may balance out the higher loss to follow-up. Furthermore, the estimated effect size differences for both outcomes were below 0.14, with the 97.5% CI bound translating to an effect size of 0.34 on the lower 0.30 to 0.50 range that we were powered to detect, indicating that inadequate power was not an issue. Third, sensitivity analyses using all available measures (EHR and survey) and multiple imputation yielded similar results to the primary analysis. Fourth, the analysis of survey outcomes only (with the higher follow-up rates) yielded similar results to the primary analysis.

As noted, this trial did not include a usual care arm, which can be considered another limitation. This choice was consistent with our goal of offering participating sites at least 1 option for implementing a new care pathway. Given there was no usual care comparator, some within-arm improvements may reflect regression to the mean.

Conclusions

The AIM-Back cluster randomized clinical trial adds to the existing literature by being the first to our knowledge to compare 2 alternative LBP care models and finding no superiority of the SCP over the PNP for pain interference and physical function outcomes. Future research should consider designs that optimize pathway adherence, assess effectiveness in other settings, and investigate patient-level factors indicative of a favorable response to the SCP or PNP.

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SUPPLEMENT 1.

Trial Protocol and Statistical Analysis Plan

SUPPLEMENT 2.

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SUPPLEMENT 3.

Data Sharing Statement

Fibromyalgia TENS in Physical Therapy Study (FM-TIPS)

Top-Level Results

- Primary outcome: Clinically significant improvement in movement-evoked pain at Day 60 in PT+TENS group compared to PT-Only group.
- Secondary outcomes:
  - Clinically significant improvement in resting pain, movement-evoked fatigue, resting fatigue at Day 60 in PT+TENS compared to PT-Only.
  - PT-Only group obtained significant improvements in movement-evoked pain and fatigue, and resting pain and fatigue, at Day 180 after starting TENS on Day 65.

Lessons Learned

- Community and clinic engagement enhanced recruitment and retention.
- Need to engage with participants regularly to ensure enrollment, completion of outcomes.
- Regular communication and relationship-building between clinics, clinicians, healthcare systems, and study team are essential to success.

Future Plans

- Publish primary and secondary outcomes; manuscripts on EHR, responders to TENS and PT.
- Present results at annual physical therapy and US association for the study of pain meetings, World Congress on Pain.
- Share results with participants, support groups, and participating healthcare systems.

FM-TIPS
Fibromyalgia TENS In Physical Therapy Study

JAMA Network Open

Original Investigation | Physical Medicine and Rehabilitation

Transcutaneous Electrical Nerve Stimulation and Pain With Movement in People With Fibromyalgia

A Cluster Randomized Clinical Trial

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Abstract

IMPORTANCE Fibromyalgia is characterized by chronic widespread pain that is often exacerbated by movement that interferes with daily activities. Development of effective treatments for movement-evoked pain is essential for improving function for individuals with fibromyalgia.

OBJECTIVE To evaluate whether the addition of transcutaneous electrical nerve stimulation (TENS) to outpatient physical therapy improves fibromyalgia-associated movement-evoked pain.

DESIGN, SETTING, AND PARTICIPANTS The Fibromyalgia TENS in Physical Therapy (FM-TIPS) study was a cluster-randomized clinical trial of participants with fibromyalgia at 28 outpatient PT clinics from 6 health care systems. Between February 1, 2021, and September 31, 2024, 958 participants were screened, 459 participants enrolled, and 384 completed baseline data collection, with final data collected in March 2025.

INTERVENTION Clinics were randomized to PT plus TENS (PT-TENS) and PT-only groups. Data were captured on days 1, 30, 60 (primary end point, randomized phase), 90, and 180. Participants in the PT-only group received TENS after day 60 (extension phase). TENS was applied to the upper and lower back with instructions to use 2 hours daily with parameters of modulating frequency of 2 to 125 Hz for 100 to 180 microseconds at a strong but comfortable intensity.

MAIN OUTCOMES AND MEASURES The primary outcome was a change in movement-evoked pain (scale of 0-10, with 0 indicating no pain and 10 indicating worst pain imaginable) from baseline to day 60 rated during a 5-times sit-and-stand task using a linear mixed-effects model. In addition, patient-reported improvement based on the Patient Global Impression of Change score and patient-reported adverse events were assessed.

RESULTS A total of 384 FM-TIPS participants (mean [SD] age, 53 [15] years; 351 [91%] female) completed baseline data collection (modified intention-to-treat), with 191 individuals in PT-TENS group and 193 in PT-only group. Movement-evoked pain at day 60 during TENS treatment was significantly lower in the PT-TENS group compared with the PT-only group (group mean difference, −1.2; 95 CI, −1.6 to −0.7; d = 0.46). A dose-response effect for TENS was observed, with more participants in the PT-TENS group reporting improvement on the Patient Global Impression of Change (120 [72%] vs 86 [51%], P = .001) and a 30% or greater reduction in movement-evoked pain in responder analysis (66 of 161 [41%] vs 22 of 169 [13%]; P < .001). At day 180, 217 respondents

(continued)

Key Points

Question Is transcutaneous electrical nerve stimulation (TENS) effective for treating pain when combined with physical therapy (PT) in individuals with fibromyalgia?

Findings This cluster randomized clinical trial of 459 participants with fibromyalgia from 28 PT clinics from 6 health systems found that adding TENS to routine PT resulted in a statistically significant and clinically meaningful reduction of movement-evoked pain at 2 months, with effectiveness sustained for at least 6 months.

Meaning This study's findings suggest that TENS is a safe and effective modality for managing fibromyalgia pain.

+ Visual Abstract

+ Invited Commentary

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

Abstract (continued)

(81%) found TENS helpful and 147 (55%) used TENS daily. There were no serious adverse events, and 109 of 358 (30%) experienced minor adverse events during the entire 6 months of the study.

CONCLUSIONS AND RELEVANCE In this cluster randomized clinical trial of TENS in fibromyalgia, TENS meaningfully reduced movement-evoked pain and remained effective for 6 months. This study's results suggest that TENS is a safe, inexpensive, and readily available treatment for fibromyalgia.

TRIAL REGISTRATION ClinicalTrials.gov Identifier: NCT04683042

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Introduction

Fibromyalgia is a complex condition characterized by chronic widespread pain and accompanied by fatigue, nonrefreshing sleep, and cognitive dysfunction.[1-3] Fibromyalgia pain is exacerbated with movement that contributes to reduced function.[3] Treatment guidelines recommend nonpharmacologic approaches with exercise as a first-line intervention.[4-17] However, adherence to exercise is often poor due to movement-evoked pain, which presents a significant barrier to participation.[18-20]

Transcutaneous electrical nerve stimulation (TENS) is a safe, inexpensive, nonpharmacological treatment often used by physical therapists to reduce pain in a variety of conditions, including fibromyalgia.[21,22] Mechanistically, TENS activates endogenous inhibitory mechanisms in the central nervous system that subsequently reduce central excitability in pain transmission pathways.[21] Thus, TENS may be particularly useful for individuals with altered central pain processing.

Although the mechanisms underlying fibromyalgia are heterogeneous, there is strong evidence of altered central pain processing, making fibromyalgia a candidate condition to manage with TENS. A prior placebo-controlled randomized clinical trial (Fibromyalgia Activity Study With TENS [FAST])[23] observed improvements in movement-evoked pain during TENS compared with placebo or no TENS in women with fibromyalgia. However, FAST used a selected clinical population that excluded individuals with potential confounding comorbidities, was conducted in a research setting, and tested efficacy for only 1 month.

The Fibromyalgia TENS in Physical Therapy Study (FM-TIPS) was a pragmatic cluster randomized clinical trial designed to test effectiveness of TENS in a clinical setting for 6 months. This trial was pragmatic as it was embedded into physical therapy (PT) clinics during routine care; local clinicians screened, enrolled, and provided the intervention; and all individuals with fibromyalgia were included as long as they did not have a contraindication to use of the intervention. We tested whether TENS paired with routine PT (PT-TENS group) would reduce movement-evoked pain in individuals with fibromyalgia when compared with PT alone (PT-only group).

Methods

Study Design

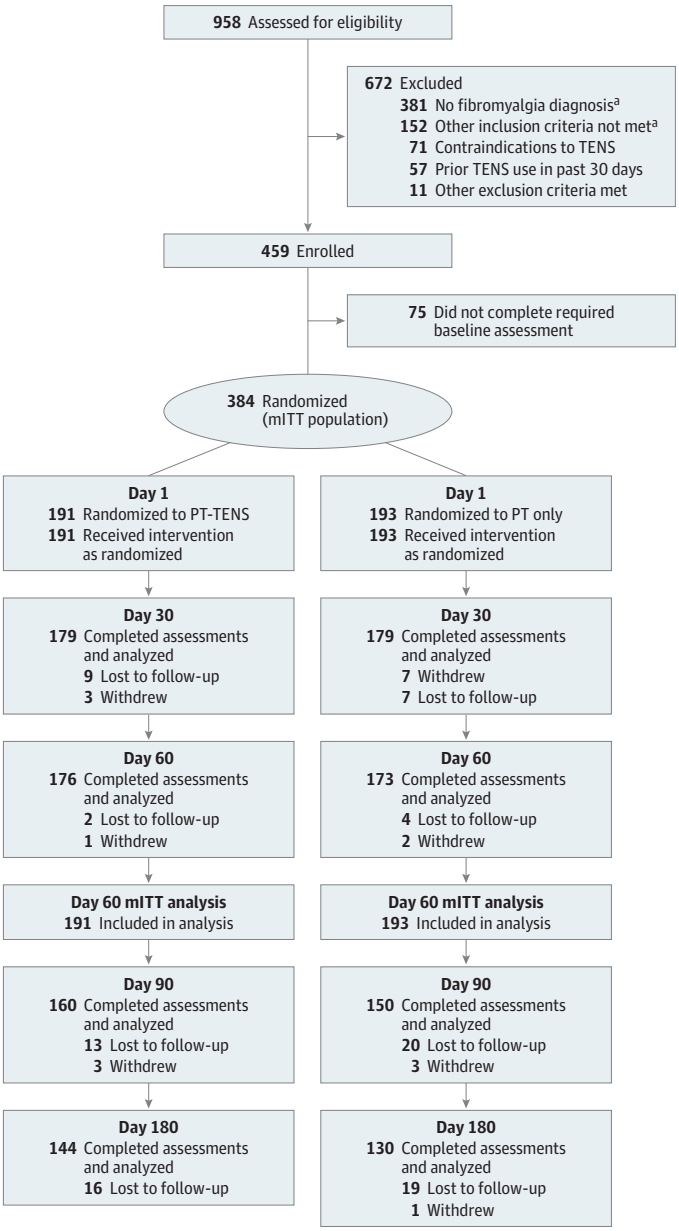
FM-TIPS was a pragmatic cluster randomized clinical trial approved by the University of Iowa institutional review board. Participants were enrolled after completion of electronic informed consent between February 1, 2021, and September 31, 2024, with final data collected in March 2025. A detailed study protocol has been published[24] and is available in Supplement 1. Additional methodology is available in the eMethods in Supplement 2. The study followed the Consolidated Standards of Reporting Trials (CONSORT) reporting guideline.

Study Participants

Twenty-eight clinics screened and enrolled participants. Demographic data, including race and ethnicity, were collected to characterize the sample. Race categories included African American or Black, American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, White, multiracial, and unknown or missing; ethnicity categories included Hispanic or Latino, not Hispanic or Latino, and unknown or missing. Clinics were randomized by a study statistician (D.-E.L., B.M.Z., or E.O.B.) to the PT-TENS (n = 13) or PT-only (n = 15) group and stratified by health care system and clinic size (large [>3 physical therapists] or small [≤3 physical therapists]).

A total of 958 participants were screened, 459 participants enrolled, and 384 completed baseline data collection (modified intention to treat [mITT]). There were 191 participants in the PT-TENS group and 193 in the PT-only group (**Figure 1**). All participants received the intervention as assigned and none were excluded from the mITT analysis. After completion of the day 60

Figure 1. CONSORT Flow Diagram



We randomized 384 participants to clinics providing physical therapy (PT) and transcutaneous electrical nerve stimulation (TENS) (PT-TENS group) or PT only (PT-only group) who served as our modified intention-to-treat (mITT) population by completing baseline (day 1) assessments. After day 60 (end of randomized phase and primary end point), the PT-TENS group continued using TENS, and the PT-only group was provided TENS units and telehealth instructions to use through day 180 (extension phase). A total of 79 physical therapists were trained and participated in the PT-TENS group and 82 in the PT-only group.

[a] Eligibility failure could occur for more than one reason.

assessments, 176 participants in the PT-TENS group continued TENS and 173 participants in the PT-only group received TENS (extension phase). A total of 144 participants in the PT-TENS group and 130 in the PT-only group completed day 180.

Study Flow

Study participation lasted 6 months. During the randomized phase (days 1-60), both groups received routine PT as recommended by their physical therapist. In the extension phase (days 60-180), both groups used TENS. The PT-only group was mailed a TENS unit and received virtual instruction after completing day 60. Assessments were completed remotely with Research Electronic Data Capture (REDCap) on days 1, 30, 60 (primary outcome), 90, and 180.

Participants completed screening, enrollment, and study training during their first 3 PT visits. On PT visit 1, patients presenting with chronic pain and/or fibromyalgia were assessed for eligibility with an electronic screening survey (REDCap). Adults (aged >18 years) were included in the study if diagnosed with fibromyalgia by a clinician, able to read English, and willing to use TENS. Patients were excluded if they had contraindications to TENS or TENS use in the last 30 days. On PT visit 2, participants received study materials and instructions on TENS use and/or study procedures by their physical therapist. Participants were asked to complete baseline data collection at home before PT visit 3.

Each assessment session consisted of resting pain and fatigue ratings and a 5 times repeated sit-and-stand test with movement-evoked pain and movement-evoked fatigue ratings. The PT-TENS group then applied TENS and the PT-only rested quietly while completing additional surveys. Next, participants repeated the sit-and-stand test with movement-evoked pain and fatigue ratings with after 30 minutes of TENS with the units active, if applicable.

Intervention

TENS (NeuroMetrix Inc) was applied through electrodes (butterfly 4 × 6 in, CompassHealth) placed on the upper and lower back. Parameters were an asymmetric biphasic waveform with a modulating frequency of 2 to 125 Hz for a pulse duration of 100 to 180 microseconds and a strong but comfortable stimulation intensity. Participants were instructed to wear TENS for 2 hours daily during activity with a minimum of 30 minutes per session. Use was monitored with a custom nerve stimulation device (Quell Flex, Quell Wearable Pain Relief Technology) that recorded data on a cloud-based server. Participants were instructed to open the application once a week, which uploaded use data to a cloud.

Outcomes

Demographics, baseline data and medication use were collected by self-report. The primary outcome measure was change in movement-evoked pain from baseline before TENS to day 60 after TENS measured on a scale of 0 to 10, with 0 indicating no pain and 10 indicating worst pain imaginable. The sit-and-stand test used in the prior randomized clinical trial[23] was adapted for FM-TIPS to be completed by participants at home because of an observed clinically significant reduction in movement-evoked pain with TENS.[23] Secondary and exploratory outcome measures included additional measures of pain, fatigue, function, disease severity, and HEAL (Helping to End Addiction Long-Term) common data elements. These measures are further described in the published protocol article for FM-TIPS.[24]In addition, self-report adverse events and Patient Global Impression of Change scores were collected at all time points after baseline. Participants completed a survey asking about their experience with TENS on day 180.

Sample Size Calculation

To reach 80% power with a 2-sided type 1 error rate of 0.05, the original sample size was estimated at 600 enrolled patients. This was based on detecting a mean (SD) difference of 1.0 (2.0) between the PT-TENS and the PT-only groups for change in movement-evoked pain. We used an intraclass

correlation coefficient (ICC) of 0.12 for 25 participants per clinic for 24 clinics. A planned interim reassessment of the ICC was performed after the first 200 participants completed day 60 assessments. The target sample size was recalculated assuming an observed ICC of 0.10 and a coefficient of variation of 0.60 for the number of patients enrolled per clinic. Sample size was reduced to 450, leaving us with an estimate of 342 participants completing day 60 based on a 24% dropout rate. The final ICC was calculated as 0.01, calculated using a generalized linear mixed model with type I sums of squares.

Statistical Analysis

Following the prespecified analysis plan (Supplement 1), an mITT plan was completed for all participants with complete baseline data. Linear mixed-effects models analyzed differences in the change from baseline to day 60 between the PT-TENS and the PT-only groups. Movement-evoked pain, resting pain, movement-evoked fatigue, and resting fatigue were calculated as a change from day 1 before TENS to day 60 after TENS. Secondary and exploratory outcomes were calculated as change from day 1 to day 60. These models included random effects for treatment nested within the clinic and health care systems and fixed effects for treatment group, clinic size, and baseline values. Model estimation was conducted using residual maximum likelihood. Sensitivity analyses were conducted to evaluate the robustness of results under different missing data mechanisms, for fibromyalgia-positive vs fibromyalgia-negative groups, and for analysis of the Rapid Assessment of Physical Activity questionnaire (Supplement 2). Treatment effects were tested using 2-sided tests at a $P < .05$ significance level and summarized as means with 95% CIs. The Cohen *d* estimated effect sizes. Per protocol analysis defined a minimally effective dose (8 times per month, 1600 minutes per month) based on the prior study.[23] The number of responders on day 60 was calculated based on prior studies showing a clinically important difference of 30% or more in movement-evoked pain[25] and resting pain.[26,27]

Results

Participants

A total of 384 FM-TIPS participants (mean [SD] age, 53 [15] years; 351 [91%] female; 32 [8%] African American or Black; 3 [<1%] American Indian or Alaska Native, 3 [<1%] Asian, 2 [<1%] Native Hawaiian or Pacific Islander, 315 [82%], 7 [2%] multiracial, 26 [7%] unknown or missing; 26 [2%] Hispanic or Latino, 326 [85%] not Hispanic or Latino, 22 [6%] unknown or missing) completed baseline data collection (modified intention-to-treat), with 191 individuals in PT-TENS group and 193 in PT-only group. Participants experienced moderate resting pain (mean [SD] score, 5.4 [2.0]) and fatigue (mean [SD] score, 5.9 [2.3]), with a mean (SD) Fibromyalgia Impact Questionnaire Revised (FIQR) score of 57.4 (17.4). A total of 296 participants (74%) met the American College of Rheumatology 2016 criteria for fibromyalgia at baseline. Additional demographic and baseline measures are given in **Table 1** and eTable 1 in Supplement 2.

Primary Outcome

Movement-evoked pain on day 60 was significantly lower during TENS in the PT-TENS group when compared with the PT-only group in the randomized phase (group mean difference, −1.2; 95% CI, −1.6 to −0.7; $d = 0.46$). When missing data were imputed using multiple imputation models, findings were similar to the observed data (group mean difference, −1.1; 95% CI, −1.6 to −0.7) (eTable 3 in Supplement 2). Significant group differences were observed for both the fibromyalgia-positive (mean score, −1.0; 95% CI, −1.5 to −0.5) and fibromyalgia-negative (mean score, −1.6; 95% CI, −2.6 to −0.7) participants (eTable 4 in Supplement 2).

Movement-evoked pain was lower during TENS treatment by day 30 and remained lower through day 180 in the PT-TENS group using within-group comparisons (**Figure 2**A and **Table 2**; eTable 5 in Supplement 2). In the extension phase, movement-evoked pain was lower on days 90 and

Table 1. Baseline Characteristics of the Study Participants

Characteristic	No. (%) of participants[a]		
	Total (N = 384)	PT-TENS (n = 191)	PT only (n = 193)
Age, mean (SD), y	53.2 (15.2)	52.6 (15.5)	53.9 (14.8)
Sex			
Female	351 (91)	175 (92)	176 (9)
Male	33 (9)	16 (8)	17 (9)
Ethnicity			
Hispanic or Latino	26 (2)	7 (4)	19 (10)
Not Hispanic or Latino	326 (85)	170 (89)	156 (81)
Unknown or missing	22 (6)	9 (5)	13 (7)
Race			
African American or Black	32 (8)	17 (9)	15 (8)
American Indian or Alaska Native	3 (<1)	1 (<1)	2 (1)
Asian	3 (<1)	3 (2)	9 (0)
Native Hawaiian or Pacific Islander	2 (<1)	0	2 (1)
White	315 (82)	156 (82)	159 (82)
Multiracial	7 (2)	3 (2)	4 (2)
Unknown or missing	26 (7)	11 (6)	11 (6)
Educational level			
Postsecondary	224 (60)	114 (61)	110 (59)
High school or less	149 (40)	73 (39)	76 (41)
Missing	11 (3)	4 (2)	7 (4)
Yearly income, $			
>50 000	159 (48)	84 (51)	75 (46)
<50 000	171 (52)	82 (49)	89 (54)
Environment			
Rural (RUCA code 4-10)	193 (50)	79 (41)	114 (59)
Urban (RUCA code 1-3)	191 (50)	112 (59)	79 (41)
Employment			
Employed	160 (43)	84 (45)	76 (41)
Unemployed	210 (57)	102 (55)	108 (59)
Missing	14 (4)	5 (3)	9 (5)
Disability insurance	107 (28)	51 (27)	56 (29)
Relationship status			
Married	238 (64)	117 (64)	121 (64)
Unmarried	135 (36)	66 (36)	69 (36)
Missing	11 (3)	8 (4)	3 (2)
Fibromyalgia measures			
Fibromyalgia impact (FIQR, scale of 0-100) score, mean (SD)[b]	57.4 (17.4)	57.5 (17.3)	57.2 (17.5)
Widespread pain score (WPI, scale of 0-19), mean (SD)[b]	9.3 (4.0)	9.2 (4.1)	9.4 (4.0)
Somatic symptoms score (SSS, scale of 0-12), mean (SD)[b]	7.5 (2.3)	7.5 (2.4)	7.5 (2.1)
PSD score (scale of 0-31), mean (SD)[b]	16.9 (5.3)	16.8 (5.6)	17.1 (5.0)
Fibromyalgia positive[c]	286 (74)	139 (73)	147 (76)
Pain duration, median (IQR), y[b]	11.2 (5.9-20.5)	11.0 (5.9-20.0)	11.4 (5.9-21.0)

(continued)

Table 1. Baseline Characteristics of the Study Participants (continued)

Characteristic	No. (%) of participants[a]		
	Total (N = 384)	PT-TENS (n = 191)	PT only (n = 193)
Baseline measures of outcome variables, mean (SD)			
MEP (NRS, scale of 0-10)[b]	5.6 (2.2)	5.5 (2.1)	5.6 (2.3)
Pain at rest (NRS, scale of 0-10)[b]	5.4 (2.0)	5.5 (2.0)	5.9 (1.7)
Pain interference (BPI, scale of 0-10)[b]	6.1 (2.1)	6.2 (2.1)	6.0 (2.1)
Pain severity (BPI, scale of 0-10)[b]	5.9 (1.7)	5.8 (1.8)	5.9 (1.7)
Global Fatigue Index (MAF, scale of 0-10)[b]	33.9 (9.3)	34.2 (9.1)	33.7 (9.6)
Fatigue at rest (NRS, scale of 0-10)[b]	5.9 (2.3)	5.8 (2.3)	5.9 (2.3)
Fatigue with movement (NRS, scale of 0-10)[b]	6.0 (2.3)	6.0 (2.3)	6.0 (2.2)
Sleep (PROMIS, T score)[b]	56.3 (4.2)	56.3 (4.1)	56.2 (4.3)
Sleep duration (PROMIS, hours)[b]	6.2 (1.8)	6.2 (1.8)	6.2 (1.8)
Pain catastrophizing (PCS, scale of 0-52)[b]	23.6 (14.2)	23.8 (14.5)	23.5 (13.8)
Depression (PHQ-8, scale of 0-24)[b]	10.8 (5.6)	11.0 (6.0)	10.5 (5.2)
Anxiety (GAD-7, scale of 0-21)[b]	8.0 (5.9)	8.1 (6.2)	7.9 (5.6)
Activity average (PSFS, scale of 0-10)[d]	4.4 (2.5)	4.7 (2.6)	4.1 (2.4)
Physical function (PROMIS, T score)[d]	32.8 (3.9)	32.8 (4.0)	32.9 (3.9)
Aerobic activity (RAPA 1, scale of 1-7)[d]	3.7 (1.2)	3.8 (1.2)	3.5 (1.2)
Strength and flexibility (RAPA 2, scale of 1-3)[d]	1.4 (1.2)	1.5 (1.2)	1.3 (1.2)
Concomitant medications (take regularly, at least 5 d/wk)			
Acetaminophen	86 (23)	38 (21)	48 (26)
NSAIDs	107 (29)	54 (29)	53 (28)
Opioid	47 (13)	19 (10)	28 (15)
Gabapentin or pregabalin	117 (32)	55 (30)	62 (34)
Antidepressant	188 (51)	92 (51)	96 (52)
Antianxiety or sleeping medication	110 (30)	49 (27)	61 (32)
Muscle relaxants	84 (23)	43 (23)	41 (22)
Marijuana or cannabidiol	45 (12)	27 (15)	18 (10)
No prescription medications	51 (14)	26 (14)	25 (14)
Substance use (daily or almost daily in the last 12 mo [TAPS 1])			
Tobacco	54 (14)	26 (14)	28 (15)
Drinking 4 to ≥5 d/wk	57 (15)	28 (14)	29 (15)
Marijuana or cannabidiol	26 (7)	14 (7)	12 (6)
Prescription misuse	14 (4)	5 (3)	9 (5)

Abbreviations: BPI, Brief Pain Inventory; FIQR, Fibromyalgia Impact Questionnaire Revised; GAD 7, Generalized Anxiety Disorder 7; FIQR, Fibromyalgia Impact Questionnaire Revised; MAF; Multidimensional Assessment of Fatigue; MEP, movement-evoked pain; NRS, numeric rating scale; NSAIDs, nonsteroidal anti-inflammatory drugs; PCS, Pain Catastrophizing Scale; PHQ-8, Personal Health Questionnaire 8; PROMIS, Patient-Reported Outcomes Measurement Information System; PSD, Polysymptomatic Distress Scale; PT, physical therapy; PT-TENS, PT plus transcutaneous electrical nerve stimulation; SSS, Symptom Severity Scale; PSFS, Patient-Specific Functional Scale; RAPA, Rapid Assessment of Physical Activity; RUCA, Rural-Urban Commuting Area; TAPS, tobacco, alcohol, prescription medication, and other substance use; WPI, Widespread Pain Index.

[a] Unless otherwise indicated.

[b] Higher score indicates worse.

[c] Baseline demographics for fibromyalgia-positive and fibromyalgia negative are in eTable 1 in Supplement 2.

[d] Higher score indicates better.

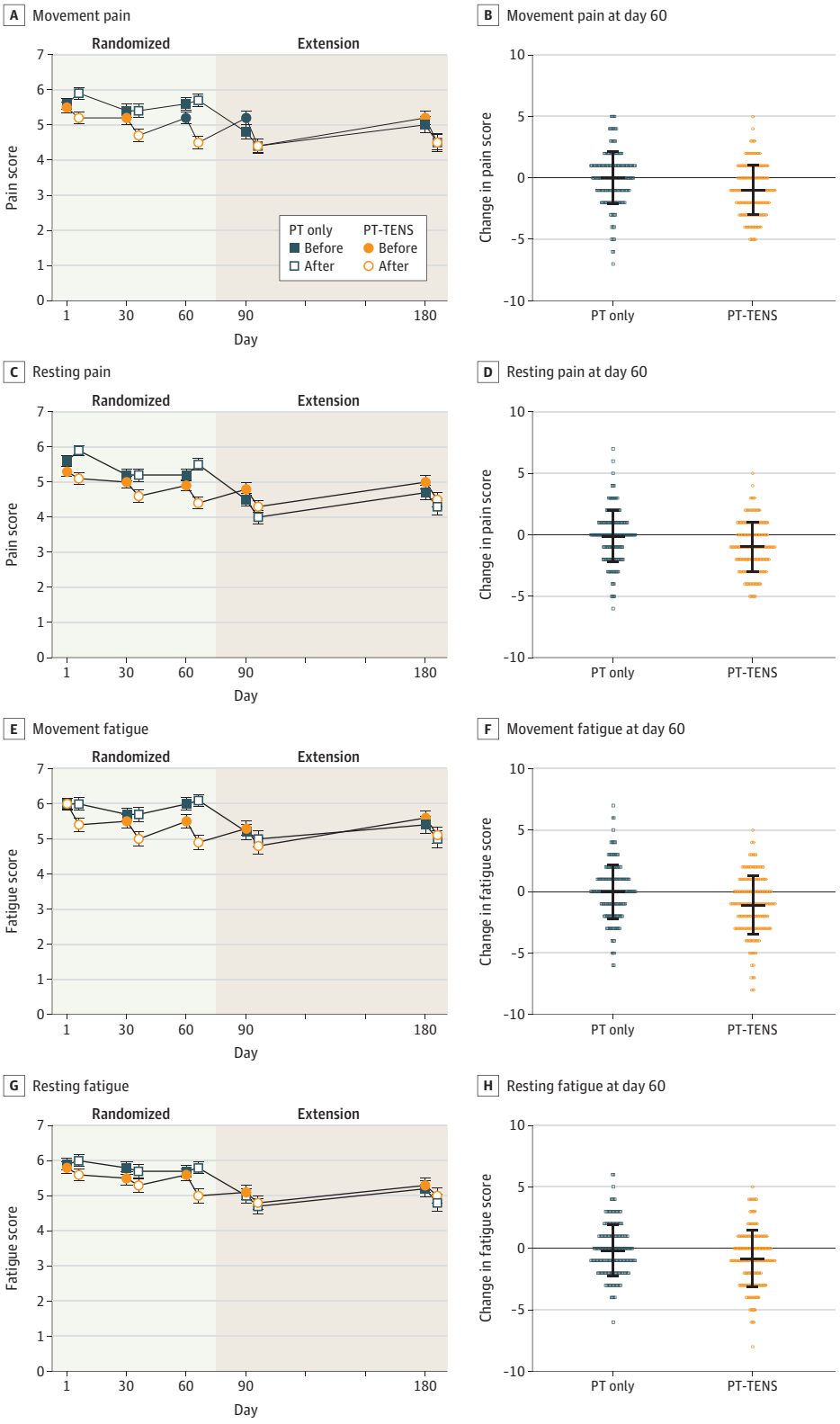
180 during TENS treatment in the PT-only group compared with day 60 (Figure 2; eTable 5 in Supplement 2). A dose-dependent effect was observed with those who used TENS at the study-defined minimally effective dose through day 60 presenting the greatest decrease in movement-evoked pain followed by those who used the minimally effective dose for only the first 30 days ($F_{3,328}$ = 9.05; P = .001) (**Figure 3**A; eFigure 1 and eTable 6 in Supplement 2).

Secondary Outcomes

Pain

Resting pain was significantly lower during TENS on day 60 in the PT-TENS group when compared with the PT-only group (Figure 2B and Table 2). Compared with baseline, resting pain was lower during TENS treatment by day 30 and remained reduced through day 180. Pain interference was lower in the PT-TENS group (mean [SD] score, −0.9 [1.9]) compared with the PT-only group (mean

Figure 2. Changes in Movement-Evoked Pain, Resting Pain, Movement-Evoked Fatigue, and Resting Fatigue Before and During Transcutaneous Electrical Nerve Stimulation (TENS) Through Day 180



Line graphs show the mean (SEM) data before and after 30-minute application of TENS on each day while the TENS unit was on. The physical therapy (PT)–only group tested all measures before and after 30 minutes of rest on each day through day 60 (randomized phase) and before and after 30 minutes of TENS during the extension phase on days 90 and 180 while the TENS unit was on. The scatterplot shows individual-level data for the difference score on day 60 with means (SDs) for the physical therapy (PT)–only and PT-TENS groups. Data were measured on a scale of 0 to 10. For pain, 0 indicated no pain and 10 indicated worst pain imaginable. For fatigue, 0 indicated no fatigue and 10 indicated worst fatigue imaginable. Lower scores were observed in all measures after 30 minutes of TENS treatment for both pain and fatigue beginning on day 30 and persisting through day 180 for the PT-TENS group. There was no change in the measures for the PT-only group during the first 60 days. However, after receiving TENS, lower scores were observed in all measures after 30 minutes of TENS for the PT-only group on days 90 and 180 test while the TENS unit was on. Effect sizes were moderate for the difference in movement-evoked pain (d = 0.46), resting pain (d = 0.44), movement-evoked fatigue was (d = 0.48), and resting fatigue (d = 0.32). Error bars indicate SDs or SEMs.

[SD] score, −0.3 [1.6]; *P* = .004). A dose-response effect was observed for resting pain (eTable 5 in Supplement 1). Continued use of TENS for 6 months in the PT-TENS group resulted in significant improvements in multiple pain measures at day 180 (Table 2; eTable 5 in Supplement 2). After the PT-only group started using TENS, there were also significant improvements in multiple pain measures (Table 2; eTable 5 in Supplement 2).

Fatigue

Movement-evoked and resting fatigue on day 60 were significantly lower in the PT-TENS group compared with the PT-only group and remained lower through day 180 (Figure 2C-D and Table 2). In the PT-only group, movement-evoked and resting fatigue were lower during TENS treatment on days 90 and 180 (eTable 5 in Supplement 2; within-group comparison). There was an observed dose-response effect of TENS on movement-evoked and resting fatigue (eTable 6 in Supplement 2). Global fatigue (multidimensional assessment of fatigue) was also significantly lower in the PT-TENS group on day 60 and for both the PT-TENS and PT-only group on day 180 (Table 2; eTable 5 in Supplement 2).

Disease Impact

Disease impact (FIQR) was lower in the PT-TENS group on day 60 by a mean of −4.1 (95% CI, −7.0 to −1.1; *P* = .009) compared with the PT-only group and remained lower through day 180. Disease impact was also lower in the PT-only group during the extension phase (eTable 5 in Supplement 2).

Table 2. Primary and Secondary Outcomes Difference Scores in the Intention-to-Treat Analysis

	Baseline to day 60 difference, mean (95% CI)		PT-TENS vs PT only (day 60)	
Outcome	PT-TENS (n = 191)	PT-only (n = 193)	Group difference, mean (95% CI)	*P* value
Primary outcomes				
Movement-evoked pain (scale of 0-10)[a]	−1.0 (−1.4 to −0.7)	0.0 (−0.3 to 0.3)	−1.2 (−1.6 to −0.7)	<.001
Secondary outcomes				
Fibromyalgia impact (FIQR, scale of0-100)[a]	−7.3 (−9.4 to −5.2)	−2.9 (−4.7 to −1.0)	−4.1 (−7.0 to −1.1)	.009
Resting pain (scale of 0-10)[a]	−1.0 (−1.3 to −0.7)	−0.1 (−0.4 to 0.2)	−1.0 (−1.4 to −0.5)	<.001
Pain severity (BPI, scale of 0-10)[a]	−0.4 (−0.7 to −0.2)	−0.3 (−0.5 to −0.0)	−0.3 (−0.6 to 0.0)	.070
Pain interference (BPI, scale of 0-10)[a]	−0.9 (−1.2 to −0.6)	−0.3 (−0.5 to −0.0)	−0.7 (−1.1 to −0.2)	.004
Movement-evoked fatigue (scale of 0-10)[a]	−1.1 (−1.5 to −0.7)	0.0 (−0.3 to 0.3)	−1.2 (−1.7 to −0.6)	<.001
Resting fatigue (scale of 0-10)[a]	−0.8 (−1.2 to −0.5)	−0.1 (−0.4 to 0.2)	−0.8 (−1.3 to −0.2)	.006
Global Fatigue Index (MAF, scale of 1-50)[a]	−3.2 (−4.6 to −1.8)	−0.9 (−2.1 to 0.2)	−1.9 (−3.8 to 0.0)	.05
Aerobic activity (RAPA 1, scale of 1-7)[b]	0.1 (−0.1 to 0.3)	0.2 (0.0 to 0.4)	0.1 (−0.2 to 0.4)	.48
Fibromyalgia impact (FIQR, scale of 0-100)[a]	0.3 (0.1 to 0.4)	0.4 (0.2 to 0.6)	−0.0 (−0.3 to 0.2)	.79
HEAL and exploratory outcomes				
Sleep (PROMIS, T score)[b]	0.2 (−0.5 to 0.9)	0.1 (−0.5 to 0.8)	0.3 (−0.6 to 1.1)	.51
Sleep duration (PROMIS), h[a]	0.1 (−0.1 to 0.3)	−0.2 (−0.4 to 0.1)	0.4 (0.1 to 0.7)	.03
Pain catastrophizing (PCS, scale of 0-52)[a]	−3.2 (−4.7 to −1.6)	−2.3 (−3.8 to −0.9)	−0.5 (−2.9 to 2.0)	.70
Depression (PHQ-8, scale of 0-24)[a]	−1.3 (−1.9 to −0.6)	0.0 (−0.6 to 0.7)	−1.3 (−2.2 to −0.3)	.01
Anxiety (GAD-7, scale of 0-21)[a]	−0.6 (−1.2 to 0.0)	−0.2 (−0.8 to 0.4)	−0.5 (−1.3 to 0.4)	.28
Activity average (PSFS, scale of 0-10)[b]	0.8 (0.3 to 1.2)	0.9 (0.4 to 1.4)	0.1 (−0.8 to 0.9)	.91
Physical function (PROMIS, T score)[b]	0.8 (0.3 to 1.3)	0.2 (−0.2 to 0.6)	0.6 (−0.1 to 1.2)	.09

Abbreviations: BPI, Brief Pain Inventory; FIQR, Fibromyalgia Impact Questionnaire Revised; GAD 7, Generalized Anxiety Disorder 7; HEAL, Helping to End Addiction Long-Term; MAF, Multidimensional Assessment of Fatigue; MEP, movement-evoked pain; NRS, numeric rating scale; PCS, Pain Catastrophizing Scale; PHQ-8, Personal Health Questionnaire 8; PROMIS, Patient-reported outcomes measurement information system; PSD, Polysymptomatic Distress Scale; PSFS, Patient-Specific Functional Scale; PT, physical therapy; PT-TENS, PT plus transcutaneous electrical nerve stimulation; RAPA, Rapid Assessment of Physical Activity; SSS, Symptom Severity Scale; WPI, Widespread Pain Index.

[a] Higher score indicates worse.

[b] Higher score indicates better

Patient Global Impression of Change

On day 60, a greater number of participants in the PT-TENS group reported improvement (120 [72%]) compared with the PT-only group (86 [51%]) (χ^2 = 16.7, *P* = .001) (Figure 3B). This effect remained for the PT-TENS group at day 180 (96 [67%]) and was similar to the PT-only group after using TENS in the extension phase (98 [77%]). Table 2 and eTable 5 in Supplement 1 detail the effects of TENS on additional psychological and functional measures.

Responder Analysis

The PT-TENS group had more responders for movement-evoked pain (66 of 161 [41%]) compared with the PT-only group (22 of 169 [13%], χ^2 = 32.0, *P* < .001). In addition, there were more responders for resting pain in the PT-TENS group (65 of 166 [41%]) compared with the PT-only group (37 of 172 [21%], χ^2= 12.5, *P* = .004).

Participant Experiences With TENS

On day 180 we asked participants about their experience with TENS. Of the 268 respondents, 217 (81%) said they found TENS helpful, 147 (55%) used TENS daily, and 66 (25%) used TENS at least once per week (eTable 7 in Supplement 2).

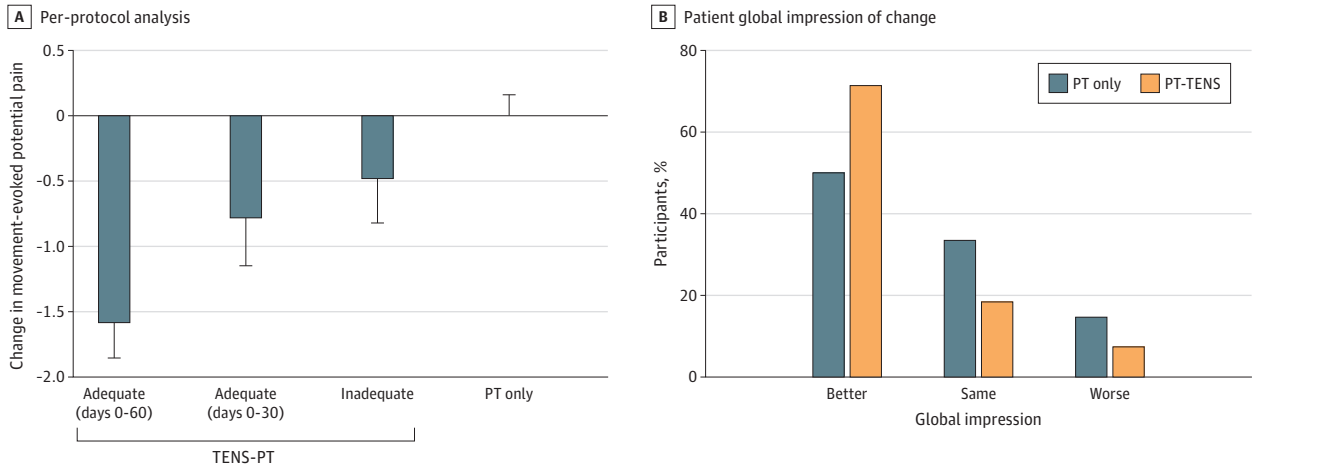
Adverse Events

During the entire reporting period (6 months for PT-TENS and 4 months for PT only), there were no serious adverse events related to TENS. Minor adverse events included pain with TENS (27 [7.5%]), skin irritation with electrodes (24 [6.7%]), itchiness with TENS (22 [6.1%]), anxiety with TENS (15 [4.2%]), and nausea with TENS (4 [1.1%]) (eTable 8 in Supplement 2). Adverse events unrelated to TENS are given in eTable 9 in Supplement 2.

Discussion

To our knowledge, this is the first trial of TENS for fibromyalgia in a clinical setting. The findings demonstrate effectiveness of this nonpharmacological intervention in reducing movement-evoked

Figure 3. Movement-Evoked Pain and Patient Global Impression of Change



Bar graph showing a dose-response effect in the per protocol analysis for change in movement-evoked pain from baseline to day 60 during the randomized phase. An adequate dose of transcutaneous electrical nerve stimulation (TENS) was defined as 8 times per month and 900 minutes per month. Movement-evoked pain decreased the most in those who used an adequate dose of TENS for the first 60 days (n = 76) followed by those who used an adequate dose for only the first 30 days (n = 30). Minimal changes in movement-evoked pain were observed for those who used less than an adequate dose of TENS throughout the 60-day period (n = 52). For comparison, the group who did not receive TENS (physical therapy [PT]–only group, n = 171) showed no change in pain. B. Bar graph showing results of the Patient Global Impression of Change on day 60 for the PT-only and PT-TENS groups. More respondents reported improvement in the PT-TENS group when compared with the PT-only group.

pain and suggest that the benefits of TENS are clinically meaningful in this population. Reductions in movement-evoked pain show a group difference of 1.2 of 10, with the clinically important change for movement-evoked pain reported as 1.1 (of 10).[25] There were clinically significant improvements in other measures, including resting pain, pain interference, movement-evoked fatigue, resting fatigue, and fibromyalgia impact (FIQR), during the randomized phase. Similar reductions in pain and fatigue were observed in the PT-only group after starting TENS in the extension phase, typically after PT had been completed. The effectiveness of TENS occurred within 30 days and was sustained for 6 months. There was a dose-response effect for TENS with greater use associated with greater pain reductions. Forty-one percent of participants in the PT-TENS group achieved a 30% or greater reduction in movement-evoked pain, which is considered a clinically meaningful change for pain[25-27] and moderately important by the consensus group Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT). Most individuals using TENS reported improvement (Patient Global Impression of Change). Lastly, most participants who completed the study found TENS helpful and still used TENS at least weekly. Thus, multiple lines of evidence support that TENS produces a clinically meaningful reduction in movement-evoked pain and other fibromyalgia symptoms, especially when provided at an adequate dose.

Clinical guidelines for fibromyalgia recommend treatment approaches specific to the individual, beginning with nonpharmacological therapies, particularly exercise, and progressing to pharmacological therapies, depending on patient response and disease severity.[10,28] Systematic reviews[29-31] show small-moderate effect sizes for aerobic exercise in reducing pain and fatigue (d = 0.31 for pain *and* 0.22 for fatigue; n = 27 randomized clinical trials) and moderate-large effects for function (d = 0.66-0.55). More recently, in individuals with fibromyalgia, lower disease impact (FIQR)[32,33] was observed following tai chi when used clinically as a mind-body intervention, and lower pain interference[34] was observed after transcutaneous direct current stimulation (d = 0.73) when combined with education and exercise. These studies[35-37] support the use of activity-based interventions in treatment of fibromyalgia and suggest that combining interventions may improve effect sizes.

Due to the heterogenous nature of fibromyalgia, treatment often requires a multidisciplinary approach and is recommended in clinical guidelines.[38] In the current study, most patients were already receiving pharmacological therapies and in the randomized phase received PT; thus, TENS was able to provide additional relief beyond that experienced with other interventions. We propose that TENS could be particularly useful as part of a multidisciplinary approach to provide a self-management tool that uniquely targets movement-evoked pain and fatigue, which are significant barriers to participation in exercise and daily activities.[18-20]

The current pragmatic cluster trial builds on FAST,[23] with both trials showing a reduction in movement-evoked pain with TENS in individuals with fibromyalgia. Although FAST showed efficacy of TENS in reducing pain against placebo and no TENS under ideal conditions, FM-TIPS shows effectiveness in a clinical setting. When compared with the group not receiving TENS, the effect size for the change in pain in FM-TIPS (d = 0.46) was lower than that from FAST (d = 0.82). These differences in effect sizes could be due to less stringent exclusion criteria, addition of physical therapy to all groups, or greater comorbidities in the current study. Indeed, it is generally expected that pragmatic trials have lower effect sizes than explanatory trials primarily due to the less controlled nature of the trial, including greater heterogeneity in participants, clinics, interventions, and concomitant treatments[39] and less control over adherence to the intervention.[40] Importantly, FM-TIPS recruited individuals from diverse backgrounds across a range of socioeconomic and educational levels and both rural and urban environments and only excluded those with contraindications to, or prior use of, TENS. Thus, results from the current pragmatic trial are applicable to a wide range of individuals with fibromyalgia.

Strengths and Limitations

The study's strengths include a large and diverse sample recruited from 28 outpatient physical therapy clinics across 6 health care systems located in both rural and urban environments. Most of

the more than 100 physical therapists who provided TENS and PT interventions had minimal to no experience with research yet were engaged in the study. The trial focused on movement-evoked pain, a substantial concern and barrier to participation in an effective exercise program and daily activities,[41-43] which is not tested and targeted by currently available treatments. Together, these trial characteristics enhance the pragmatic nature of the trial and generalizability of the results.

The study also has limitations. We were unable to evaluate treatment effects on medication changes because electronic health records from PT clinics do not collect this information. Although we recruited individuals from racial and ethnic minority populations, these numbers were lower than the national average,[44,45] which are likely related to the high recruitment we achieved of Midwest rural participants where populations of races other than White are lower (<5% Hispanic and <3% African American).[46] Surprisingly, there was no significant effect of routine PT in individuals with fibromyalgia, which could be because only 69 of the 384 participants (18%) were referred to PT for fibromyalgia, and thus PT treatment may not have been directed toward fibromyalgia symptoms, limited insurance coverage for PT, adverse socioeconomic conditions, or poorer health.[47,48]

Conclusions

The current study found clinically meaningful changes in pain, fatigue, and disease impact with TENS in individuals with fibromyalgia. TENS produced effects quickly, remained effective through 6 months, and continued to be helpful to most study participants. Importantly, the effect size observed in the clinical setting is similar to currently recommended pharmaceutical treatments and exercise, which were tested in more controlled conditions.[49-55] Thus, TENS should be considered as a safe treatment option for fibromyalgia.

ARTICLE INFORMATION

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Supervision: Donatelle, Kepros, Ecklund, Koepp, Bayman, Crofford, Sluka.

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Group Information: The Clinician Group members appear in Supplement 3.

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Data Sharing Statement: See Supplement 4.

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SUPPLEMENT 1.

Trial Protocol and Statistical Analysis Plan

SUPPLEMENT 2.

eMethods. Additional methods
eTable 1. Demographic and outcome data for those meeting and not meeting the ACR Diagnostic Criteria
eTable 2. Cluster-level consort information
eTable 3. Results of different imputation methods on movement-evoked pain
eTable 4. Sensitivity analysis for those who met the fibromyalgia diagnostic criteria (fibromyalgia-positive) and those who did not meet criteria at baseline (fibromyalgia-negative).
eTable 5: Sustained effect of TENS use in fibromyalgia
eTable 6. Per protocol analysis
eTable 7. Participant experience with TENS
eTable 8. Adverse events (AE) related to TENS
eTable 9. Adverse events unrelated to TENS
eFigure. Per protocol analysis
eReferences

SUPPLEMENT 3.

Clinician Group Members

SUPPLEMENT 4.

Data Sharing Statement

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

Top-Level Results

- Primary outcome: Pain impact scores were not significantly different from usual care after 6 weeks of acupuncture or guided relaxation interventions
- Secondary outcomes:
  - Pain catastrophizing and anxiety were lower in the acupuncture group compared to usual care at 6 weeks
  - SMART dynamic treatment regimens assessed at 12 weeks resembled 6-week outcomes

Lessons Learned

- Engagement with acupuncture and guided relaxation limited the ability to detect larger effects
- High rates of emergency department visits and hospitalizations observed underscore the clinical instability of adults with sickle cell disease

Future Plans

- Sharing results with participants, sickle cell disease support groups, and participating healthcare systems

GRACE TRIAL

Non-pharmacological Options in postoperative Hospital-based and Rehabilitation pain Management (NOHARM)

Top-Level Results

- Primary outcome: No difference in pain interference or physical function
- Secondary/exploratory outcomes:
  - Lower opioid use (MME) during intervention
  - No difference in health service utilization

Lessons Learned

- EHR infrastructure can deliver individualized preference-aligned guidance at scale
- Workflow variation across user groups necessitates tailored implementation and analytic adjustment
- High clinician appetite for low-burden EHR solutions that advance care standards
- High patient engagement (~90%) with interactive portal education and preference elicitation tools

Future Plans

- Primary/secondary outcomes; planned mediator and moderator analyses (Native American, cancer survivor, and rural subgroups); predictors of engagement
- Presentations at national meetings and stakeholder forums
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Personalized Patient Data and Behavioral Nudges to Improve Adherence to Chronic Cardiovascular Medications
A Randomized Pragmatic Trial

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IMPORTANCE Poor medication adherence is common. Text messaging is increasingly used to change patient behavior but often not rigorously tested.

OBJECTIVE To compare different types of text messaging strategies with usual care to improve medication refill adherence among patients nonadherent to cardiovascular medications.

DESIGN, SETTING, AND PARTICIPANTS Patient-level randomized pragmatic trial between October 2019 to April 2022 at 3 US health care systems, with last follow-up date of April 11, 2023. Adult (18 to <90 years) patients were eligible based on diagnosis of 1 or more cardiovascular condition(s) and prescribed medication to treat the condition. Patients who did not opt out and had a 7-day refill gap were randomized to 1 of 4 study groups.

INTERVENTION(S) Generic text message refill reminders (generic reminder); behavioral nudge text refill reminders (behavioral nudge); behavioral nudge text refill reminders plus a fixed-message chatbot (behavioral nudge + chatbot); usual care.

MAIN OUTCOMES AND MEASURES Primary outcome was refill adherence based on pharmacy data using proportion of days covered at 12 months. Secondary outcomes were clinical events of emergency department visits, hospitalizations, and mortality.

RESULTS Among 9501 enrolled patients, baseline characteristics across the 4 groups were comparable (mean age, 60 years; 47% female [n = 4351]; 16% Black [n = 1517]; 49% Hispanic [n = 4564]). At 12 months, the mean proportion of days covered was 62.0% for generic reminder, 62.3% for behavioral nudge, 63.0% for behavioral nudge + chatbot, and 60.6% for usual care (P = .06). In adjusted analysis, when compared with usual care, mean proportion of days covered was 2.2 percentage points (95% CI, 0.3-4.2; P = .02) higher for generic reminder, 2.0 percentage points (95% CI, 0.1-3.9; P = .04) higher for behavioral nudge, and 2.3 percentage points (95%, 0.4-4.2; P = .02) higher for behavioral nudge + chatbot, none of which were statistically significant after multiple comparisons correction. There were no differences in clinical events between study groups.

CONCLUSIONS AND RELEVANCE Text message reminders targeting patients who delay refilling their cardiovascular medications did not improve medication adherence based on pharmacy refill data or reduce clinical events at 12 months. Poor medication adherence may be due to multiple factors. Future interventions may need to be designed to address the multiple factors influencing adherence.

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Supplemental content

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Mobile health technologies are increasingly used in health care but often not rigorously tested to assess effectiveness. Text messaging is a form of mobile health communication technology shown to improve health care behaviors such as diabetes self-management.[1-4] Text messages can be augmented with chatbots that can facilitate interactive conversations with patients and/or brief behavioral interventions that nudge patients to improve health behaviors.[5-7] However, it is unclear if adding behavioral nudges or chatbots to generic text messages can further enhance the impact.

Poor medication adherence is common among patients with chronic diseases requiring daily medications. Nonadherence to chronic cardiovascular medications has been associated with increased adverse outcomes, including hospitalization and mortality.[8,9] Text messaging adherence interventions have generally used generic messages and reminded patients prior to the medication refill due date. This may lead to message overload, given the ubiquity of texting within and outside of health care settings. It is unknown if reminders targeting patients identified as nonadherent can be more effective.

This was a pragmatic patient-level randomized trial across 3 diverse health care systems to improve refill adherence among patients nonadherent to their chronic cardiovascular medications. The study hypothesis was that generic text message reminders would improve refill adherence compared with usual care and that incorporating behavioral nudges and a chatbot to address common medication adherence barriers would further improve refill adherence. The study assessed the effectiveness of these interventions on refill adherence using pharmacy refill data as well as clinical outcomes of emergency department visits, hospitalizations, and mortality.

Key Points

Question Can test message reminders improve medication adherence and clinical outcomes among patients nonadherent to cardiovascular medications?

Finding In a pragmatic randomized trial of 9501 patients at 3 US health care systems, the 3 text messaging medication refill reminder strategies tested (generic reminders, behavioral nudge reminders, and behavioral nudge reminders plus a fixed-message chatbot) did not increase refill adherence at 12 months or reduce clinical events.

Meaning Additional interventions need to be rigorously tested to try to improve adherence to chronic cardiovascular medications given the growing incidence of cardiovascular conditions.

Methods

Trial Design

This was a patient-level randomized pragmatic trial testing different text messaging strategies to improve refill adherence among patients with poor adherence to prescribed cardiovascular medicines. We conducted the study at 3 health care systems: Denver Health and Hospital Authority, a safety net hospital system in Denver County; Veterans Administration (VA) Eastern Colorado Health Care System, serving veterans in the Rocky Mountain region; and UCHealth's University of Colorado Hospital, an academic medical center. The study protocol is available in Supplement 1 and the statistical analysis plan in Supplement 2.

Participants

Inclusion and Exclusion Criteria

Potential eligible patients aged 18 years to less than 90 years were identified based on the presence of 1 or more cardiovascular condition (hypertension, hyperlipidemia, diabetes, coronary artery disease [CAD], or atrial fibrillation) as defined by diagnosis and procedural codes; they were prescribed 1 or more classes of medications to treat the condition within the prior 100 days.[10] Patients were excluded based on the following using electronic health record (EHR) data: (1) no landline or cell phone listed; (2) enrolled in hospice or palliative care; (3) non-English-speaking or non-Spanish-speaking; (4) home address outside of Colorado or homeless as defined in the EHR; or (5) current pregnancy. Race and ethnicity data were obtained from the EHR as recorded by each health system.

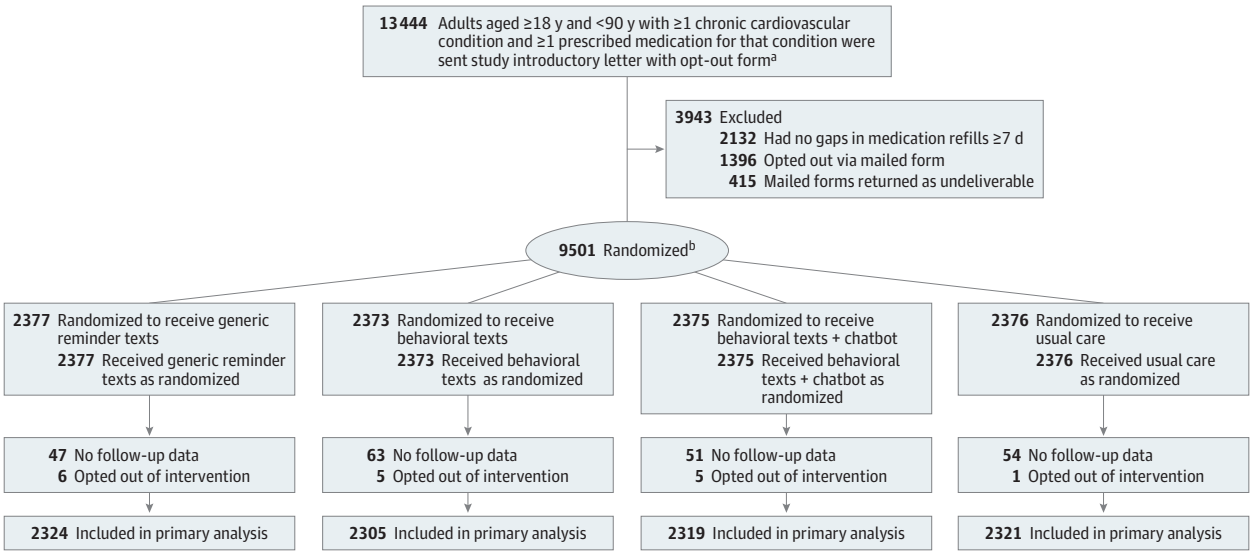
Potential eligible patients were mailed a study introduction letter and an opt-out form if the patient decided not to participate. Patients who did not return the opt-out form were monitored daily for a medication refill gap using pharmacy dispensing data. We determined if medications were available to a patient on a given day for each medication class based on prior fill days, number of days supplied, cancellation dates, and inpatient days in which medication would be supplied. Patients with a refill gap of at least 7 days for any of the cardiovascular medication classes of interest were randomized.

Interventions

Randomization was stratified by health care system and number of baseline medications and occurred in blocks of 4 patients within strata to ensure balance using an automated process. Once randomized, patients remained in the same study group for the entire study whether they had subsequent refill gaps. Patients were not blinded to their study group. The 4 study groups were (1) generic reminder text message (generic reminder; a text message reminder to refill medication with a refill gap); (2) behavioral nudge text (behavioral nudge; a text message reminder incorporating behavioral nudges to refill medication); (3) behavioral nudge text plus a fixed-message chatbot (behavioral nudge + chatbot; text message incorporating behavioral nudges plus a chatbot that engaged patients to assess common barriers to medication adherence using preprogrammed algorithms); and (4) usual care (patients did not receive text messages).[10]

Messages were delivered in either English or Spanish based on patients' language preference in the EHR and only delivered when patients have a refill gap of 7 days or longer, in

Figure 1. Patient Flow in a Study of Message Reminders to Improve Adherence to Chronic Cardiovascular Medications



[a]Study introductory letters were mailed to potentially eligible patients to provide information about the study as well as an opportunity to opt out if they chose not to participate.

[b]Randomization was stratified by health care system and number of baseline medications and occurred in blocks of 4 patients within strata to ensure balance across study groups using an automated process.

contrast to other medication refill reminders that are delivered prior to the refill due date. Patients were provided a secondary opportunity to change their default language via text messaging. Examples of English or Spanish messages are presented in eTable 1 in Supplement 3. Patients could opt out of the study by replying "STOP" to any text message. Refill reminder messages stopped once there was a pharmacy record denoting that the medication was refilled or the patient had replied "DONE." Patients could return the text message reminders with questions. Clinical pharmacists at each health system responded to clinical questions when appropriate.[11] For patients without cell phones (≈9% of patients), interactive voice response automated telephone calls delivered the same messages as texts.

Mobile Messenger (Upland Communications) was used to deliver the text messages. The study was deemed minimal risk, and a waiver of consent was obtained from the Colorado Multiple Institutional Review Board.

Outcomes

The primary outcome was refill adherence defined by proportion of days covered (PDC) in the 365 days following randomization for all medication classes identified with a refill gap at baseline. In secondary analysis, we assessed median gap lengths among enrolled patients for the medications in which the patient had a refill gap by evaluating the time from enrollment (start of initial gap[s]) to the first fill, right-censoring at death or end of follow-up. In a further analysis, all subsequent gaps after enrollment were also considered, treating each individual medication class gap as a unique time-to-event record. PDC describes overall medication availability, while gap length describes more direct effects of the intervention in terms of patients' responses to refill reminders. Secondary outcomes include time to clinical events defined by emergency department visits, hospitalizations, and mortality, measured as time from enrollment to the first event.

Sample Size

We estimated that a total sample size of 476 patients was needed to detect a 10-percentage point difference in PDC, accounting for multiple comparisons across the 4 study groups with 80% power. We enrolled 9501 patients across the 3 health care systems, which was a significantly greater number for several reasons: (1) to have sufficient sample size to detect a smaller difference in overall PDC and within specific subgroups; (2) to test the impact of an opt-out approach on patient enrollment, particularly among patients traditionally underrepresented in clinical trials given the minimal-risk study; (3) the study was funded as part of the National Institutes of Health Pragmatic Trials Collaboratory, where there is interest in implementing cost-effective, large-scale research studies that engage health care systems; and (4) sample size considerations were discussed and approved by our data and safety monitoring board and funder (National Heart, Lung, and Blood Institute).

Statistical Methods

PDC was calculated for each month in the 12 months following enrollment among all medication classes identified as gapping at baseline. Patients active on multiple study medication classes had all combinations of follow-up days for all baseline medications counted in the denominator, and days adherent were counted in the numerator. We analyzed this

Table 1. Baseline Characteristics of Study Population

Characteristic	No. (%)			
	Generic reminder texts (n = 2324)	Behavioral nudge texts (n = 2305)	Behavioral nudge + chatbot texts (n = 2319)	Usual care texts (n = 2321)
Health care system				
Denver Health	1786 (77)	1781 (77)	1775 (77)	1785 (77)
UCHealth	239 (10)	225 (10)	240 (10)	235 (10)
VA	299 (13)	299 (13)	304 (13)	301 (13)
Demographics				
Age, mean (SD), y	59.9 (12.5)	60 (12.9)	60.1 (12.7)	60.1 (12.6)
Sex				
Female	1087 (47)	1075 (47)	1101 (47)	1088 (47)
Male	1237 (53)	1230 (53)	1218 (53)	1233 (53)
Race[a]	2056 (88)	2067 (89)	2070 (89)	2066 (89)
American Indian or Alaska Native	22 (1)	27 (1)	23 (1)	35 (2)
Asian	29 (1)	31 (1)	21 (1)	29 (1)
Black or African American	391 (17)	378 (16)	356 (15)	392 (17)
Native Hawaiian/Pacific Islander	3 (<1)	2 (<1)	6 (<1)	3 (<1)
White	1601 (69)	1615 (70)	1646 (71)	1598 (69)
Multiple	10 (<1)	14 (1)	16 (1)	9 (<1)
Ethnicity[a]	2304 (99)	2288 (99)	2302 (99)	2299 (99)
Hispanic	1100 (47)	1147 (50)	1168 (50)	1149 (50)
Non-Hispanic	1204 (52)	1141 (50)	1134 (49)	1150 (50)
Preferred Spanish-language communication	619 (27)	650 (28)	682 (29)	654 (28)
Marital status	2311 (99)	2287 (99)	2302 (99)	2307 (99)
Married	994 (43)	940 (41)	980 (42)	950 (41)
Single	883 (38)	883 (38)	870 (38)	874 (38)
Divorced/widowed	434 (19)	464 (20)	452 (19)	483 (21)
Insurance	2201 (94)	2209 (95)	2189 (94)	2209 (95)
Medicare	853 (37)	878 (38)	860 (37)	889 (38)
Medicaid	659 (28)	632 (27)	629 (27)	665 (29)
Commercial	463 (20)	471 (20)	500 (22)	441 (19)
VA	8 (<1)	7 (<1)	8 (<1)	12 (1)
None	218 (9)	221 (10)	192 (8)	202 (9)
Medical history[b]				
Depression	421 (18)	463 (20)	442 (19)	416 (18)
Chronic kidney disease	191 (8)	202 (9)	203 (9)	189 (8)
Heart failure	160 (7)	199 (9)	163 (7)	171 (7)
Cerebrovascular disease	142 (6)	145 (6)	125 (5)	134 (6)
Posttraumatic stress disorder	118 (5)	114 (5)	102 (4)	108 (5)
Prior myocardial infarction	95 (4)	109 (5)	121 (5)	98 (4)
Substance abuse	89 (4)	101 (4)	116 (5)	88 (4)
Prior coronary revascularization	63 (3)	56 (2)	70 (3)	58 (2)
Qualifying condition(s)[c]				
Hypertension	1837 (79)	1829 (79)	1821 (79)	1864 (80)
Diabetes	1148 (49)	1164 (50)	1162 (50)	1149 (50)
Hyperlipidemia	1072 (46)	1052 (46)	1089 (47)	1054 (45)
Coronary artery disease	305 (13)	325 (14)	352 (15)	328 (14)
Atrial fibrillation	132 (6)	152 (7)	130 (6)	134 (6)
>1 Qualifying condition	1406 (60)	1390 (60)	1410 (61)	1438 (62)

(continued)

Table 1. Baseline Characteristics of Study Population (continued)

Characteristic	No. (%)			
	Generic reminder texts (n = 2324)	Behavioral nudge texts (n = 2305)	Behavioral nudge + chatbot texts (n = 2319)	Usual care texts (n = 2321)
Baseline medication classes[d]				
Active class(es)				
1	597 (26)	564 (24)	567 (24)	557 (24)
2	551 (24)	572 (25)	584 (25)	591 (25)
≥3	1176 (51)	1169 (51)	1168 (50)	1173 (51)
Medication class(es) with refill gap[e]				
1	1626 (70)	1604 (70)	1603 (69)	1635 (70)
2	449 (19)	464 (20)	455 (20)	437 (19)
≥3	249 (11)	237 (10)	261 (11)	249 (11)
Intervention delivery				
Text messages	2126 (91)	2089 (91)	2117 (91)	0
Interactive voice response telephone messages	198 (9)	216 (9)	202 (9)	0

Abbreviation: VA, Veterans Administration.

[a] Race and ethnicity categories were obtained from the electronic health record.

[b] Medical history was based on diagnosis and procedural codes.

[c] Qualifying conditions for patients were defined by specific cardiovascular diagnosis and procedural codes and prescription of 1 or more classes of medications to treat the cardiovascular condition of interest within the prior 100 days.

[d] Patients with eligible cardiovascular conditions were also required to be prescribed at least 1 class of medications to treat the cardiovascular condition (see eTable 5 in Supplement 3 for cardiovascular condition and classes of medications).

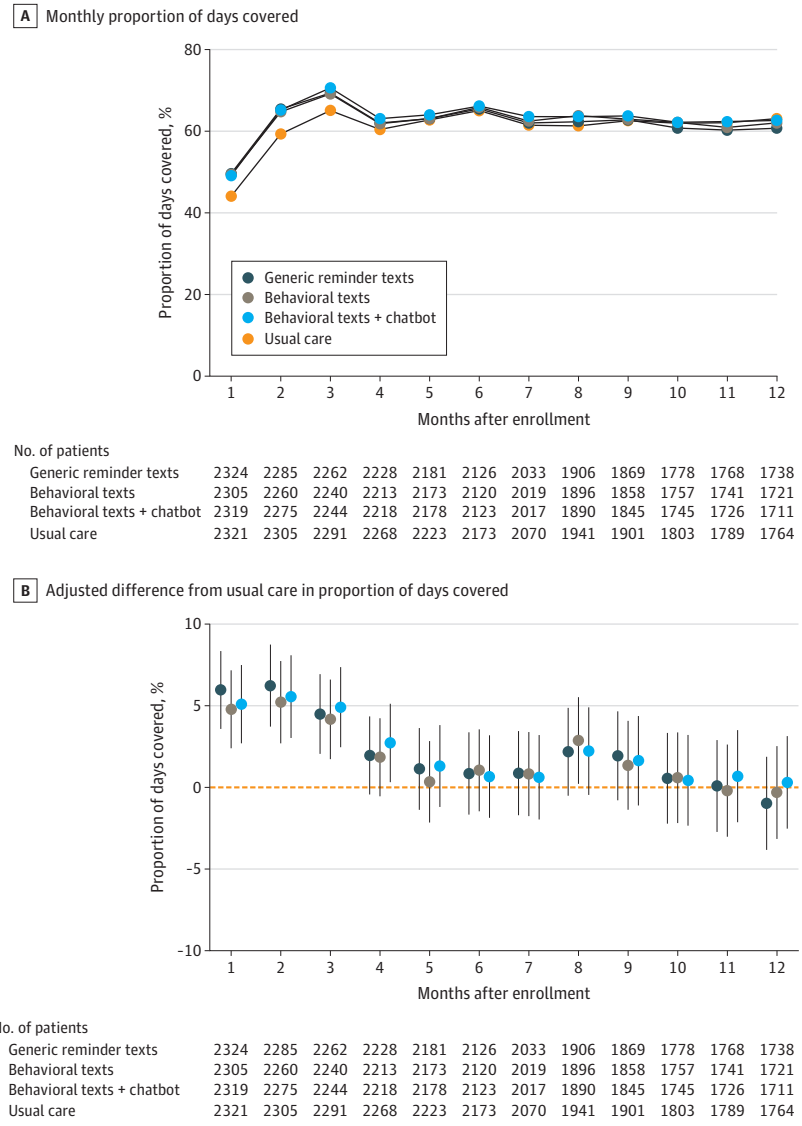
[e] Patients may have more than 1 medication class (eg, anticoagulant, statin, or oral hypoglycemic medications) in which they have a refill gap of 7 days or longer at baseline, which would make them eligible for the study. Patients with refill gaps in more than 1 medication class at baseline were only delivered 1 set of reminder messages to reduce the total number of messages received by the patient.

longitudinal data (up to 12 observations per patient) and estimated absolute differences in PDC between treatment groups and usual care using a generalized estimating equation (GEE) model with an identity link and independence with unequal variances for the covariance structure of the 12 observations, using the *geepack* package in R,[12-14] adjusting for the following variables: health care system; number of medications gapping at baseline; treatment group; follow-up month; patient demographics, including age, gender, race, ethnicity, insurance status, and marital status; and comorbidity variables including hypertension, hyperlipidemia, coronary artery disease, diabetes, atrial fibrillation, chronic heart failure, chronic kidney disease, cerebrovascular disease, prior myocardial infarction, prior revascularization, depression, posttraumatic stress disorder, and substance abuse. To account for potential data missing at random, observation-specific weights specific to each person-period were calculated using logistic regression to estimate the inverse probability that a longitudinal value was observed.[15] Logistic models included the same variables as the GEE models. Weights greater than the 95th percentile were truncated. A multistage gatekeeper approach was used to account for multiple treatment comparisons by comparing each of the 3 treatment groups with the usual care group in stage 1, using corrected thresholds for statistical significance of .05/3; if any test was significant, a significance level of (R/3) × (.05/3) using the Holm method was used for the 3 pairwise comparisons, where R is the number of significant stage 1 tests.[16]

Gap lengths (time to refill) and secondary outcome events were measured as time-to-event outcomes censored at 1 year, time of death, or early termination of follow-up due to opting out or site stoppages. For gap lengths, we first assessed each patient's time from the start of the initial enrollment gap(s) to the first of any medication fill across these classes. If no medication classes were filled, we used the maximum follow-up time across classes. As a secondary analysis, we looked at each gap after the initial enrollment gap(s) individually and assessed time from the start of the gap to a fill, treating each medication class/gap combination as a separate record. We plotted group differences with 1-year Kaplan-Meier curves and from these results summarized percentiles of gap lengths with medians and IQRs. Using 1000 bootstrapped estimates, we also presented the mean difference in median gap lengths between treatment groups and usual care, with 95% confidence intervals.

Last, subgroup analyses were performed using the weighted GEE for PDC and gap length approaches described earlier. Subgroups included health care system, qualifying conditions, gender, race, ethnicity, and Spanish as the primary language. For the qualifying condition subgroup analyses, we assessed only study medication classes related to the qualifying condition (eTable 6 in Supplement 3). When assessing patients with Spanish as the primary language, results were

Figure 2. Proportion of Days Covered



A, Proportion of days covered was calculated using all medication classes identified as gapping at baseline. Patients actively receiving multiple study medications had all combinations of follow-up days for all baseline medications counted in the denominator; days that medications were filled were counted in the numerator. Results were then presented, aggregated by month following enrollment for the initial enrollment gaps and any subsequent gaps. B, Adjusted difference from usual care in proportion of days covered, stratified by follow-up month.

limited to patients at Denver Health and UCHealth since all VA patients were considered English-speaking (a condition required for military service). In subgroup analyses, maximum follow-up at UCHealth was 7 months, due to problems with the pharmacy refill data at that site.

We carried out several sensitivity analyses for PDC based on different assumptions about medications that were never refilled, patient inclusion criteria, and which medication classes to include; sensitivity analyses for gap length were based on different assumptions about censored observations, as described in the eMethods in Supplement 3. These sensitivity analysis findings were consistent with the primary analysis results. Results are reported according to the CONSORT (Consolidated Standards of Reporting Trials) guideline.

All analyses were performed using R version 4.2.1 (R Foundation).

Results

A total of 9501 patients were enrolled between October 2019 to April 2022, with the last date of follow-up on April 11, 2023. After removing 232 patients without any follow-up data, 9269 patients comprised the analytic cohort and were evenly distributed across the 4 groups (**Figure 1**). Baseline characteristics across the 4 groups were comparable (**Table 1**). In general, the mean age was 60 years, with 47% female, 16% Black, 49% Hispanic, and 28% Spanish-speaking. In terms of the qualifying cardiovascular condition for the study, 79% of patients had hypertension, 46% had hyperlipidemia, 50% had diabetes, 14% had CAD, and 6% had atrial fibrillation. The majority of patients (51%) were prescribed at least 3 cardiovascular medication

Table 2. Differences in Mean Proportion of Days Covered From Usual Care

Primary analysis outcome	Unadjusted proportion of days covered, %[a]				Adjusted absolute difference (from usual care) in percentage points of the proportion of days covered[b]					
	Generic reminder text (n = 2324)	Behavioral nudge text (n = 2305)	Behavioral nudge text + chatbot (n = 2319)	Usual care (n = 2321)	Generic reminder text		Behavioral nudge text		Behavioral nudge text + chatbot	
					Difference (95% CI)	P value	Difference (95% CI)	P value	Difference (95% CI)	P value
3 Mo	61.4	61.1	61.6	56.2	5.6 (3.4-7.8)	<.001[c]	4.8 (2.5-7.0)	<.001[c]	5.2 (3.0-7.4)	<.001[c]
12 Mo	62.0	62.3	63.0	60.6	2.2 (0.3-4.2)	.02	2.0 (0.1-3.9)	.04	2.3 (0.4-4.2)	.02

[a] Unadjusted proportion of days covered was calculated using all medication classes identified as gapping at baseline. Patients active taking multiple study medications had all combinations of follow-up days for all baseline medications counted in the denominator and days that medications were filled counted in the numerator.

[b] Analyses adjusted for health care system, number of medications gapping at baseline, treatment group, follow-up month, patient demographics including age, gender, race, ethnicity, insurance status, marital status as well as comorbidity variables including hypertension, hyperlipidemia, coronary artery disease, diabetes, atrial fibrillation, chronic heart failure, chronic kidney disease, cerebrovascular disease, prior myocardial infarction, prior revascularization, depression, posttraumatic stress disorder, and substance abuse.

[c] Indicates significant result with adjusted level of significance (.05/3).

classes, and 70% of patients had a refill gap for only 1 class. Almost all (93.96%) study text messages were delivered successfully. If a message was returned as "undelivered," the text messaging system would send up to 3 more messages. Among enrolled patients, 38% responded in some way to the messages, with the 2 most common questions related to asking more information about the study and/or asking for the pharmacy refill line.

At 1 year, mean PDC was 62.0% for generic reminder, 62.3% for behavioral nudge, 63.0% for behavioral nudge + chatbot, and 60.6% for usual care (*P* = .06) (**Figure 2**). In adjusted analysis, mean PDC relative to usual care was 2.2 percentage points higher in the generic reminder group (95% CI, 0.3-4.2 [*P* = .02]), 2.0 percentage points higher in the behavioral nudge group (95% CI, 0.1-3.9 [*P* = .04]), and 2. 3 percentage points higher in the behavioral nudge + chatbot group (95% CI, 0.4-4.2; [*P* =.02]) (**Table 2**). Because comparisons were not significant using the adjusted level of significance of .05/3, no pairwise comparisons among intervention groups were performed. There were no differences in time to emergency department visits (log-rank *P* = .70), hospitalizations (log-rank *P* = .56), or death (log-rank *P* = .55) across study groups (**Figure 3**).

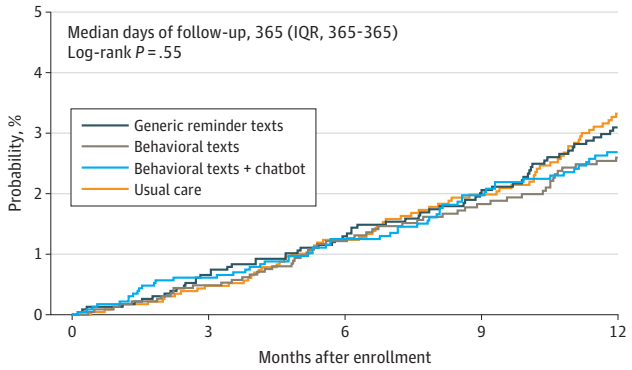
Consistent with the primary results, similar trends in treatment effect between the intervention groups relative to usual care were seen in key subgroups, including health systems (Denver Health and VA), qualifying cardiovascular conditions (diabetes, hyperlipidemia, and hypertension), and demographic characteristics (female sex, Hispanic ethnicity, and Spanish-speaking) (eFigure 3 in Supplement 3). In addition, these trends were consistent for cardiovascular conditions and medications generally for primary prevention (eg, hypertension) vs secondary prevention (eg, CAD).

Post Hoc Analysis

Given that most medication refills were 30 or 90 days following the initial delay, we conducted a post hoc analysis of the intervention effect on shorter-term adherence. At 3 months, mean PDC relative to usual care was 5.6 percentage points higher in the generic reminder group (95% CI, 3.4-7.8; *P* < .001), 4.8 percentage points higher in the behavioral nudge group (95% CI, 2.5-7.0; *P* < .001), and 5.2 percentage points higher in the behavioral nudge + chatbot group (95% CI, 3.0-7.4; *P* < .001) (Figure 2B and Table 2). Next, since the intervention targeted refill adherence delays, we also evaluated median gap lengths to assess whether the intervention reduced the number of days patients were without medications. The initial enrollment gaps were 9 days for the generic reminder group, 9 days for the behavioral nudge group, 10 days for the behavioral nudge + chatbot group, and 15 days for the usual care group (**Table 3**). The mean reduction in median initial refill gap length relative to usual care was 5 days for all 3 intervention groups (95% CI, 3-7 [*P* < .001] for generic reminder; 95% CI, 3-7 [*P* < .001] for behavioral nudge; 95% CI, 3-7 [*P* < .001] for behavioral nudge + chatbot). For all subsequent gaps, the median length for individual medication gaps was 20

Figure 3. Kaplan-Meier Rates for Secondary Clinical Outcomes Stratified by Treatment Group

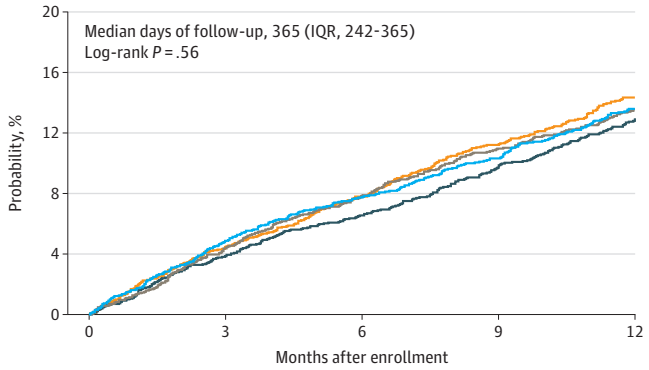
A Death



No. of patients

Generic reminder texts	2324	2249	2067	1811	1771
Behavioral texts	2305	2239	2060	1800	1769
Behavioral texts + chatbot	2319	2252	2064	1800	1766
Usual care	2321	2284	2103	1845	1805

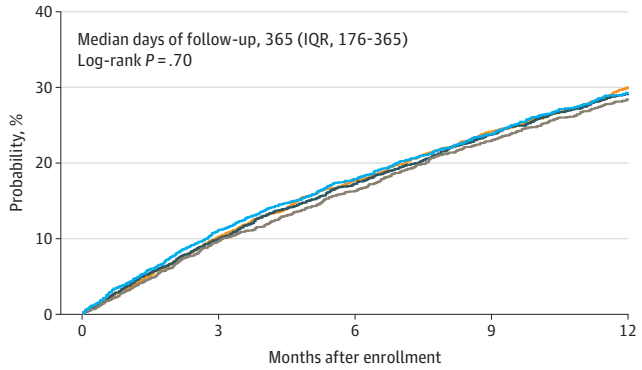
B Hospitalization



No. of patients

Generic reminder texts	2324	2163	1936	1647	1563
Behavioral texts	2305	2147	1914	1618	1551
Behavioral texts + chatbot	2319	2147	1908	1626	1546
Usual care	2321	2184	1946	1657	1576

C Emergency department visits



No. of patients

Generic reminder texts	2324	2023	1717	1405	1281
Behavioral texts	2305	2031	1736	1400	1287
Behavioral texts + chatbot	2319	2007	1696	1380	1262
Usual care	2321	2053	1735	1412	1279

Table 3. Mean Difference in Median Gap Lengths in Days From Usual Care

Secondary analysis	Gap length, median (IQR), d				Mean difference (from usual care) in medians					
	Generic reminder text (n = 2324)	Behavioral nudge text (n = 2305)	Behavioral nudge text + chatbot (n = 2319)	Usual care (n = 2321)	Generic reminder text		Behavioral nudge text		Behavioral nudge text + chatbot	
					Difference (95% CI)	P value	Difference (95% CI)	P value	Difference (95% CI)	P value
Initial gap[a]	9 (1-55)	9 (1-62)	10 (1-59)	15 (1-85)	5 (3-7)	<.001[b]	5 (3-7)	<.001[b]	5 (3-7)	<.001[b]
All subsequent gap(s)[c]	16 (6-56)	17 (6-59)	15 (6-56)	20 (8-58)	4 (1-6)	.01[b]	3 (0-6)	.06	4 (2-7)	.01[b]

[a] Refers to required gap for study inclusion.

[b] Indicates significant result with adjusted level of significance (.05/3).

[c] All gaps following the initial enrollment gap were tracked individually and assessed time from the start of the gap to a fill. Subsequent gaps exclude the initial gap.

days for the usual care group, 16 days for the generic reminder group, 17 days for the behavioral nudge group, and 15 days for the behavioral nudge + chatbot group (Table 3). Additional details regarding the intervention and sensitivity analyses are reported in eFigures 1-4 and eTables 1-7 in Supplement 3.

Discussion

The objective of this study was to assess the effectiveness of different text message reminders to improve medication refill adherence. In a pragmatic trial with high patient enrollment including patients traditionally underrepresented in clinical trials (eg, ≈49% Hispanic) and few patients opting out, overall rates of medication adherence were low (≈60%). Text message reminders were not effective in improving refill adherence at 12 months, regardless of the type of message, generic reminders, behavioral nudges, or behavioral nudges + chatbot. There were no differences in clinical events across the study groups.

In post hoc exploratory analysis focused on the first 3 months, we found refill adherence was 5 percentage points higher and median length of initial gaps was reduced by approximately 5 days for all 3 intervention groups compared with usual care. Although this study did not improve adherence at 12 months, other similar research offers contrasting evidence that text messaging may be an effective approach.[17-19] Differences in message design, frequency, and intensity may explain the differential outcomes. In this trial, up to 5 messages over a 10-day period were sent to remind patients to refill and only when they delayed refilling their cardiovascular medications. In the study by Horne et al,[17] messages were generally sent weekly for a longer duration than in the current study, suggesting that periodic brief reminders over time can be effective. Additionally, the messages in the current study were unidirectional, limiting patient opportunities to engage with messages. Newer technologies, including artificial intelligence–enabled chatbots, may facilitate tailored conversations that meet specific patient needs.[20,21]

In this study, there was no difference between generic reminders and behavioral nudge text messages with or without a chatbot. Prior text messaging studies have typically assessed tailoring or personalization of messages over a short period (eg, 30-90 days) and have not evaluated intervention decay effects over time.[22-25] This study followed up patients for up to 365 days and found that most patients refilled their medications within 30 days of the reminder message (eFigure 2 in Supplement 3). The lack of benefit beyond 30 days may be related to the typical intervention decay observed for other interventions. Furthermore, the intervention was delivered only when patients delayed filling their prescriptions and did not address other aspects of medication-taking behaviors, such as daily reminders. Last, the outcome measure of 12-month refill adherence may not have been a sensitive enough measure to assess the impact of the intervention.

Limitations

This study has some limitations. First, the study was conducted in 2 health systems (Denver Health and VA) where a majority of patients filled their prescriptions using health system pharmacies. In 2 of the health systems (Denver Health and UCHealth), patients filling prescriptions outside of health system pharmacies were included; however, not all prescriptions filled at outside pharmacies may have been captured (eg, due to use of prescription discount cards), despite use of national pharmacy claims data (eg, SureScripts). Second, the study demonstrated a modest improvement in refill adherence in post hoc analysis at 3 months. The intervention was not integrated within the health system pharmacy, and co-interventions such as retail pharmacy text message reminders may have limited its effectiveness. However, the use of text messaging may still be a cost-effective strategy for health systems relative to other technologies such as standalone apps or more time-intensive interventions such as motivational interviewing to deploy as a first-line strategy among a series of strategies to improve medication adherence. Future studies could use an adaptive design whereby patients are randomized to more intensive adherence interventions if the initial ones are not effective. Third, text messaging may not have been available to all patients. However, the majority of patients (≈91%) in the intervention groups selected text messages rather than telephone. Text message interventions may be more generalizable than app-based interventions.

Conclusions

Text message reminders did not improve medication refill adherence at 12 months. Given overall low rates of adherence at 12-month follow-up, additional interventions need to be rigorously tested to try to improve adherence to chronic cardiovascular medications, given the growing incidence of chronic cardiovascular conditions.

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Concept and design: Ho, Glorioso, Allen, Glasgow, Khanna, Magid, Peterson, Trinkley, Waughtal, Bull.
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Group-Based Mindfulness for Patients With Chronic Low Back Pain in the Primary Care Setting (OPTIMUM)

Top-Level Results

- Primary outcome: PEG significantly improved as compared to usual care control at Week 8, Month 6, and Month 12, ITT approach.
- Secondary/exploratory outcomes:
  - PROMIS-29 Pain Interference, Pain Intensity, Sleep Disturbance significantly improved as compared to control but not Physical Function, Social Roles, Fatigue.
  - Global Impression of Change: As compared to control, participants in the intervention group were significantly more likely to state improvement.

Lessons Learned

- Embedding into primary care through telehealth caused minimal disruption to the participating clinics.
- It was necessary to collect outcomes from participants and not the electronic health record.
- Telehealth requires significant onboarding for persons not familiar with technology.

Future Plans

- Publication of primary and secondary outcomes. Presentations at national meetings. Share with participating healthcare systems.
- Funding to address further uptake and integration into primary care.

Optimum
Optimizing Pain Treatment in Medical Settings Using Mindfulness

CHALLENGES SCORECARDS

AIM-CP: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)			x			
Study design issues (e.g., ICC, power, sample size, confounders)		x				
Using community-centered research methods			X			
Engaging with patient partners to inform the study		X				
Engaging with clinicians and health systems to identify or recruit participants					x	
Engaging with clinicians and health systems to deliver the intervention					X	
Data access (e.g., approval, privacy, security) and data management planning		X				
EHR integration and/or data extraction, including data management and quality assessment		X				
Collecting prospective data, including PROs		X				
Optimizing intervention sustainability and planning for sustainment			x			

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

APA-SM: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)		X				
Study design issues (e.g., ICC, power, sample size, confounders)			X			
Using community-centered research methods			X			
Engaging with patient partners to inform the study			X			
Engaging with clinicians and health systems to identify or recruit participants				X		
Engaging with clinicians and health systems to deliver the intervention				X		
Data access (e.g., approval, privacy, security) and data management planning				X		
EHR integration and/or data extraction, including data management and quality assessment				X		
Collecting prospective data, including PROs		X				
Optimizing intervention sustainability and planning for sustainment				X		

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

ARBOR Telehealth: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)			X			
Study design issues (e.g., ICC, power, sample size, confounders)			X			
Using community-centered research methods				X		
Engaging with patient partners to inform the study			X			
Engaging with clinicians and health systems to identify or recruit participants			X			
Engaging with clinicians and health systems to deliver the intervention					X	
Data access (e.g., approval, privacy, security) and data management planning			X			
EHR integration and/or data extraction, including data management and quality assessment				X		
Collecting prospective data, including PROs			X			
Optimizing intervention sustainability and planning for sustainment	X					

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

BeatPain Utah: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)		X				
Study design issues (e.g., ICC, power, sample size, confounders)		X				
Using community-centered research methods			X			
Engaging with patient partners to inform the study	X					
Engaging with clinicians and health systems to identify or recruit participants	X					
Engaging with clinicians and health systems to deliver the intervention	X					
Data access (e.g., approval, privacy, security) and data management planning		X				
EHR integration and/or data extraction, including data management and quality assessment		X				
Collecting prospective data, including PROs		X				
Optimizing intervention sustainability and planning for sustainment			X			

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

BEST-ICU: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)			X			
Study design issues (e.g., ICC, power, sample size, confounders)			X			
Using community-centered research methods		X				
Engaging with patient partners to inform the study		X				
Engaging with clinicians and health systems to identify or recruit participants		X				
Engaging with clinicians and health systems to deliver the intervention			X			
Data access (e.g., approval, privacy, security) and data management planning					X	
EHR integration and/or data extraction, including data management and quality assessment						X
Collecting prospective data, including PROs			X			
Optimizing intervention sustainability and planning for sustainment			X			

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

CARNATION: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)		X				
Study design issues (e.g., ICC, power, sample size, confounders)				X		
Using community-centered research methods		X				
Engaging with patient partners to inform the study				X		
Engaging with clinicians and health systems to identify or recruit participants						X
Engaging with clinicians and health systems to deliver the intervention			X?	X?		
Data access (e.g., approval, privacy, security) and data management planning			X			
EHR integration and/or data extraction, including data management and quality assessment				X		
Collecting prospective data, including PROs					X	
Optimizing intervention sustainability and planning for sustainment		X				

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

Chat 4 Heart Health: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)						X
Study design issues (e.g., ICC, power, sample size, confounders)					X	
Using community-centered research methods						X
Engaging with patient partners to inform the study			X			
Engaging with clinicians and health systems to identify or recruit participants				X		
Engaging with clinicians and health systems to deliver the intervention		X				
Data access (e.g., approval, privacy, security) and data management planning				X		
EHR integration and/or data extraction, including data management and quality assessment				X		
Collecting prospective data, including PROs						X
Optimizing intervention sustainability and planning for sustainment					X	

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

EquiP PC: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)		X				
Study design issues (e.g., ICC, power, sample size, confounders)			X			
Using community-centered research methods				X		
Engaging with patient partners to inform the study				**X**		
Engaging with clinicians and health systems to identify or recruit participants		X				
Engaging with clinicians and health systems to deliver the intervention				X		
Data access (e.g., approval, privacy, security) and data management planning		X				
EHR integration and/or data extraction, including data management and quality assessment				**X**		
Collecting prospective data, including PROs			X			
Optimizing intervention sustainability and planning for sustainment					X	

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

FM-TIPS: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)		X				
Study design issues (e.g., ICC, power, sample size, confounders)			X			
Using community-centered research methods			X			
Engaging with patient partners to inform the study	X					
Engaging with clinicians and health systems to identify or recruit participants					X	
Engaging with clinicians and health systems to deliver the intervention			X			
Data access (e.g., approval, privacy, security) and data management planning					X	
EHR integration and/or data extraction, including data management and quality assessment						X
Collecting prospective data, including PROs			X			
Optimizing intervention sustainability and planning for sustainment			X			

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

GGC4H: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)		X				
Study design issues (e.g., ICC, power, sample size, confounders)			X			
Using community-centered research methods	X					
Engaging with patient partners to inform the study			X			
Engaging with clinicians and health systems to identify or recruit participants		X				
Engaging with clinicians and health systems to deliver the intervention		X				
Data access (e.g., approval, privacy, security) and data management planning		X				
EHR integration and/or data extraction, including data management and quality assessment			X			
Collecting prospective data, including PROs				X		
Optimizing intervention sustainability and planning for sustainment					X	

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

GRACE: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)					X	
Study design issues (e.g., ICC, power, sample size, confounders)				X		
Using community-centered research methods		X				
Engaging with patient partners to inform the study		X				
Engaging with clinicians and health systems to identify or recruit participants				X		
Engaging with clinicians and health systems to deliver the intervention				X		
Data access (e.g., approval, privacy, security) and data management planning			X			
EHR integration and/or data extraction, including data management and quality assessment				X		
Collecting prospective data, including PROs				X		
Optimizing intervention sustainability and planning for sustainment	X					

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

I CAN DO Surgical ACP: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)					X	
Study design issues (e.g., ICC, power, sample size, confounders)				X		
Using community-centered research methods					X	
Engaging with patient partners to inform the study					X	
Engaging with clinicians and health systems to identify or recruit participants		X				
Engaging with clinicians and health systems to deliver the intervention		X				
Data access (e.g., approval, privacy, security) and data management planning		X				
EHR integration and/or data extraction, including data management and quality assessment			X			
Collecting prospective data, including PROs			X			
Optimizing intervention sustainability and planning for sustainment	X					

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

IMPACt-LBP: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)	X					
Study design issues (e.g., ICC, power, sample size, confounders)	X					
Using community-centered research methods	X					
Engaging with patient partners to inform the study	X					
Engaging with clinicians and health systems to identify or recruit participants	X					
Engaging with clinicians and health systems to deliver the intervention	X					
Data access (e.g., approval, privacy, security) and data management planning		X				
EHR integration and/or data extraction, including data management and quality assessment				X		
Collecting prospective data, including PROs			X			
Optimizing intervention sustainability and planning for sustainment	X					

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

LungSMART: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)				X		
Study design issues (e.g., ICC, power, sample size, confounders)		X				
Infusing health equity across the research life cycle, including enrolling a diverse and representative population			X			
Engaging with patient partners to inform the study			X			
Engaging with clinicians and health systems to identify or recruit participants		X				
Engaging with clinicians and health systems to deliver the intervention		X				
Data access (e.g., approval, privacy, security) and data management planning						X
EHR integration and/or data extraction, including data management and quality assessment				X		
Collecting prospective data, including PROs		X				
Optimizing intervention sustainability and planning for sustainment						X

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

MOMs Chat & Care Study: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)		x				
Study design issues (e.g., ICC, power, sample size, confounders)			x			
Using community-centered research methods		x				
Engaging with patient partners to inform the study		x				
Engaging with clinicians and health systems to identify or recruit participants			x			
Engaging with clinicians and health systems to deliver the intervention	x					
Data access (e.g., approval, privacy, security) and data management planning		x				
EHR integration and/or data extraction, including data management and quality assessment		x				
Collecting prospective data, including PROs		x				
Optimizing intervention sustainability and planning for sustainment			x			

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

NOHARM: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)			X			
Study design issues (e.g., ICC, power, sample size, confounders)				X		
Using community-centered research methods			X			
Engaging with patient partners to inform the study				X		
Engaging with clinicians and health systems to identify or recruit participants			X			
Engaging with clinicians and health systems to deliver the intervention			X			
Data access (e.g., approval, privacy, security) and data management planning			X			
EHR integration and/or data extraction, including data management and quality assessment					X	
Collecting prospective data, including PROs			X			
Optimizing intervention sustainability and planning for sustainment				X		

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

OPTIMUM: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)		x				
Study design issues (e.g., ICC, power, sample size, confounders)		x				
Using community-centered research methods			x			
Engaging with patient partners to inform the study			x			
Engaging with clinicians and health systems to identify or recruit participants				x		
Engaging with clinicians and health systems to deliver the intervention		x				
Data access (e.g., approval, privacy, security) and data management planning				x		
EHR integration and/or data extraction, including data management and quality assessment						x
Collecting prospective data, including PROs			x			
Optimizing intervention sustainability and planning for sustainment					x	

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

RAMP: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)		X				
Study design issues (e.g., ICC, power, sample size, confounders)		X				
Using community-centered research methods		X				
Engaging with patient partners to inform the study		X				
Engaging with clinicians and health systems to identify or recruit participants		X				
Engaging with clinicians and health systems to deliver the intervention		X				
Data access (e.g., approval, privacy, security) and data management planning			X			
EHR integration and/or data extraction, including data management and quality assessment			X			
Collecting prospective data, including PROs			X			
Optimizing intervention sustainability and planning for sustainment					X	

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

STEP-2: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)			X			
Study design issues (e.g., ICC, power, sample size, confounders)				X		
Using community-centered research methods				X		
Engaging with patient partners to inform the study		X				
Engaging with clinicians and health systems and health plans to identify or recruit participants				X		
Engaging with clinicians and health systems and health plans to deliver the intervention					X	
Data access (e.g., approval, privacy, security) and data management planning				X		
EHR integration and/or data extraction, including data management and quality assessment				X		
Collecting multi-level prospective data, including PROs			X			
Optimizing intervention sustainability and planning for sustainment					X	

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

TAICHIKNEE: Challenges Scorecard

Challenge	Level of Difficulty*					
	NA	1	2	3	4	5
Regulatory issues (e.g., IRBs, consent)			X			
Study design issues (e.g., ICC, power, sample size, confounders)					X	
Using community-centered research methods	X					
Engaging with patient partners to inform the study			X			
Engaging with clinicians and health systems to identify or recruit participants				X		
Engaging with clinicians and health systems to deliver the intervention					X	
Data access (e.g., approval, privacy, security) and data management planning				X		
EHR integration and/or data extraction, including data management and quality assessment				X		
Collecting prospective data, including PROs			X			
Optimizing intervention sustainability and planning for sustainment					X	

*Your best guess: 1 = little difficulty; 5 = extreme difficulty

DATA AND RESOURCE SHARING PLANS

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Coordinated cARe paiN mAnagement Technology ImplementatiON (CARNATION)

DATA MANAGEMENT AND SHARING PLAN

Principal Investigators: Lynn DeBar, PhD, MPH; Rachel Gold, PhD, MPH; Nicole Cook, PhD, MPA

Element 1: Data Type:

A. Types and amount of scientific data expected to be generated in the project:
The CARNATION study will generate qualitative data on experience with the implementation strategies/intervention and opportunities for improvement; this information will be collected from advisory group meetings and co-development workshops, qualitative interviews with community health center (CHC) staff and patients, as well as meeting observations with CHC teams.

CARNATION will also utilize data from patient electronic health records (EHR) in standardized formats, including the data related to pain management care coordination that is entered by CHC staff into the EHR-integrated Compass Rose module. However, all clinical data that will be used in this study are existing within patient charts and not collected as part of this study. There will be no consenting of individual patients receiving integrated pain management-related services supported by the study implementation support, as the clinical assessment and pain-related services patents are part of standard care at the CHCs.

B. Scientific data that will be preserved and shared, and the rationale for doing so:
All qualitative data and EHR-based datasets produced during the project will be preserved on secure OCHIN servers. All OCHIN data is hosted in a HIPAA Audited tier III data center. All data work will be conducted on secure, password-protected HIPAA compliant OCHIN computers. OCHIN computers are protected through the use of passwords and encryption (Microsoft Bitlocker for whole disk encryption) as well as other industry standard controls such as password strength, password expiration, screen lockout, password obfuscation, defense in-depth (multiple firewalls), IPS/IDS, DLP and centralized audit and event logging of all platforms to a central SIEM platform for all services following HIPAA/NIST 800-53 controls.

The analytic EHR-based datasets produced by OCHIN will be transferred to the KPWHRI analytic team (Dr. Andrea Cook and Mr. Robert Wellman, biostatisticians) who will conduct the quantitative primary, secondary and exploratory analyses. In addition, an analytic dataset will also be provided/transferred to RAND where Dr. Patricia Herman will conduct the cost analyses.

Patient-level datasets, qualitative data, and Epic/Clarity electronic health record (EHR) code and

variable names will not be shared. As described above, all clinical data that will be used in this study are existing within patient charts and not collected as part of this study; patient consent will not be obtained for use of these EHR data. The OCHIN Research Data Warehouse (RDW) includes patient-level data generated from multiple health systems across the OCHIN network; restrictions apply to the availability and re- release of patient-level data under organizational member agreements. Therefore, to honor member agreements and protect potentially identifiable patient information, patient-level datasets, qualitative data, and Epic/Clarity code and variables names cannot be shared publicly. Epic/Clarity variable names will be removed and replaced before sharing statistical data analytic code (e.g., R, SAS). The study team discussed this inability to comply with the HEAL Data Sharing Requirements with the Scientific/Research Contacts for **RFA-NS-24-041** during an October 2, 2024 conference call.

Aggregate data, qualitative codebooks, and statistical data analytic code (e.g., R, SAS) will be shared with relevant publications or by the end of the project period. OCHIN defines aggregate data as a dataset or data display that consolidates data from multiple individuals (e.g., patients) and does not contain identifiers that can be used to identify individual patients.

C. Metadata, other relevant data, and associated documentation:

To facilitate interpretation of aggregate data to be shared, documentation (i.e., data dictionary), qualitative codebooks, and statistical data analytic code (e.g., R, SAS) will also be shared.

Element 2: Related Tools, Software and/or Code:

OCHIN uses SQL to access EHR data stored in a Research Data Warehouse (RDW). Qualitative data will be entered into QSR NVivo for data analysis.
Data will be analyzed by the KPWHRI analytic team per the CARNATION study protocol and statistical analysis plan using R.

Element 3: Standards:

All OCHIN researchers and staff are trained in and follow federal HIPAA regulations, which require specific protocols for the transferring, storage, and reporting of protected health information (PHI). In addition, OCHIN requires all Research personnel to complete CITI training in the Responsible Conduct of Research. OCHIN computers are protected through the use of passwords and encryption (Microsoft Bitlocker for whole disk encryption) as well as other industry standard controls such as password strength, password expiration, screen lockout, password obfuscation, defense in-depth (multiple firewalls), IPS/IDS, DLP and centralized audit and event logging of all platforms to a central SIEM platform for all services following HIPAA/NIST 800-53 controls. All OCHIN data is hosted in a HIPAA Audited tier III data center.

Element 4: Data Preservation, Access and Associated Timelines:

A. Repository where scientific data and metadata will be archived:

All scientific data that can be shared will be deposited as supplementary material with manuscripts in PubMed Central or another suitable public repository. Other scientific data generated in this project that cannot be publicly shared will be preserved for five (5) years and then archived on secure OCHIN

servers as described above indefinitely.

B. How scientific data will be findable and identifiable:

Aggregate data will be included as supplementary material with manuscripts on PubMed Central, thus the metadata and persistent identifiers (i.e., PMCID) will be supported by the National Library of Medicine. Each PubMed Central study is also assigned a digital object identifier (DOI) to facilitate findability of scientific data.

C. When and how long the scientific data will be made available:

The research community will have access to aggregate data, qualitative codebooks, and statistical data analytic code (e.g., R, SAS) as soon as possible or at the time of associated publication, but no later than the end of the project period. Shared scientific data and associated qualitative codebooks, statistical data analytic code (e.g., R, SAS), and data dictionaries will be available indefinitely and access will not be controlled by the study team or OCHIN.

Qualitative data: Audio recordings of interviews and online meeting recordings (e.g., Zoom) will be securely stored and professionally transcribed by an outside vendor (who OCHIN has a Business Associates Agreement with). Recordings will be sent via secure file transfer (SFT) to be transcribed; access to the SFT site will be limited to appropriate members of the research team. Any identifiable patient information (inadvertently shared by clinic staff) in the transcript will be deleted. The transcriptionist will send back the file to the appropriate members of the research team via SFT. Recordings, transcripts, and digital copies of all collected artifacts will be kept on a secure network at OCHIN and accessible to qualitative team members. The study team will keep an audit trail for all qualitative data and enter data into QSR NVivo for data analysis. Qualitative data will not be shared publicly; however, codebooks will be shared as described above.

EHR data: OCHIN EHR data is centrally maintained. No transfer needs to occur from the CHC to OCHIN research analysts. Clinical data and research data (once abstracted) are stored on and backed up on secure servers and all data work will be conducted on secure, password-protected HIPAA compliant OCHIN computers. Facilities that store PHI in paper or electronic form have controlled access procedures and 24 hour monitored alarm service. Patient-level datasets containing EHR data will not be shared publicly; however, aggregate data will be shared as described above.

Element 5: Access, Distribution, or Reuse Considerations:

CARNATION will be registered on ClinicalTrials.gov and the CARNATION protocol and study findings will be shared in peer-reviewed journals per journal policies.

A. Factors affecting subsequent access, distribution, or reuse of scientific data:

As described above, patient-level datasets, qualitative data, and Epic/Clarity electronic health record (EHR) code and variable names cannot be shared. All clinical data to be used in this study are existing within patient charts and not collected as part of this study; patient consent will not be obtained for use of these EHR data.

The OCHIN Research Data Warehouse includes patient-level electronic health record (EHR) data generated from multiple health systems across the OCHIN network; restrictions apply to the

availability and re- release of patient-level data under organizational member agreements. Therefore, to honor member agreements and protect potentially identifiable patient information, patient-level datasets, qualitative data, and Epic/Clarity code and variables names cannot be shared publicly. Epic/Clarity variable names will be removed and replaced before sharing statistical data analytic code (e.g., R, SAS).

B. Whether access to scientific data will be controlled:

Manual of Procedures: The KP CHR and OCHIN Research Associates will collaboratively develop a study replication plan that will include the Institutional Review Board (IRB)-approved study protocol, approvals, data documentation (e.g., data dictionary), analysis plans, and research products. As the study progresses, this plan will be updated and made available to interested researchers.
Access to aggregate scientific data and data dictionaries, qualitative codebooks, and statistical data analytic code (e.g., R, SAS) will not be controlled. Other scientific data generated as part of the project (e.g., patient- level datasets, qualitative data) will not be shared even if requested to uphold OCHIN member and vendor agreements and patient and study participant confidentiality.

Types of Research Products: We will share products resulting from this research which have been specified as sharable with publications or by the end of the project period. Products will include study process flows, non- proprietary assessment tools (e.g., interview guide), the study replication plan, and actionable recommendations developed during the mixed-method analysis. We will not be able to share our patient-level research datasets maintained by OCHIN, as these data were collected for clinical purposes, and it is not allowed to be shared per data use agreements with OCHIN member clinics.
We developed the following plan for dissemination of study materials and findings to primary care and safety- net organizations, including Community Health Centers, and academic colleagues through a variety of methods. While conducting this study and disseminating findings, we will use community engagement strategies with OCHIN member clinics as active partners. The content of materials disseminated through presentations and, and manuscripts will be driven by study findings.

Presentations: Study results will be shared through presentations at international, national, and local conferences and forums, including peer-reviewed conferences with large public health and health center representation.
Manuscripts: The research project team will present findings through peer-reviewed manuscripts and commentaries.

C. Protections for privacy, rights, and confidentiality of human research participants:

Once patient-level data are pulled from the Research Data Warehouse, direct identifiers will be immediately removed by Research Analysts before providing to the research team for analysis to protect human subjects' privacy, rights, and confidentiality. Thus, all identifying information will be removed prior to sharing aggregate scientific data. All OCHIN researchers and staff are trained in and follow federal HIPAA regulations, which require specific protocols for the transferring, storage, and reporting of protected health information (PHI). In

addition, OCHIN requires all personnel contributing to the design and/or conduct of this research to complete CITI training in the Responsible Conduct of Research.
For the proposed qualitative data collection from human research participants, IRB-approved informed consent documents will include language describing plans for data management and sharing, motivation for sharing data, and explain that any potentially identifying information will be removed. We will not share transcripts, even with identifiers removed, but will share qualitative codebooks publicly.

Element 6: Oversight of Data Management and Sharing:
The OCHIN Research Department is responsible for overseeing implementation and compliance with this plan, specifically the OCHIN Principal Investigator, Dr. Rachel Gold.

NIH PRAGMATIC TRIALS COLLABORATORY
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Equitable Primary Care for Pain Care (EquiP PC)

DATA MANAGEMENT AND SHARING PLAN

Principal Investigators: Kari Stephens, PhD; Rodger Kessler, PhD

Element 1: Data Type

A. Types and amount of scientific data expected to be generated in the project:

Types of data will include*:* 1) Participant surveys (at baseline, post-intervention, and 6-months post-intervention), 2) EHR data to facilitate recruitment (i.e., patient contact information and demographics) and outcome evaluation data (i.e., patient demographics, social determinants of health, service utilization patterns, and diagnoses), 3) practice champion and behavioral health provider (BHP) surveys (i.e., measures of behavioral health provider self-efficacy for delivering treatment for chronic pain, engagement throughout the intervention, elements of the intervention used, cost survey, and anticipated maintenance of practice changes), 4) post-intervention key informant interview data, and 5) mobile app usage data.

Estimated amount of data will include: 1) EHR data for recruitment will be across all eligible patients with rolling recruitment per practice until 75 are recruited from each of the 27 practices; therefore total number of patients is TBD but will likely be thousands to reach the goal of *N* = 2,030; 2) 2,030 participants for EHR and patient survey data; 3) practice champions and (BHP) surveys will be collected across all 27 practices; 4) interviews will be conducted with *N* = 36 participants (2 from each of the 18 intervention practices); and 5) mobile app usage data will be from no more than 1,350 participants who participate in the intervention arms.

B. Scientific data that will be preserved and shared, and the rationale for doing so:

The final research dataset will include a compilation of: 1) participant data from the EHR and surveys, 2) practice surveys from champions and BHPs, 3) mobile app usage data from intervention arm participants. Data will be prepared into a final research dataset to conduct study aims related analyses and shared and structured to maximize future scientific value while protecting patient and health system privacy.

C. Metadata, other relevant data, and associated documentation:

A comprehensive data dictionary will provide definitions for all data variables, as well as a detailed study protocol that includes measure definitions and references, to support data usage.

Element 2: Related Tools, Software and/or Code: N/A

Element 3: Standards: Standards from the Heal Initiative Common Data Elements (CDEs) will be used, along with standard EHR related codes (e.g., ICD codes for diagnoses) and summary totals computed for published measures used in surveys.

Element 4: Data Preservation, Access, and Associated Timelines

A. Repository where scientific data and metadata will be archived:

Inter-university Consortium for Political and Social Research (ICPSR)
https://www.icpsr.umich.edu/web/pages/about/

B. How scientific data will be findable and identifiable:

We will use the native ICPSR search features and include published works that will be uploaded and associated with the dataset in ICPSR. We will also include a link to this repository from our research group's main webpage that will have a description of the study posted once completed.

C. When and how long the scientific data will be made available:

Data will be made available after the primary outcomes of the trial are published and will remain available for at least 7 years.

Element 5: Access, Distribution, or Reuse Considerations

***A.* Factors affecting subsequent access, distribution, or reuse of scientific data:**

Only patient participant de-identified data will be shared with all practice location data removed to protect patient confidentiality.

***B.* Whether access to scientific data will be controlled:**

Data will be made available by the above stated data repository based on dated permission specifications submitted at time of deposit of data. Data will be freely available via the associated repository's public website.

C. Protections for privacy, rights, and confidentiality of human research participants:

All patients' protected health information (based on HIPAA identifiers) will be removed, only age will be included at time of baseline, all geographic location information will be removed and only quantitative survey and EHR related data will be shared that include only summary data of service utilization to ensure all service dates can be removed. All IRB and certificates of confidentiality will be honored.

Element 6: Oversight of Data Management and Sharing:

Administrative PI, Dr. Kari Stephens, Professor at University of Washington Family Medicine, will ensure that data are monitored and uploaded for sharing based on FAIR principles to the above noted repository, based on details in this plan and in compliance with the repository's processes and in accordance with all data sharing governance requirements to protect participant confidentiality. Data will be monitored by Dr. Stephens and the appointed research team members, including the senior project manager, who have been delegated data coordination responsibilities regularly throughout the study's active period. All members of the research team will review this plan and coordinate to ensure compliance with this stated plan.

ENROLLMENT REPORTS

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

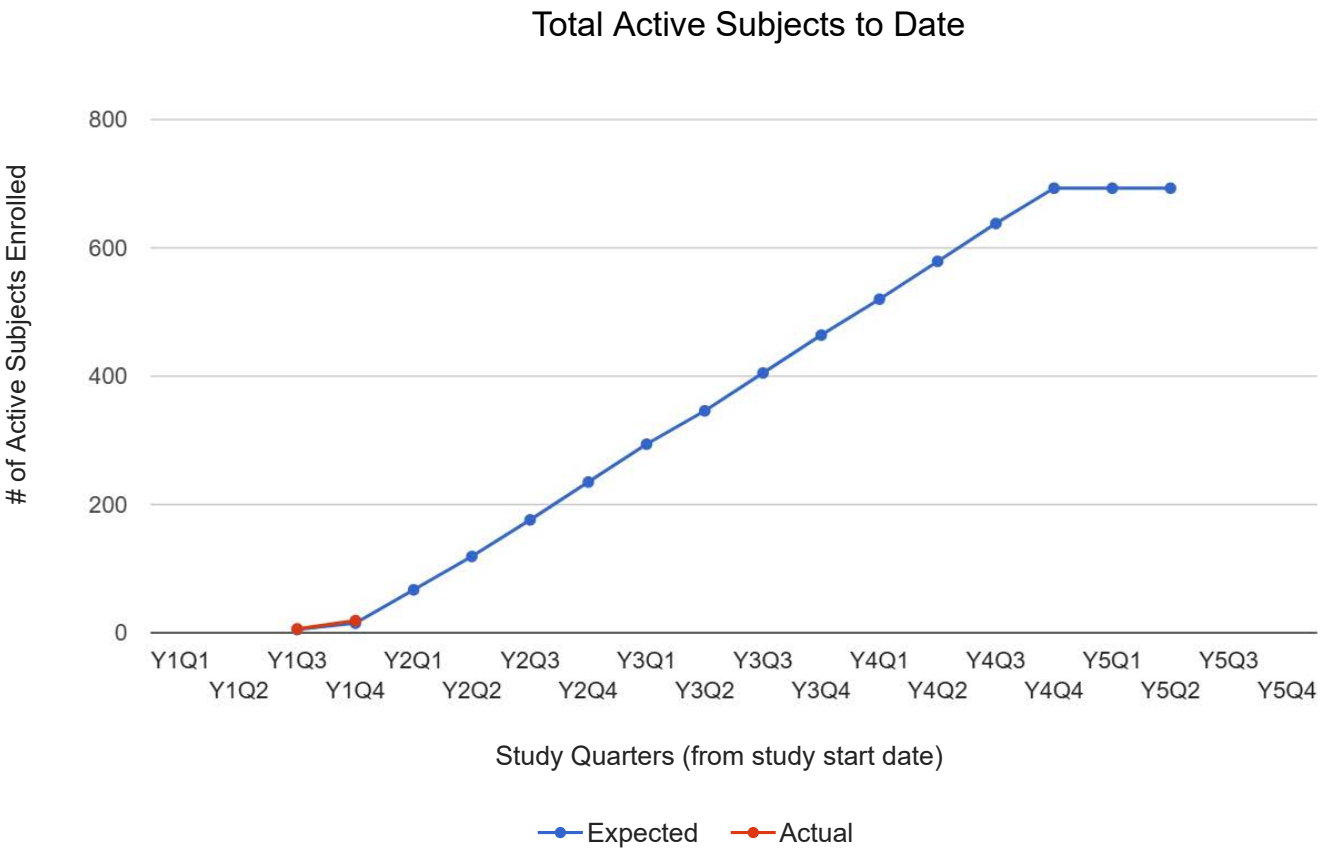
Personalized Articular Point Acupressure for Self-Management in Rural Populations (APA-SM)

Principal Investigator: Jennifer Kawi, Jane Bolin, Hulin Wu

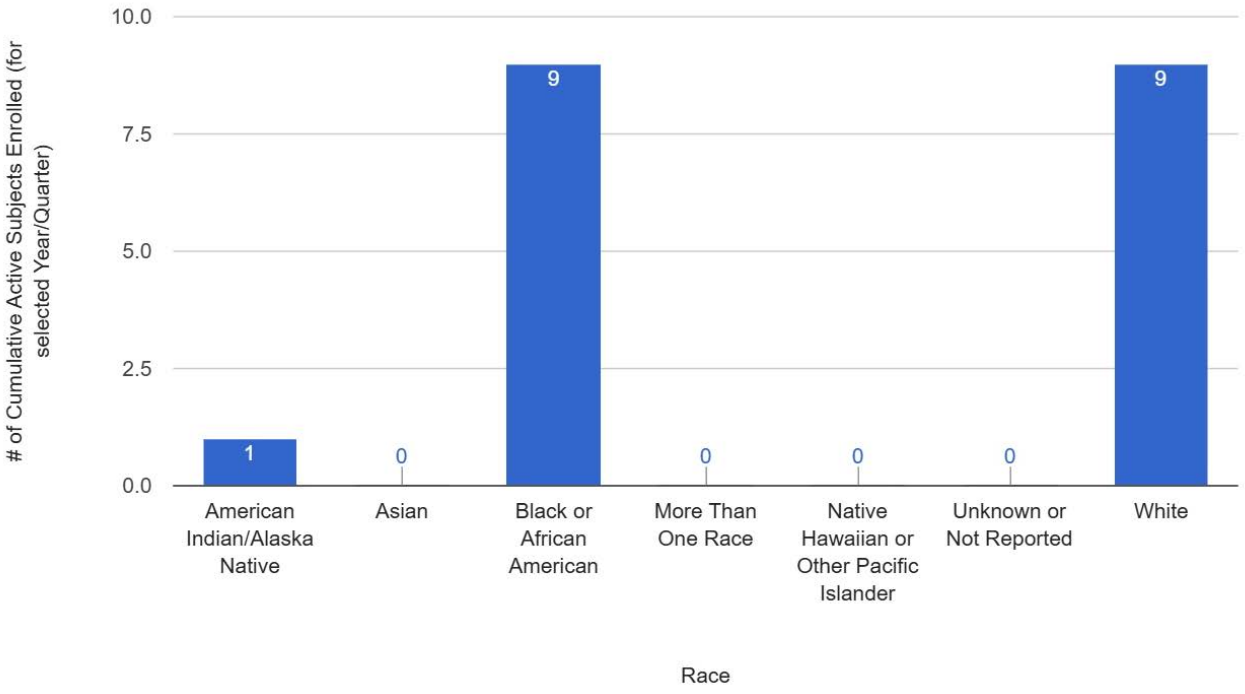
NIH Grant Number: UH3AT012728

UH3 Award Date: 2025-08-14

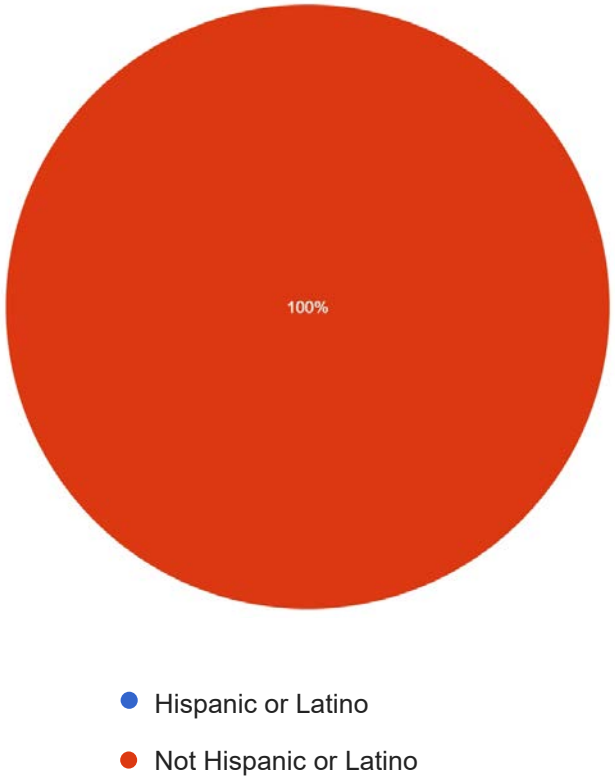
Data Reported as of: 2025 Q4



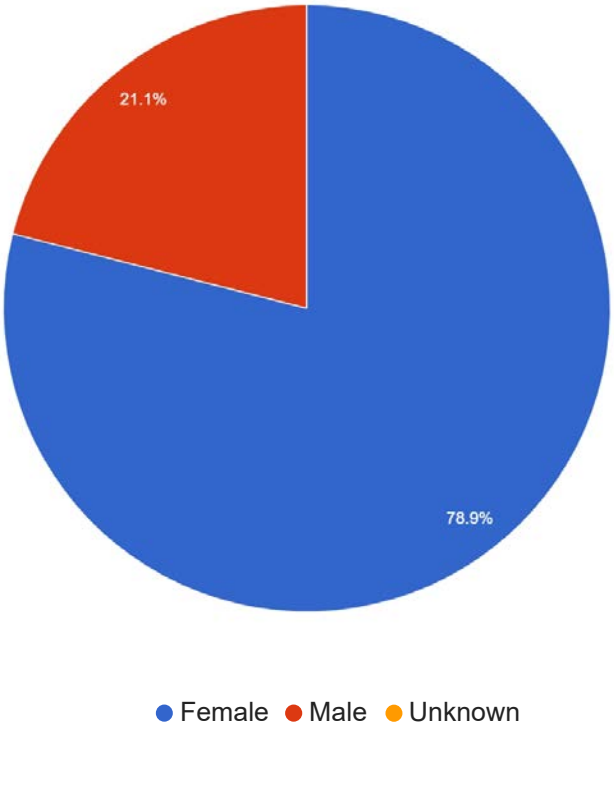
Racial Breakdown 2025 - Q4



Ethnicity Breakdown 2025 - Q4



Sex Breakdown 2025 - Q4



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Improving Function and Reducing Opioid Use for Patients with Chronic Low Back Pain in Rural Communities through Improved Access to Physical Therapy using Telerehabilitation (ARBOR-Telehealth)

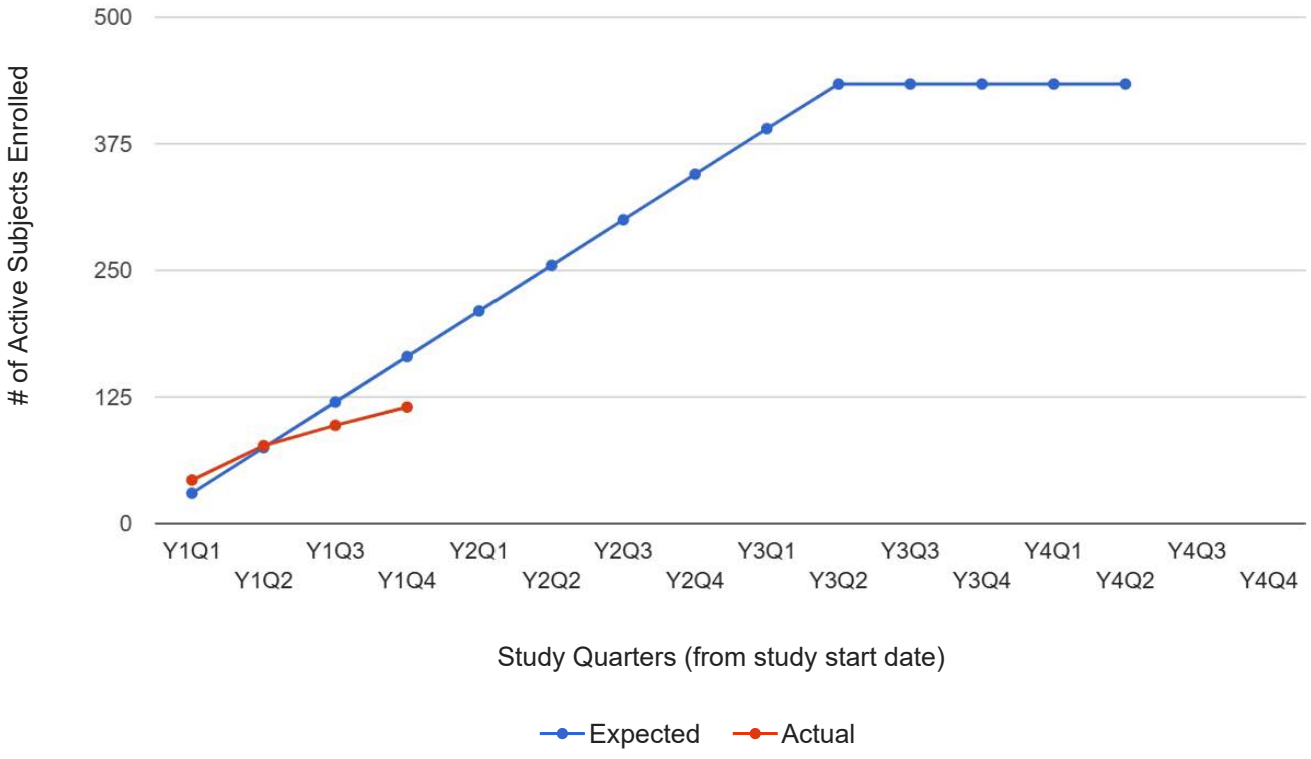
Principal Investigator: Richard L. Skolasky, Kevin McLaughlin

NIH Grant Number: 4UH3AR083838

UH3 Award Date: 2024-09-13

Data Reported as of: 2025 Q4

Total Active Subjects to Date



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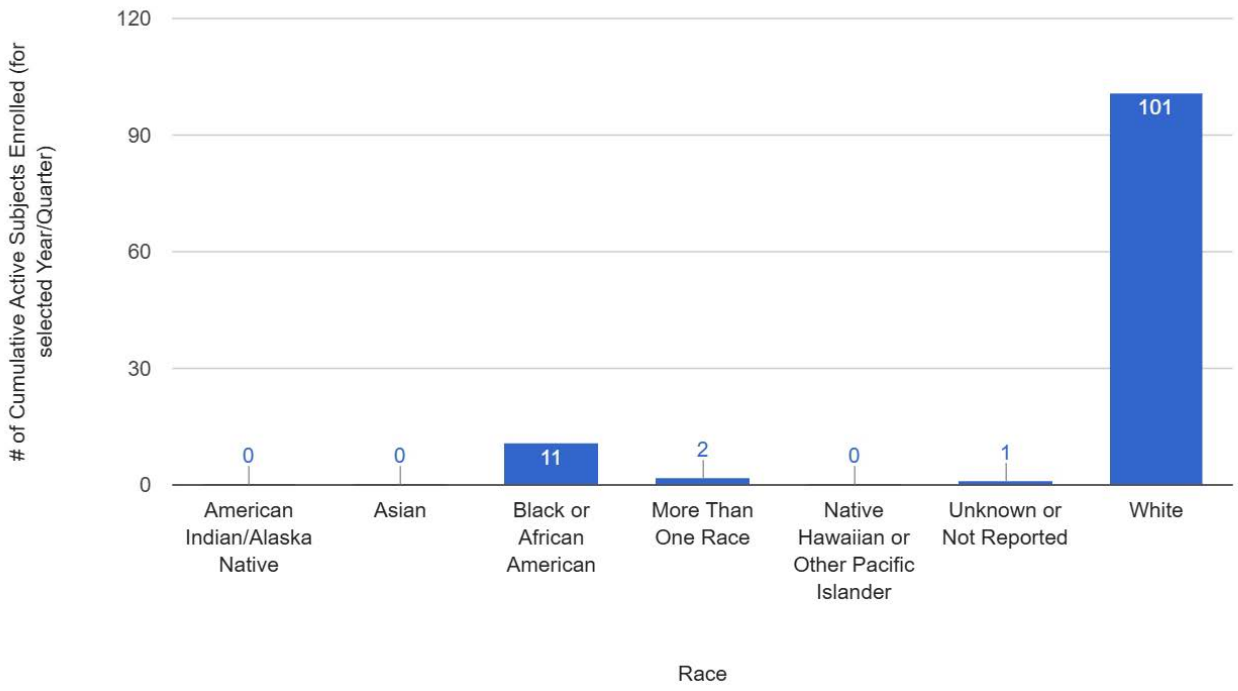

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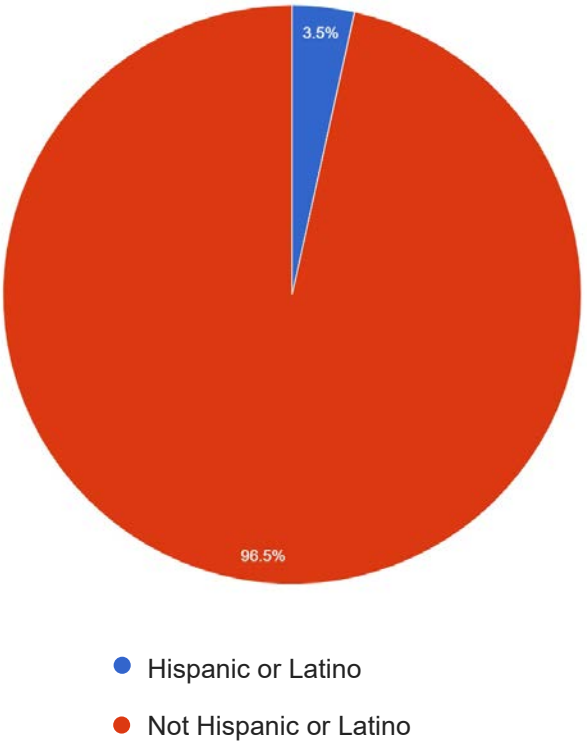
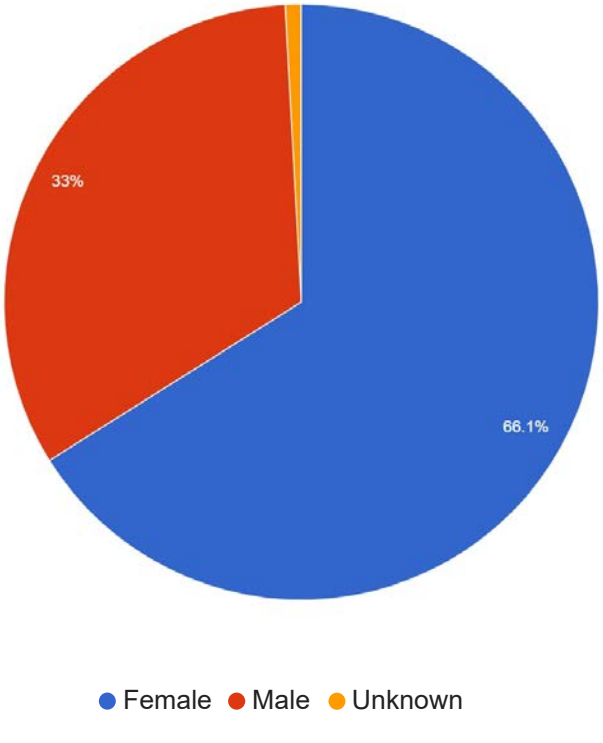


Sex Breakdown 2025 - Q4



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

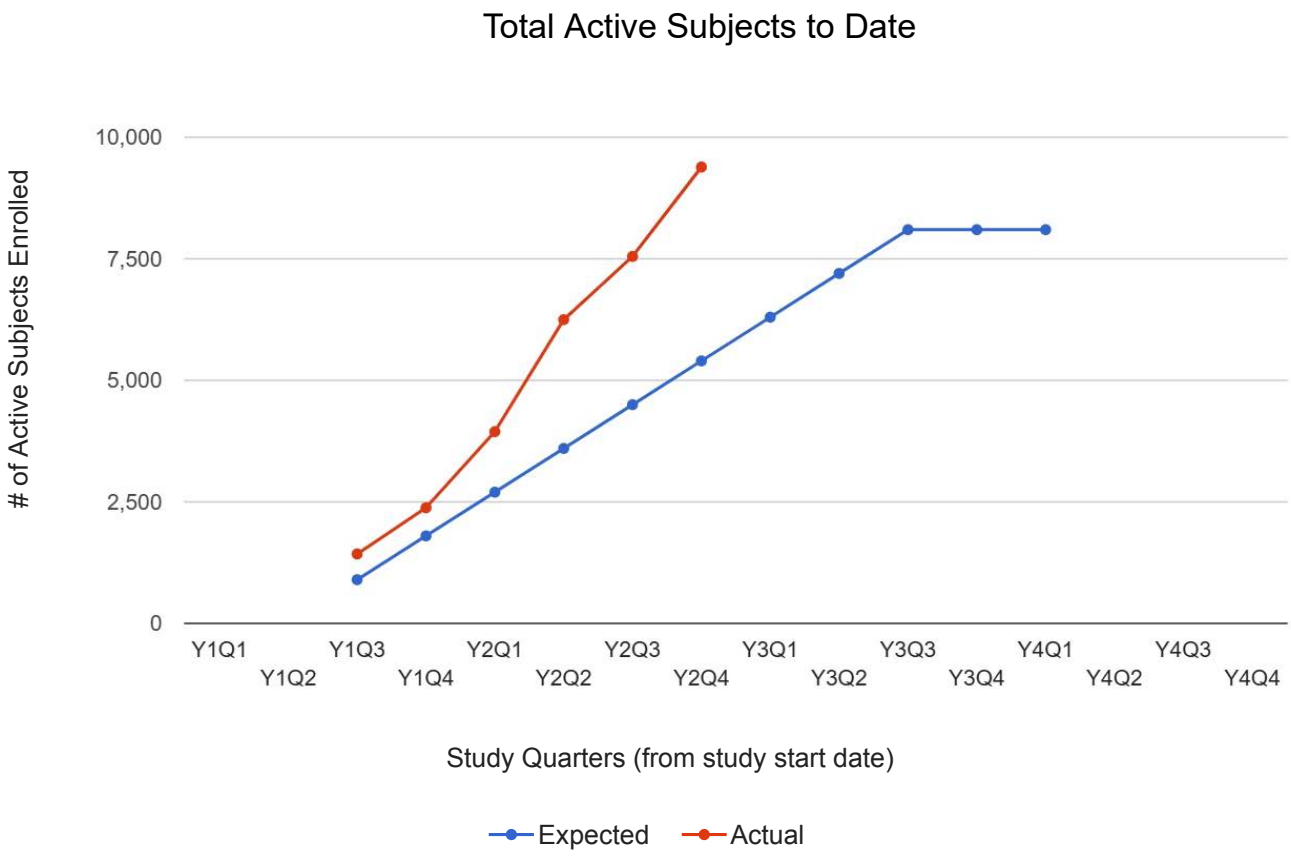
Behavioral Economic and Staffing Strategies to Increase Adoption of the ABCDEF Bundle in the ICU (BEST-ICU)

Principal Investigator: Michele Balas, Eduard Vasilevskis

NIH Grant Number: 1UG3HL165740-01A1

UH3 Award Date: 2023-04-27

Data Reported as of: 2025 Q4



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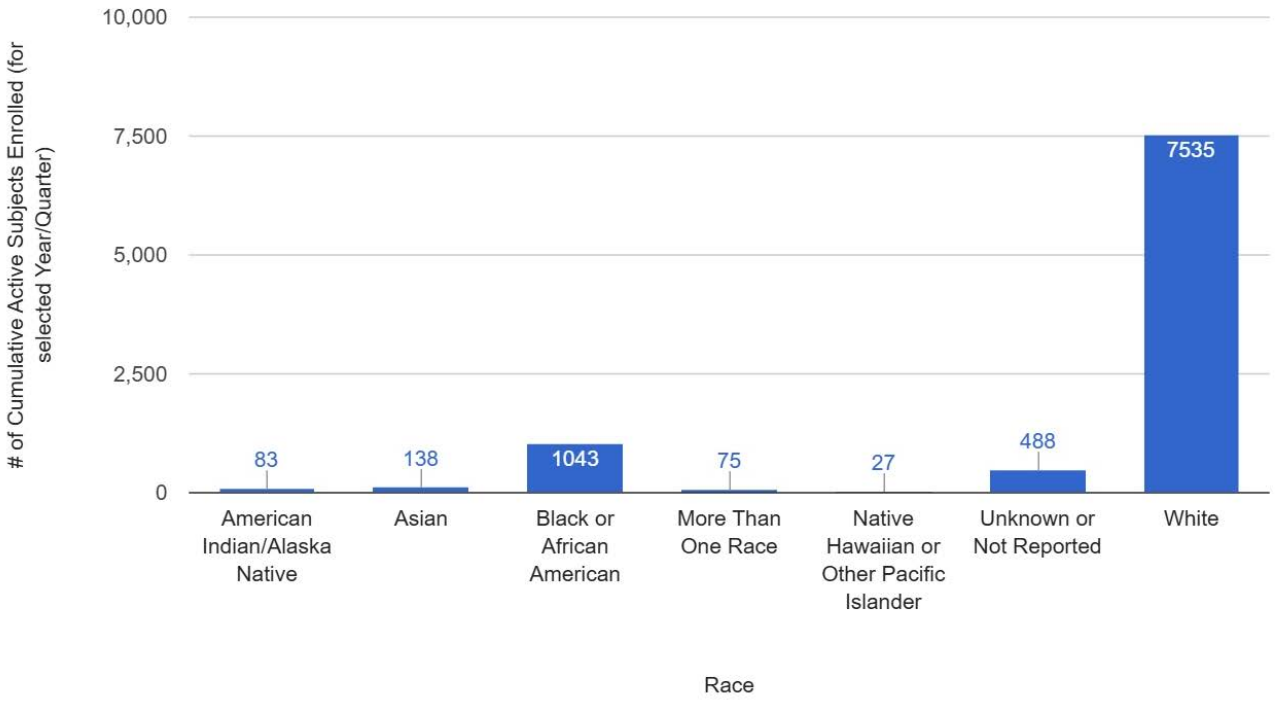
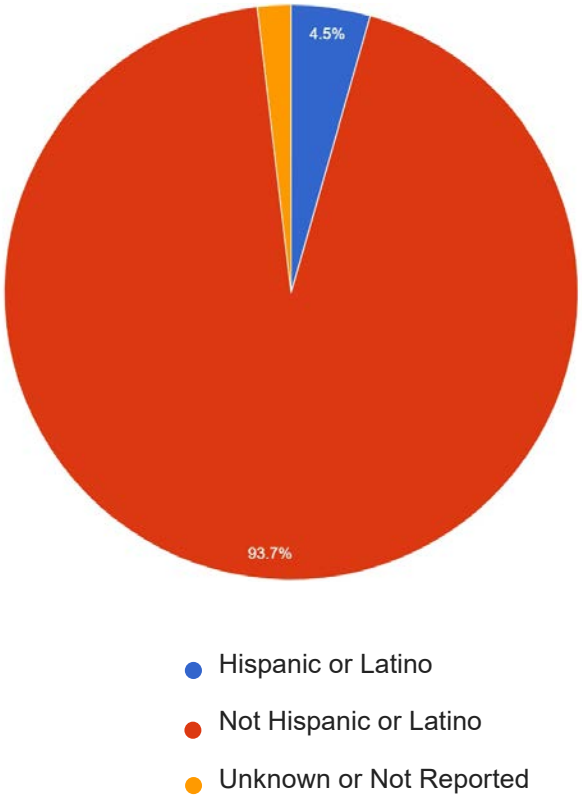
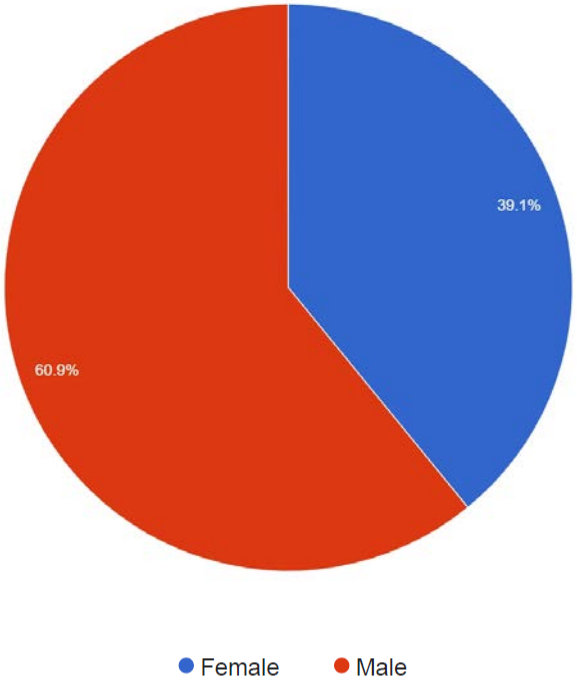


Ethnicity Breakdown 2025 - Q4



Sex Breakdown 2025 - Q4



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

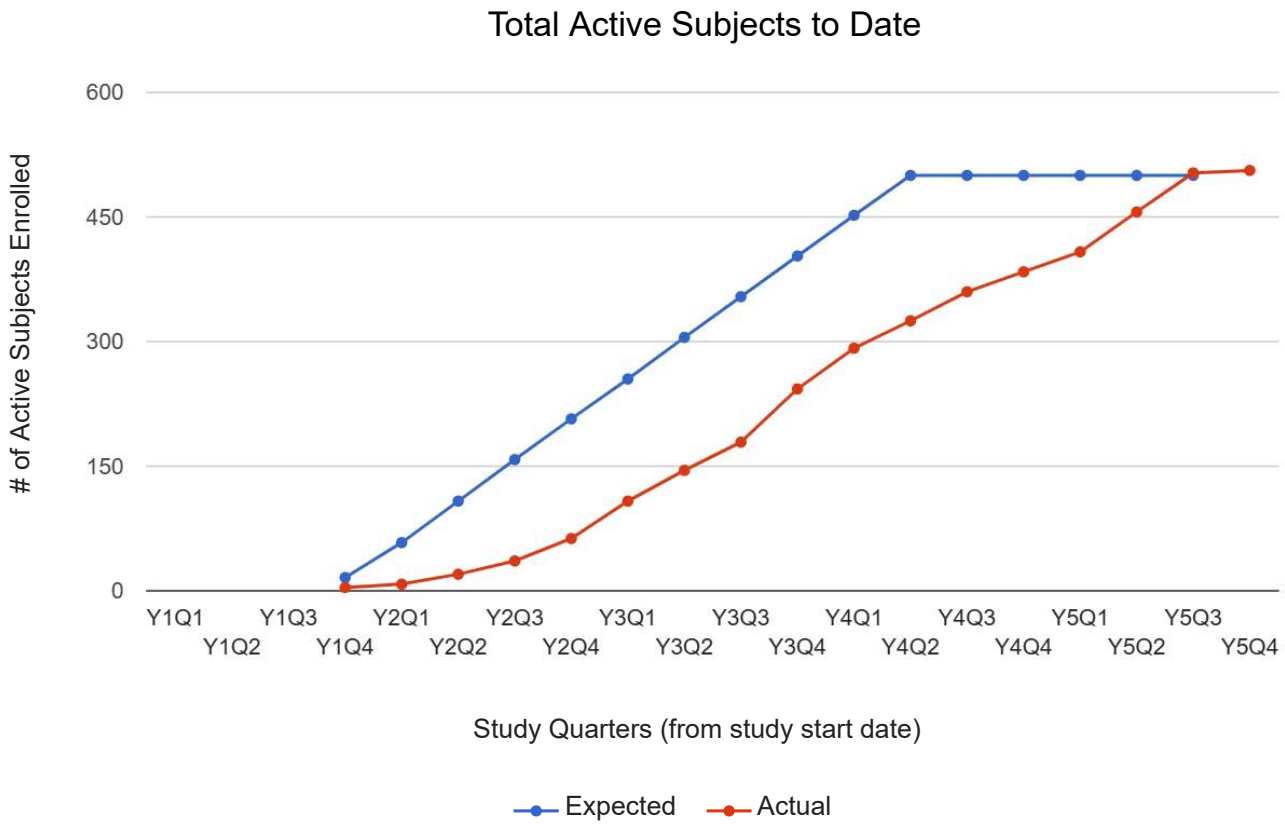
Nonpharmacologic Pain Management in Federally Qualified Health Centers Primary Care Clinics (BeatPain Utah)

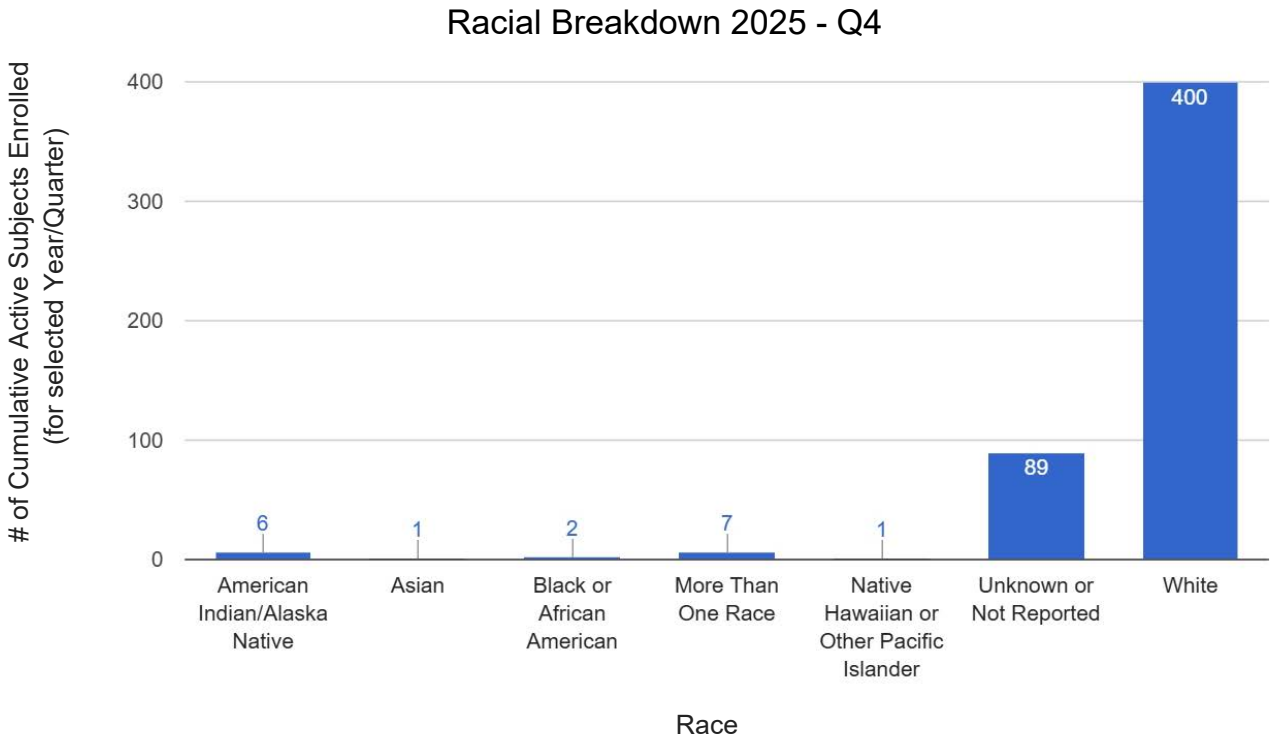
Principal Investigator: Julie Fritz

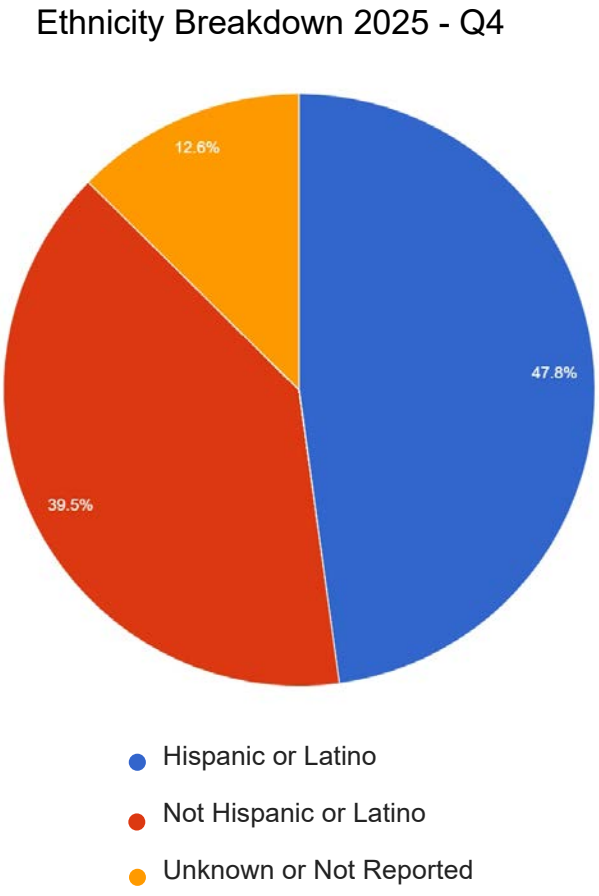
NIH Grant Number: UH3NR019943

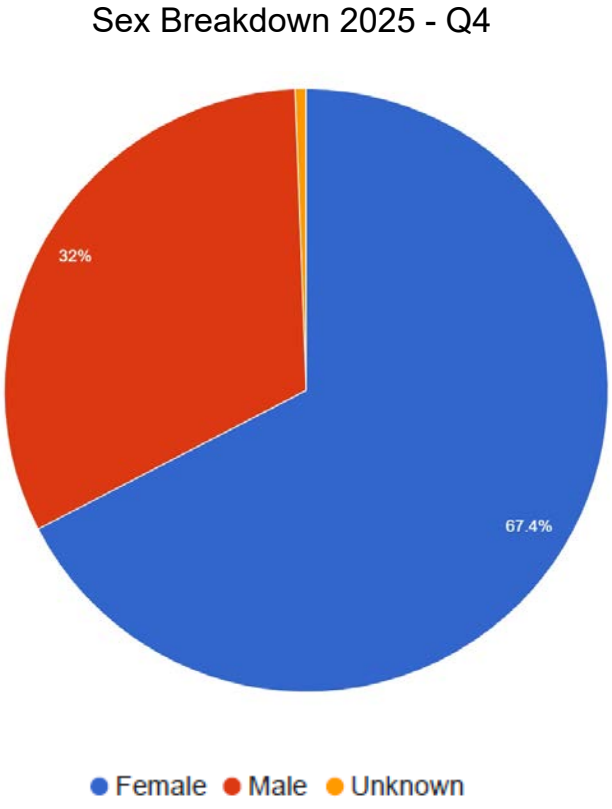
UH3 Award Date: 2021-09-07

Data Reported as of: 2025 Q4




Racial Breakdown 2025 - Q4
# of Cumulative Active Subjects Enrolled (for selected Year/Quarter)
400
300
200
100
0
6
1
2
7
1
89
400
American Indian/Alaska Native
Asian
Black or African American
More Than One Race
Native Hawaiian or Other Pacific Islander
Unknown or Not Reported
White
Race


Ethnicity Breakdown 2025 - Q4
12.6%
47.8%
39.5%
Hispanic or Latino
Not Hispanic or Latino
Unknown or Not Reported


Sex Breakdown 2025 - Q4
32%
67.4%
Female
Male
Unknown

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

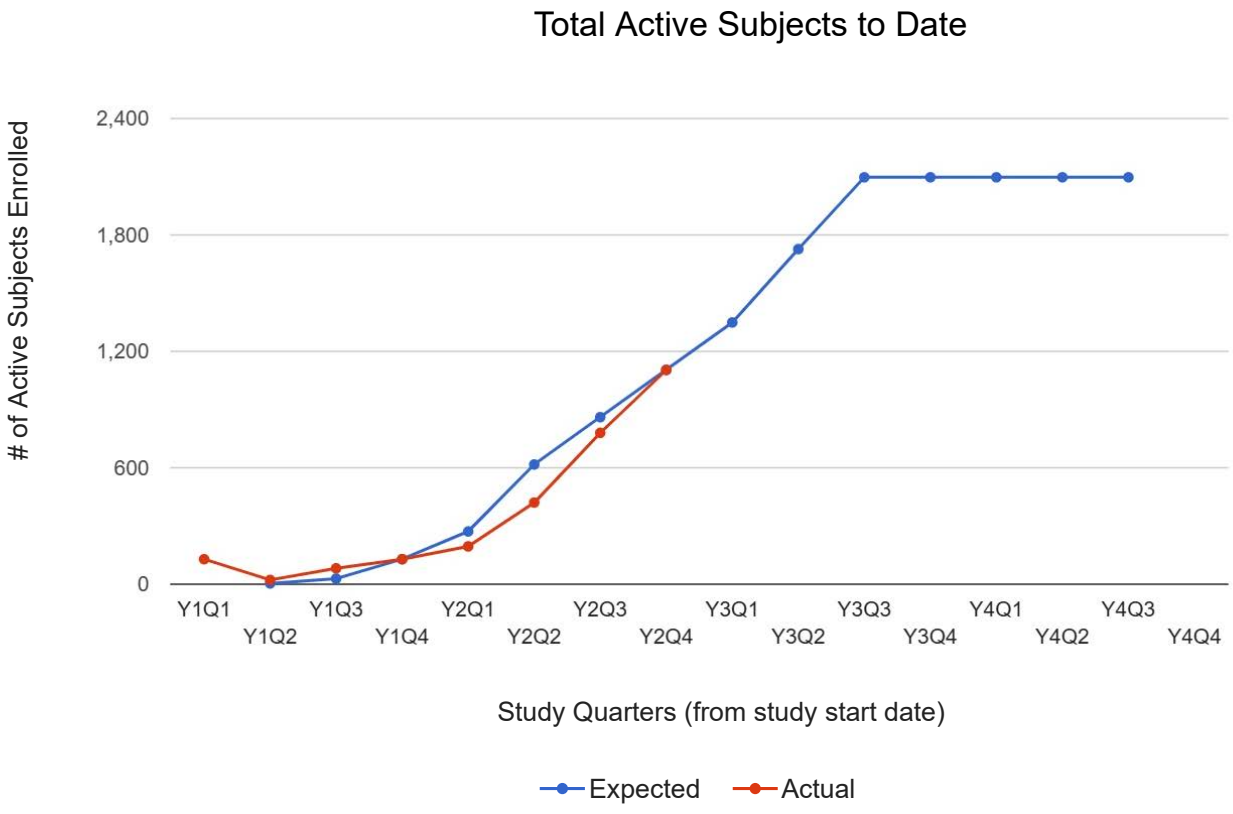
Using artificially intelligent text messaging technology to improve American Heart Association's Life's Simple 7 Health Behaviors (Chat 4 Heart Health)

Principal Investigator: Michael Ho, Sheana Bull

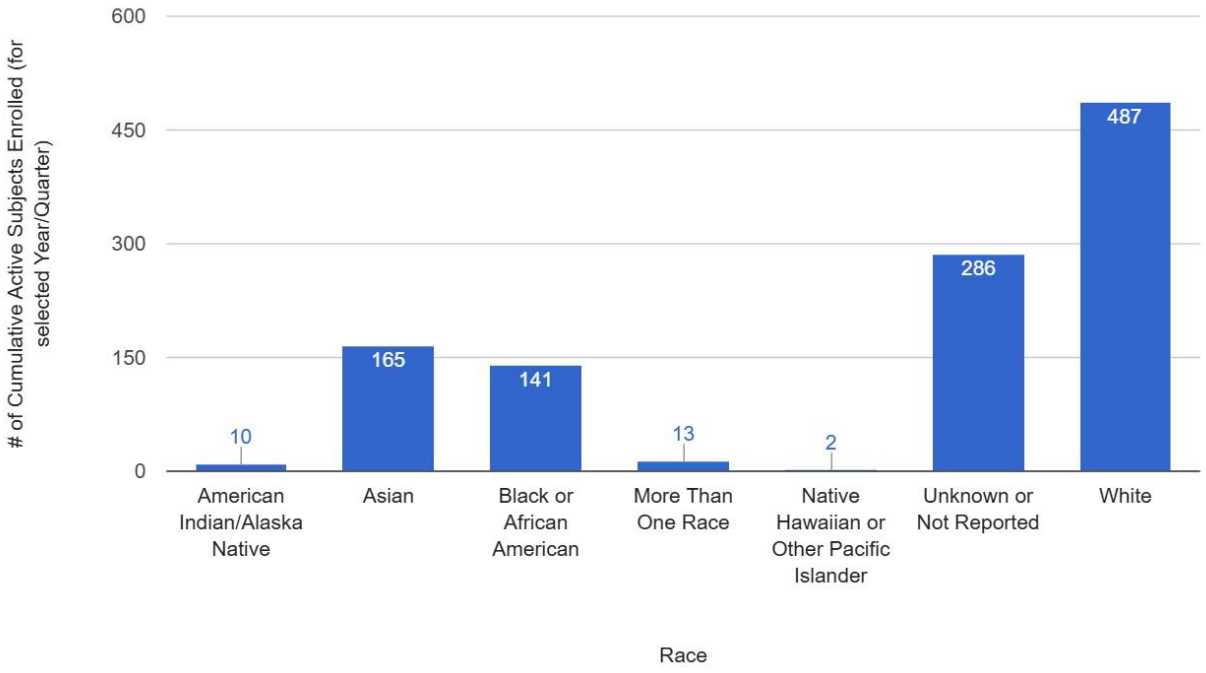
NIH Grant Number: RFA-AT-22-001

UH3 Award Date: 2024-07-11

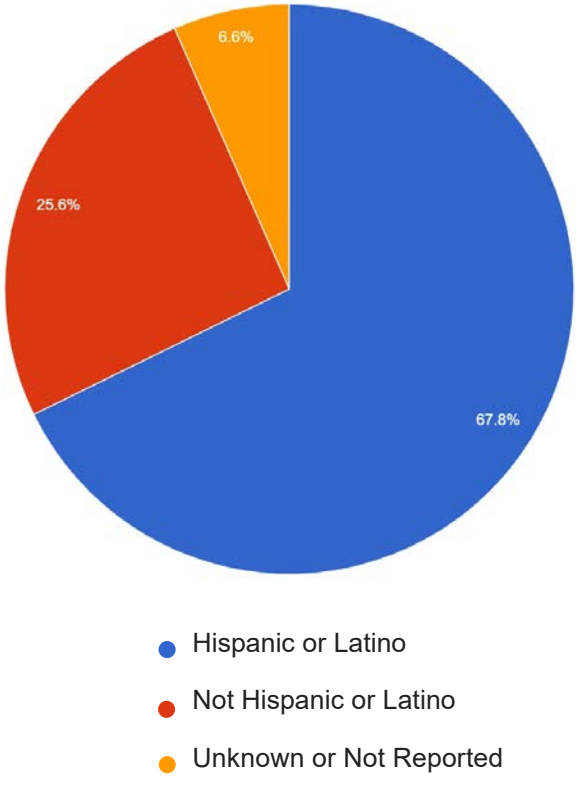
Data Reported as of: 2025 Q4



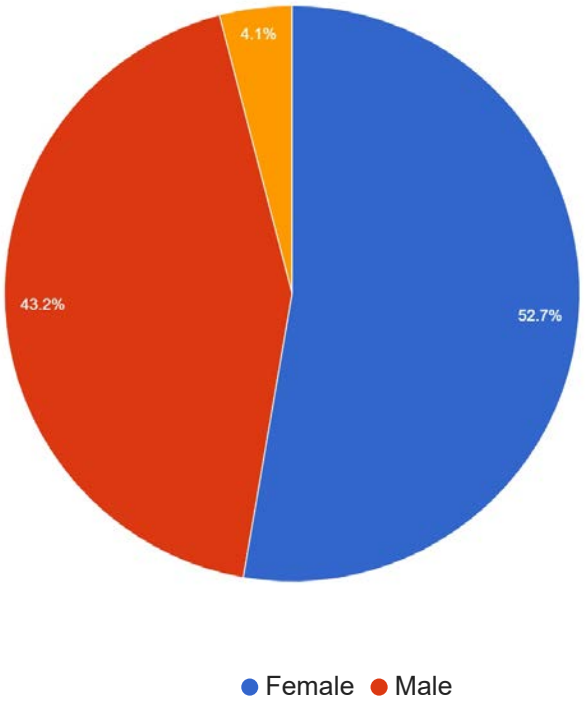
Racial Breakdown 2025 - Q4



Ethnicity Breakdown 2025 - Q4



Sex Breakdown 2025 - Q4



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

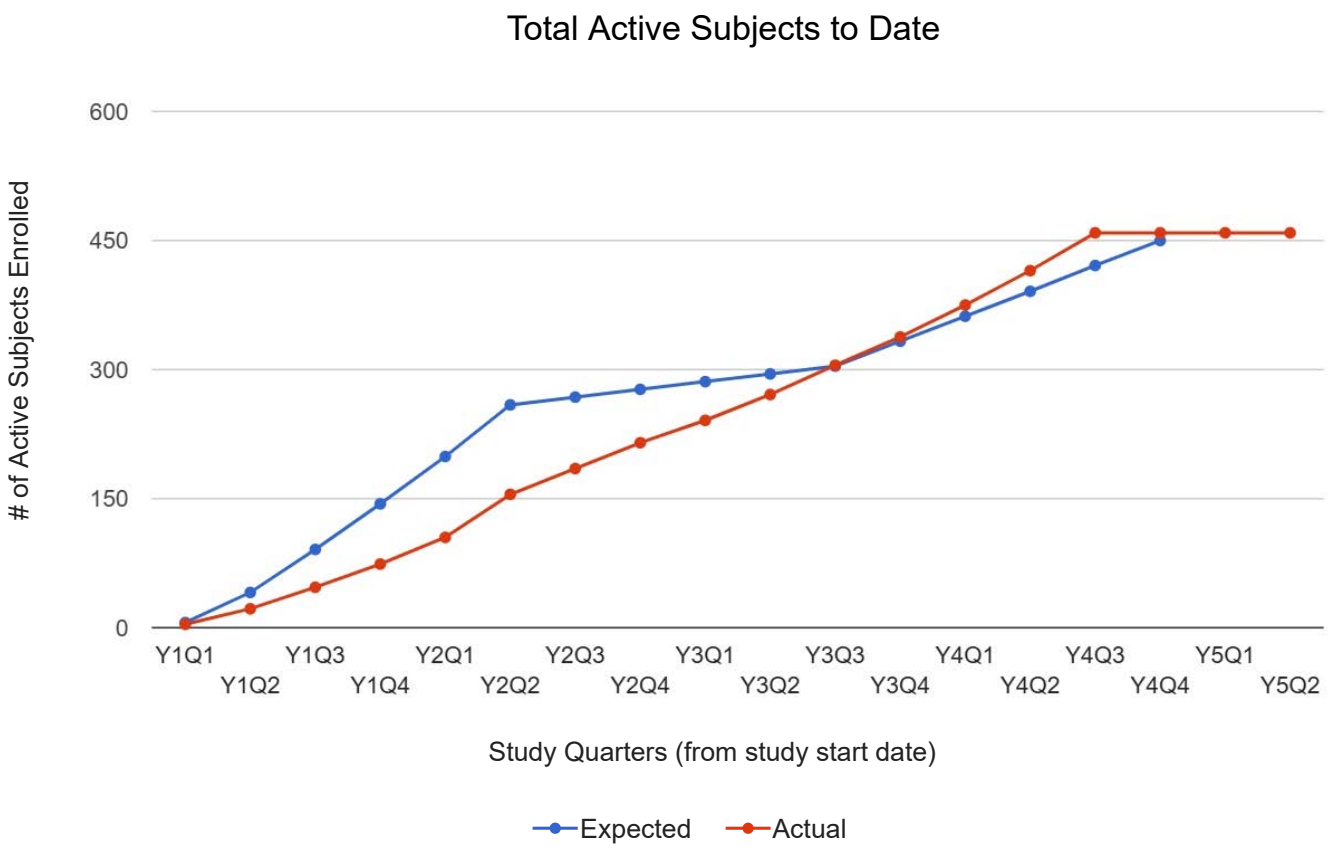
Fibromyalgia TENS in Physical Therapy Study (FM-TIPS)

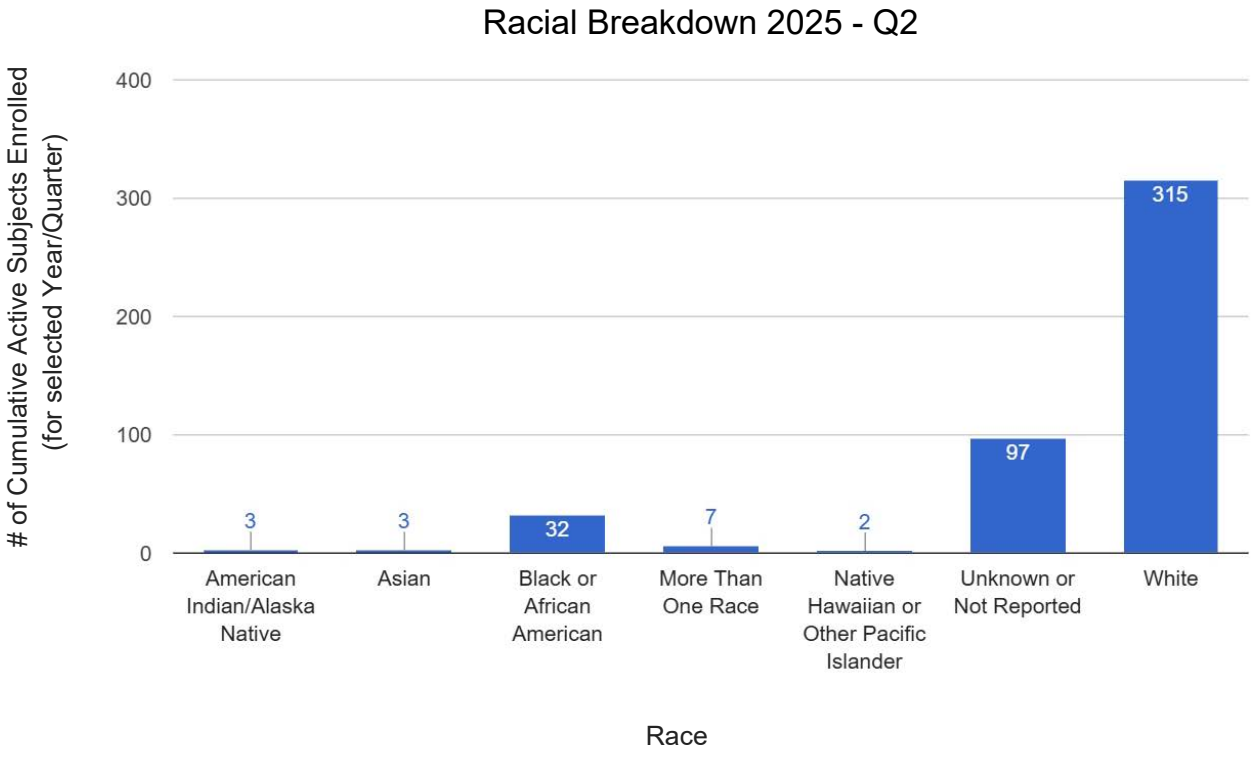
Principal Investigator: Kathleen Sluka, Leslie Crofford

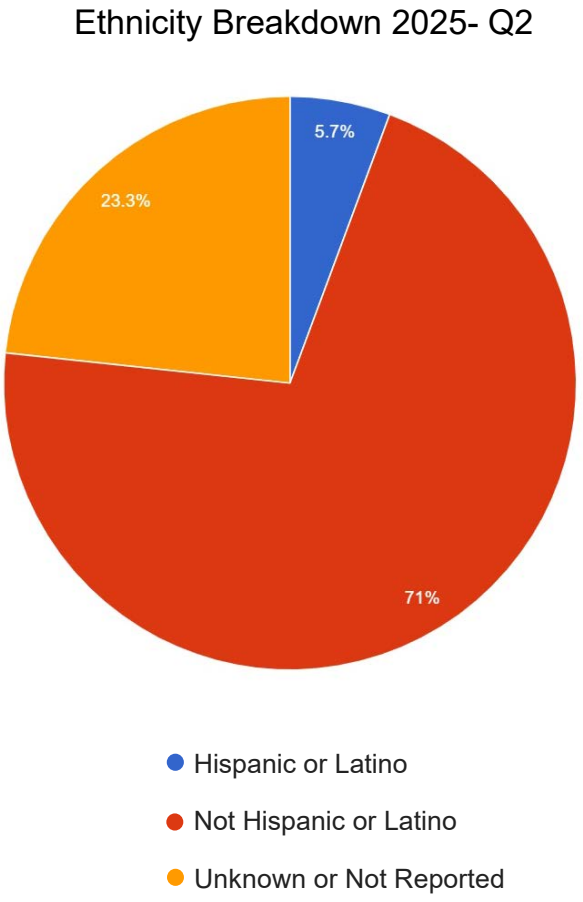
NIH Grant Number: UH3AR076387

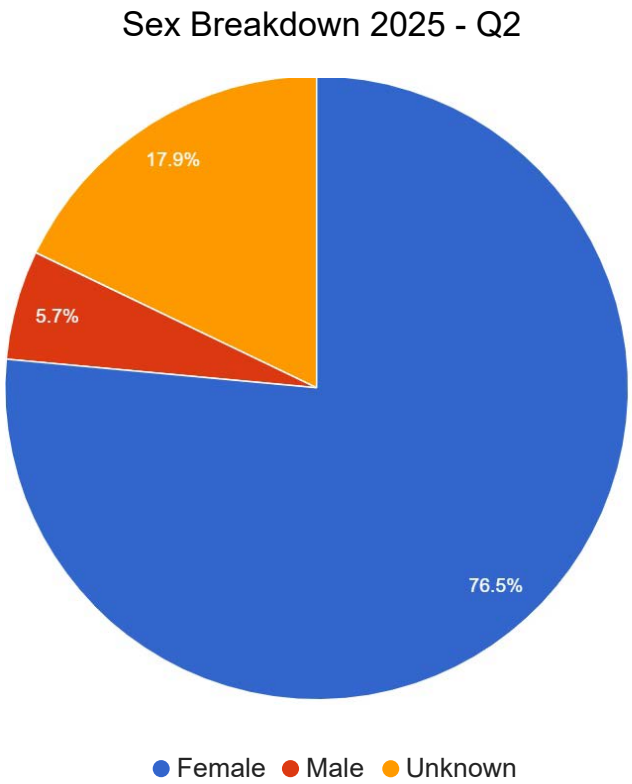
UH3 Award Date: 2020-09-18

Data Reported as of: 2025 Q2




Racial Breakdown 2025 - Q2
# of Cumulative Active Subjects Enrolled (for selected Year/Quarter)
400
300
200
100
0
3
3
32
7
2
97
315
American Indian/Alaska Native
Asian
Black or African American
More Than One Race
Native Hawaiian or Other Pacific Islander
Unknown or Not Reported
White
Race


Ethnicity Breakdown 2025- Q2
5.7%
23.3%
71%
Hispanic or Latino
Not Hispanic or Latino
Unknown or Not Reported


Sex Breakdown 2025 - Q2
17.9%
5.7%
76.5%
Female
Male
Unknown

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

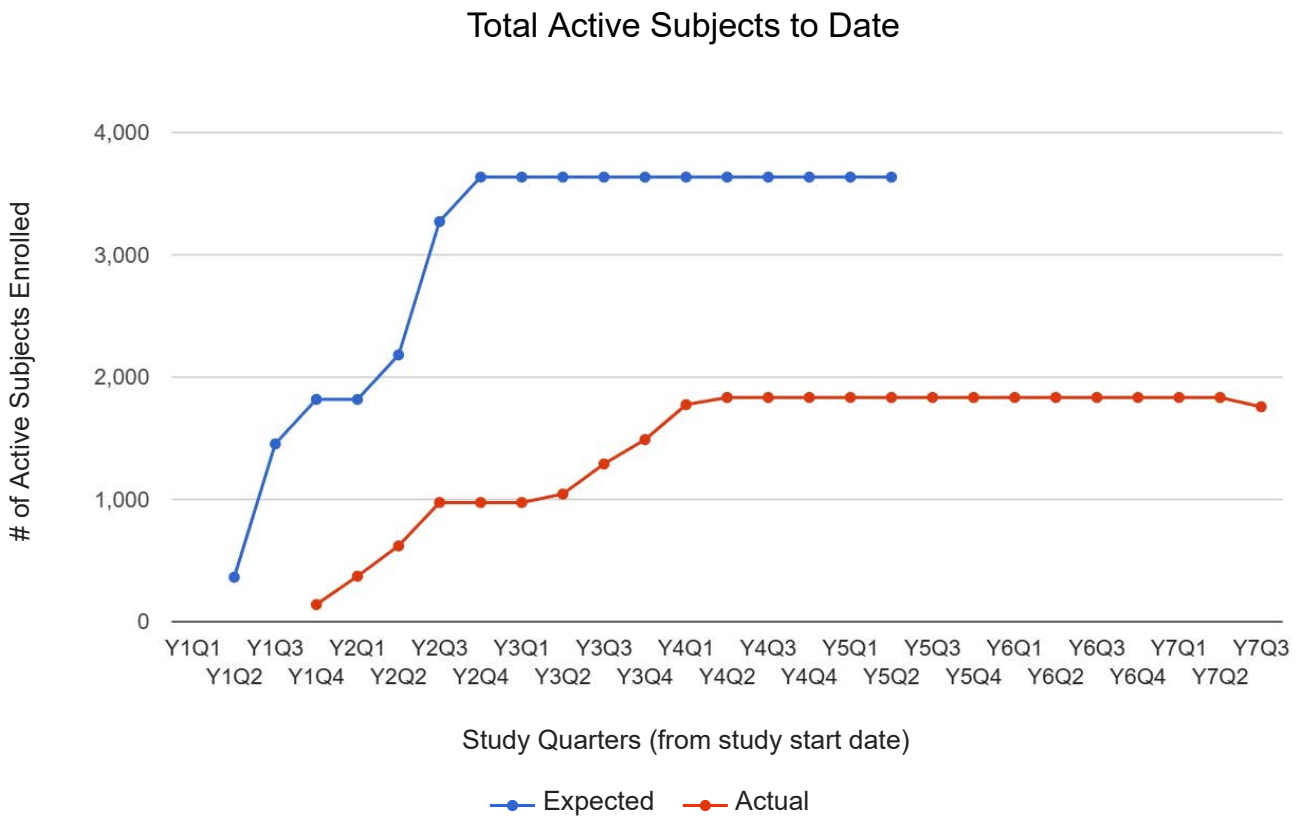
Guiding Good Choices for Health (GGC4H)

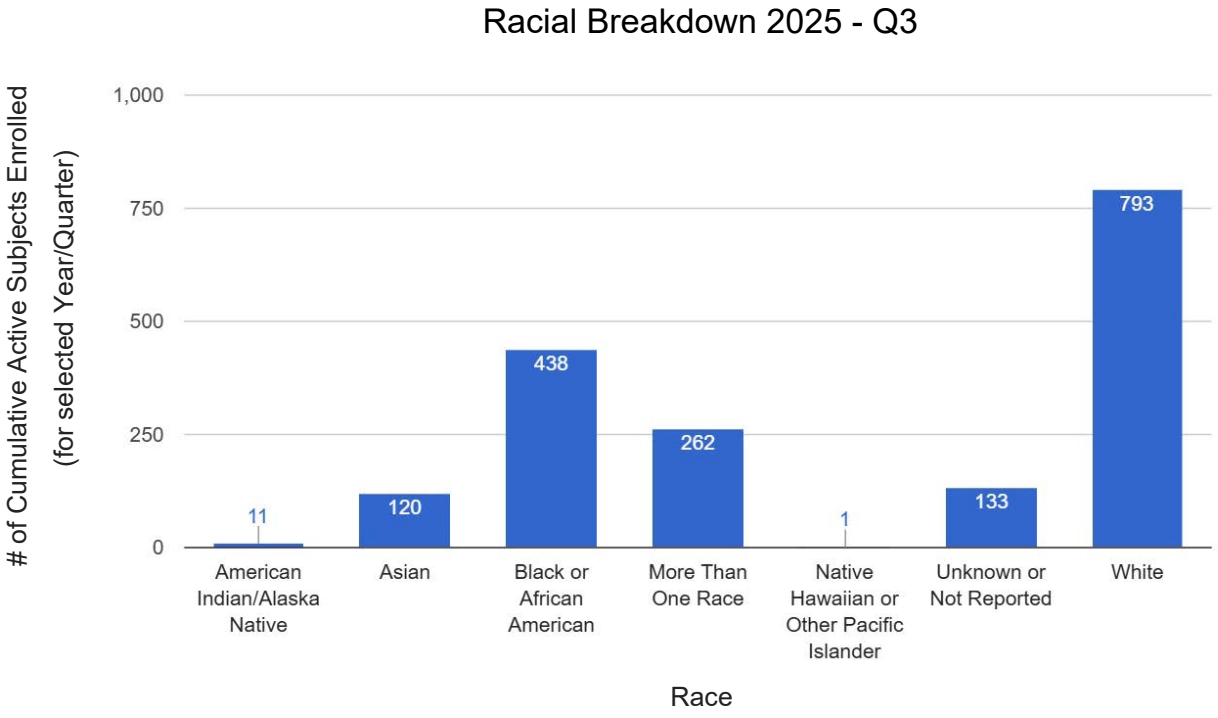
Principal Investigator: Margaret Kuklinski, Stacy Sterling

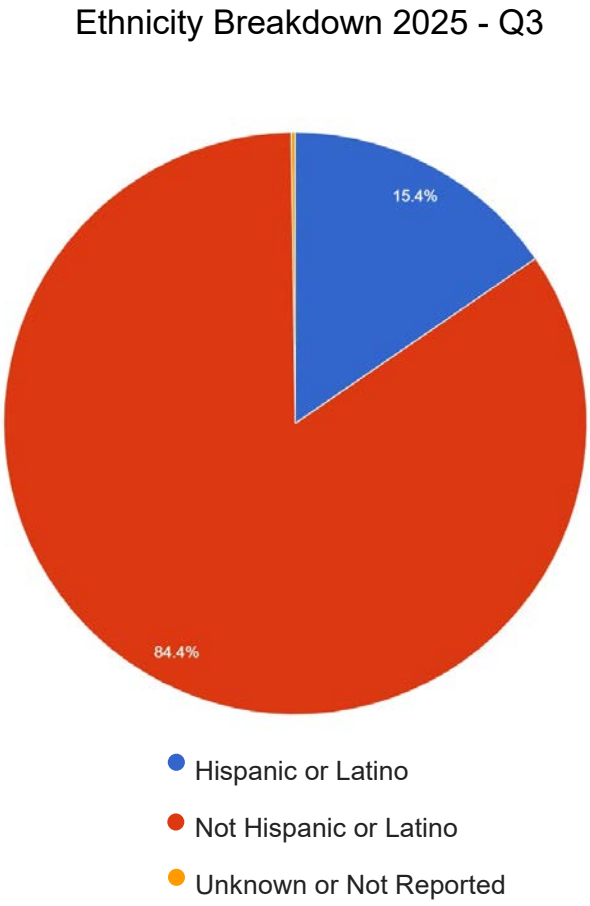
NIH Grant Number: 1UG3AT009838-01

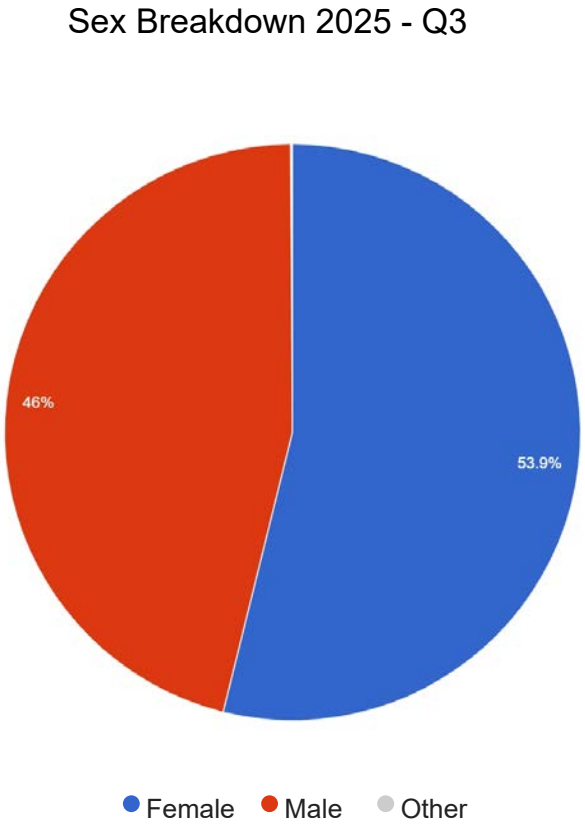
UH3 Award Date: 2018-06-15

Data Reported as of: 2025 Q3




Racial Breakdown 2025 - Q3
# of Cumulative Active Subjects Enrolled (for selected Year/Quarter)
1,000
750
500
250
0
11
120
438
262
1
133
793
American Indian/Alaska Native
Asian
Black or African American
More Than One Race
Native Hawaiian or Other Pacific Islander
Unknown or Not Reported
White
Race


Ethnicity Breakdown 2025 - Q3
15.4%
84.4%
Hispanic or Latino
Not Hispanic or Latino
Unknown or Not Reported


Sex Breakdown 2025 - Q3
46%
53.9%
Female
Male
Other

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

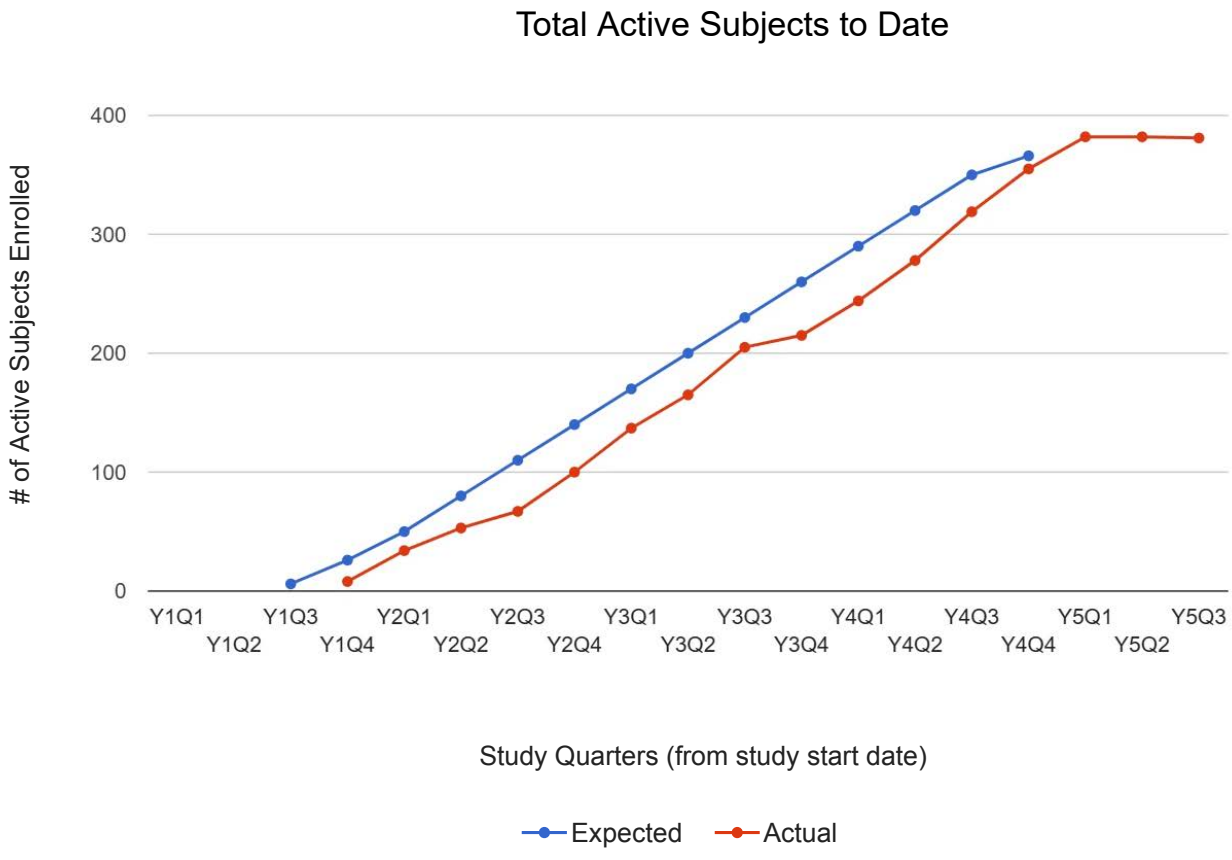
Hybrid Effectiveness-Implementation Trial of Guided Relaxation and Acupuncture for Chronic Sickle Cell Disease Pain (GRACE)

Principal Investigator: Ardith Doorenbos, Judith Schlaeger, Robert Molokie, Miriam Ezenwa, Nirmish Shah

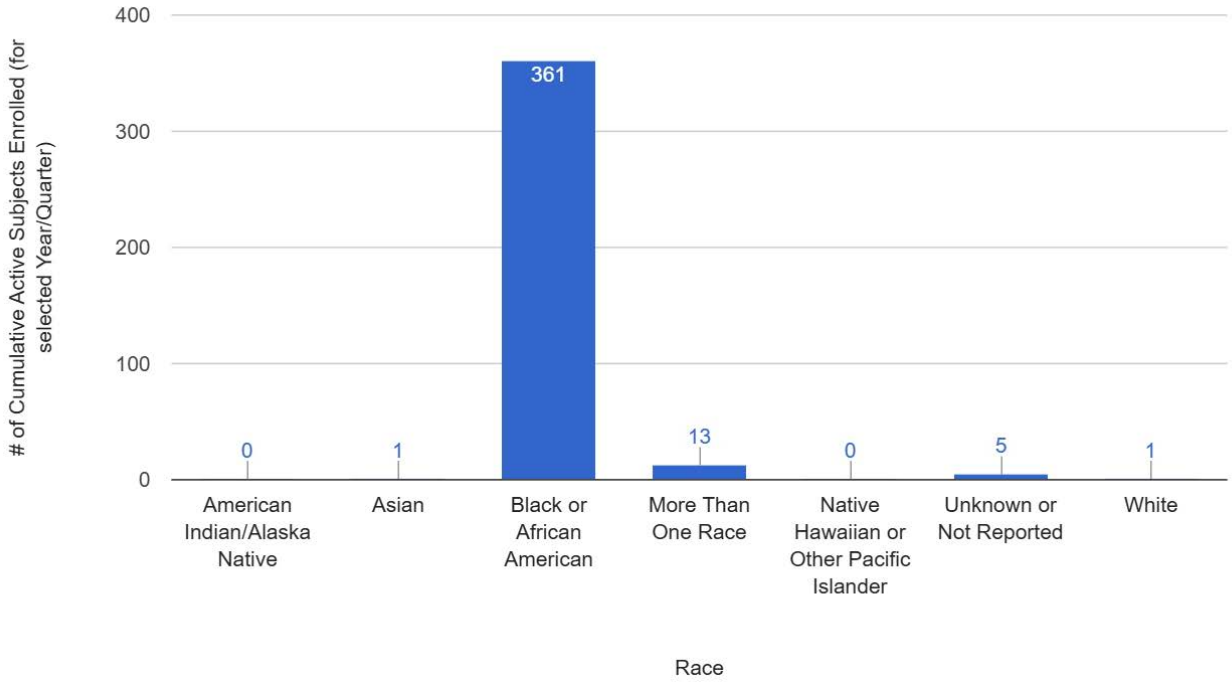
NIH Grant Number: 1UG3AT011265

UH3 Award Date: 2021-09-24

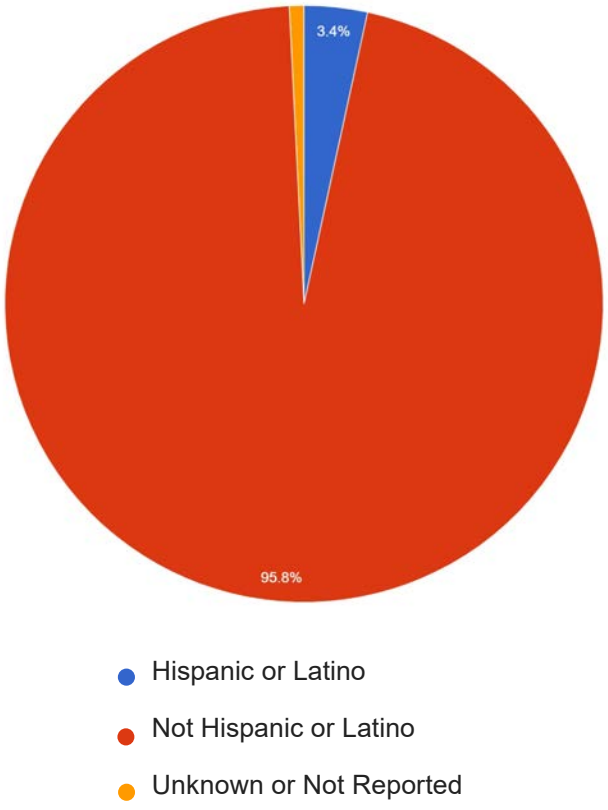
Data Reported as of: 2025 Q3



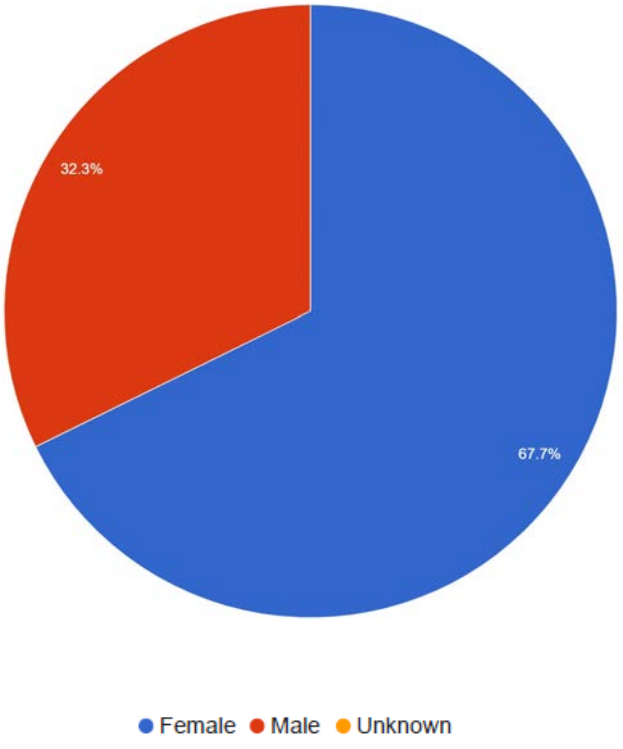
Racial Breakdown 2025 - Q3



Ethnicity Breakdown 2025 - Q3



Sex Breakdown 2025 - Q3



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Improving Completion, Accuracy, and Dissemination of Surgical Advanced Care Planning (I CAN DO Surgical ACP)

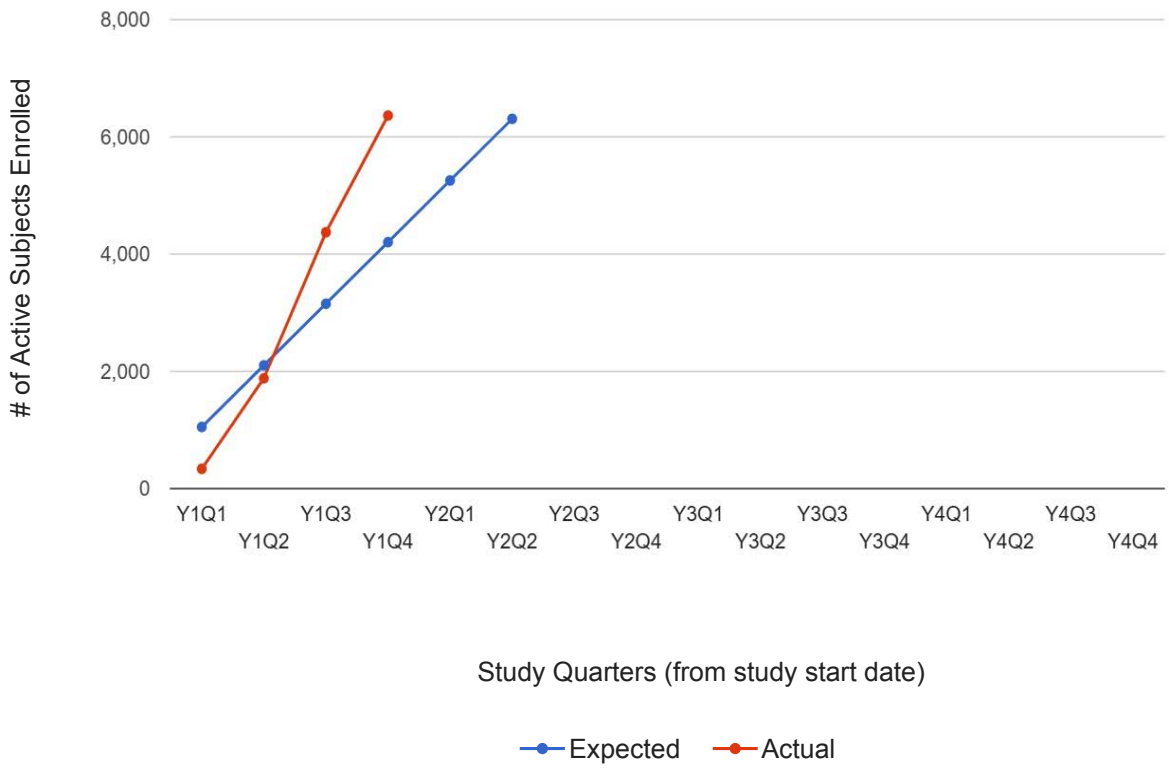
Principal Investigator: Elizabeth Wick, Genevieve Melton-Meaux, Rebecca Sudore

NIH Grant Number: A144368

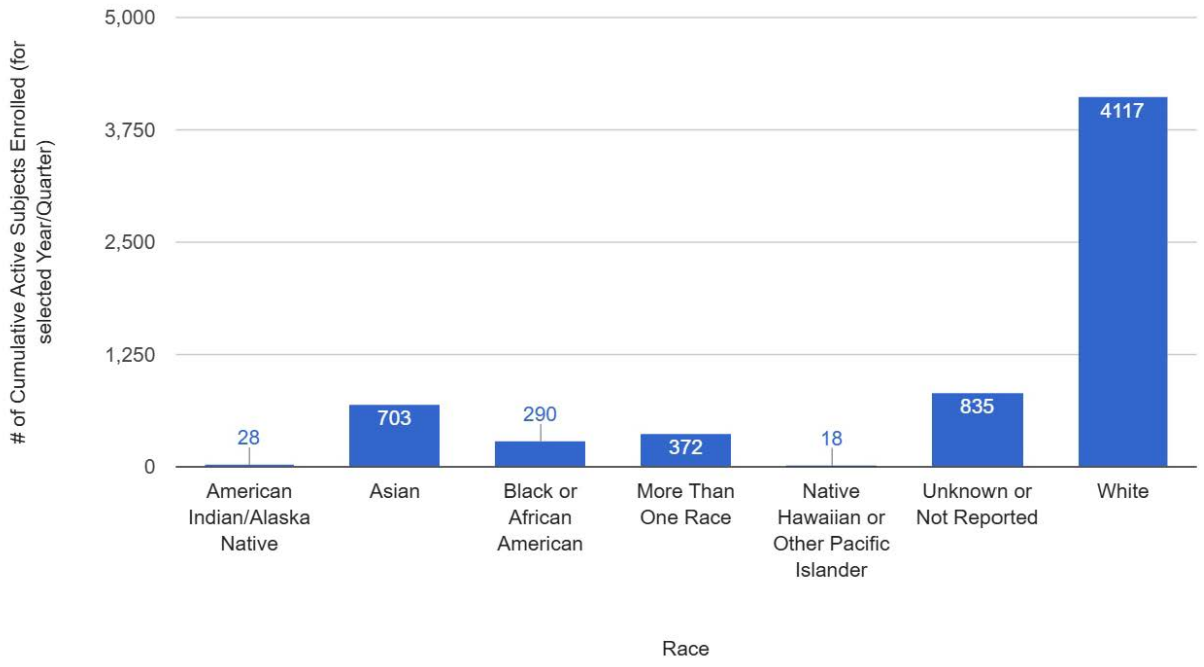
UH3 Award Date: 2023-08-01

Data Reported as of: 2025 Q4

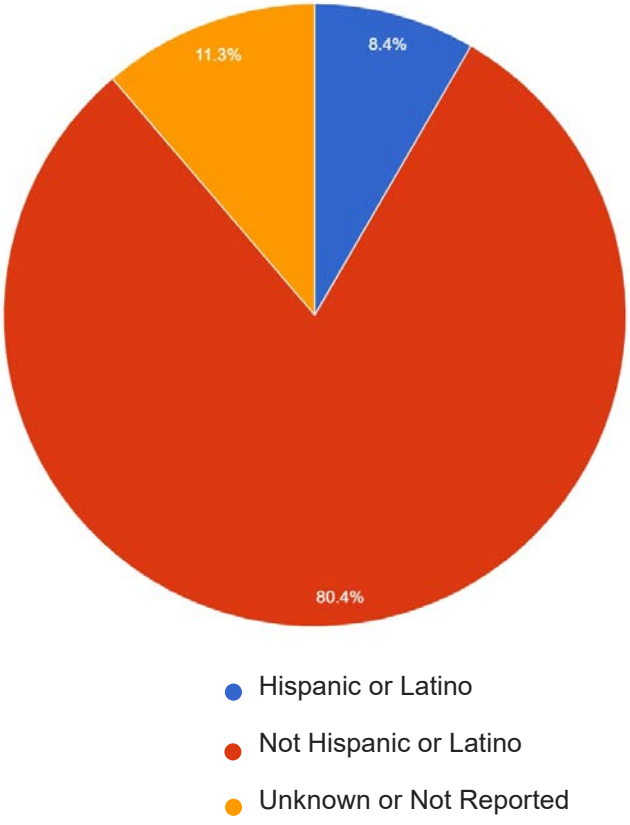
Total Active Subjects to Date



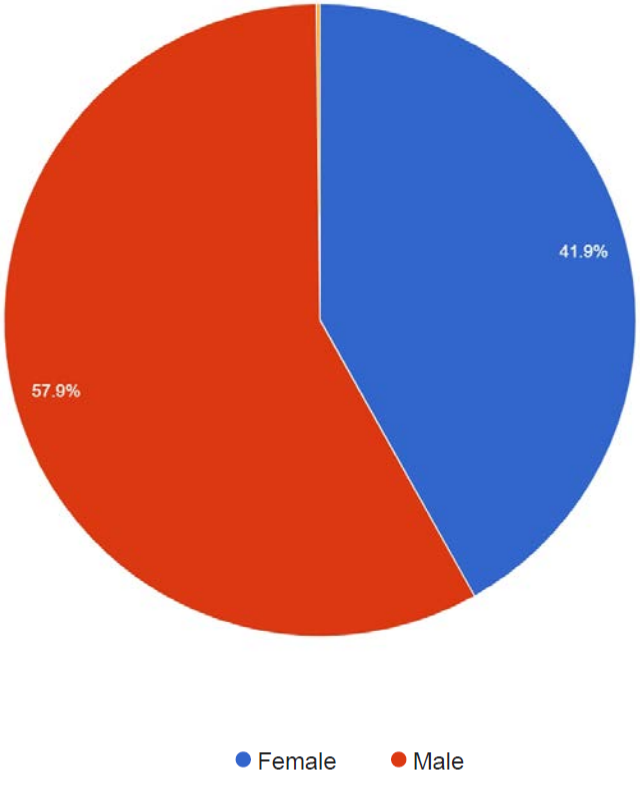
Racial Breakdown 2025 - Q4



Ethnicity Breakdown 2025 - Q4



Sex Breakdown 2025 - Q4



NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

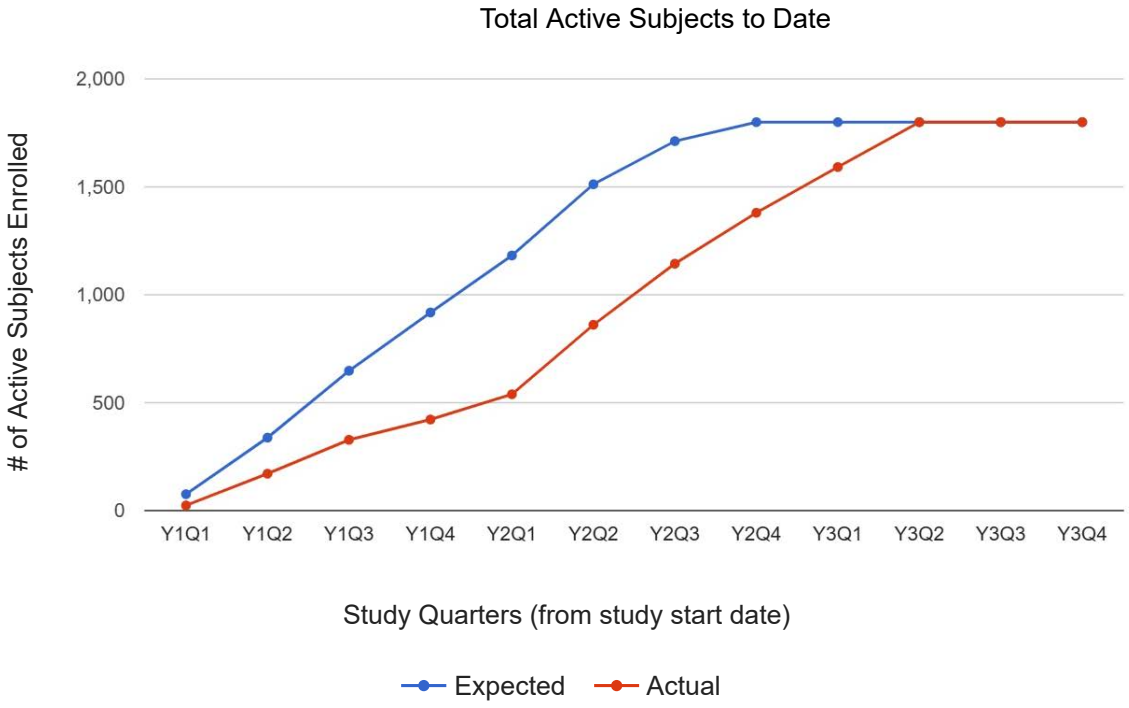
Implementation of the American College of Physicians Guideline for Low Back Pain (IMPACt-LBP)

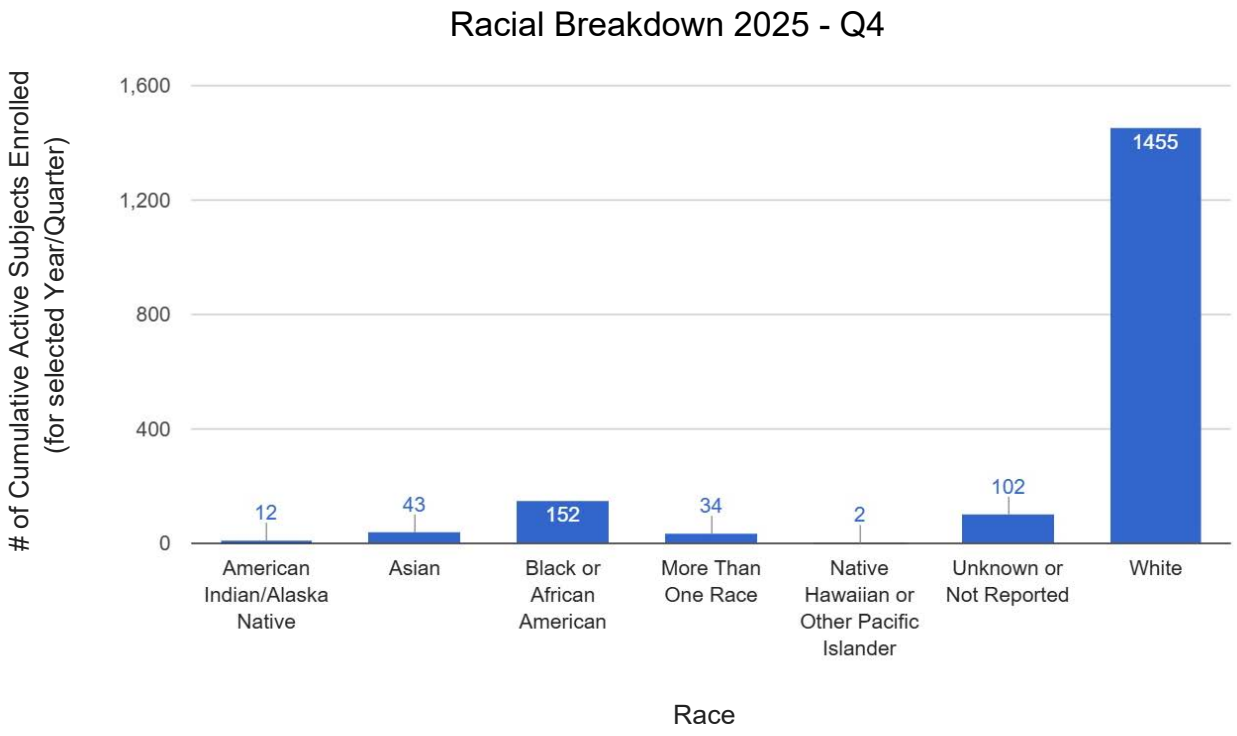
Principal Investigator: Christine Goertz, Adam Goode, Jon Lurie, Hrishikesh Chakraborty

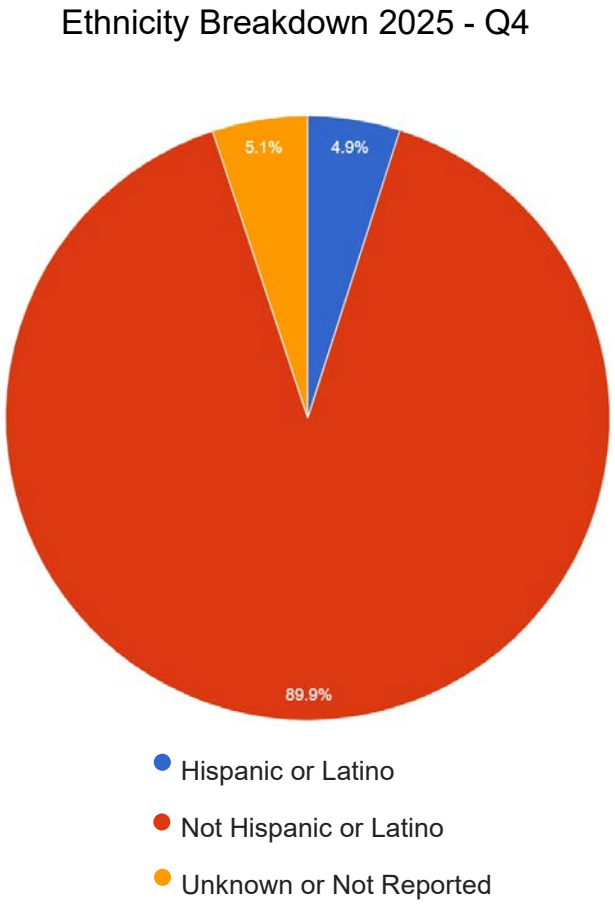
NIH Grant Number: 4UH3AT011187-02

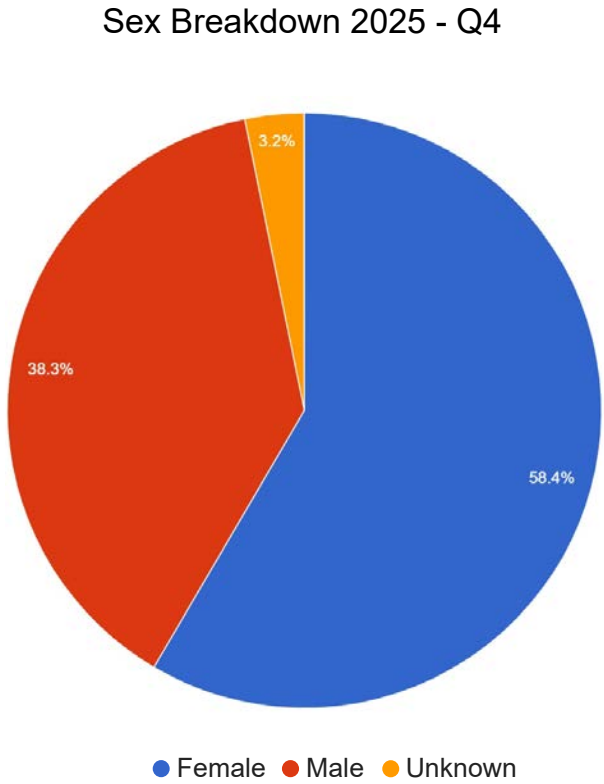
UH3 Award Date: 2022-08-11

Data Reported as of: 2025 Q4




Racial Breakdown 2025 - Q4
# of Cumulative Active Subjects Enrolled (for selected Year/Quarter)
1,600
1,200
800
400
0
12
43
152
34
2
102
1455
American Indian/Alaska Native
Asian
Black or African American
More Than One Race
Native Hawaiian or Other Pacific Islander
Unknown or Not Reported
White
Race


Ethnicity Breakdown 2025 - Q4
5.1%
4.9%
89.9%
Hispanic or Latino
Not Hispanic or Latino
Unknown or Not Reported


Sex Breakdown 2025 - Q4
3.2%
38.3%
58.4%
Female
Male
Unknown

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

Maternal OutcoMes (MOMs) Program: Testing Integrated Maternal Care Model Approaches to Reduce Disparities in Severe Maternal Morbidity (MOMs Chat & Care Study)

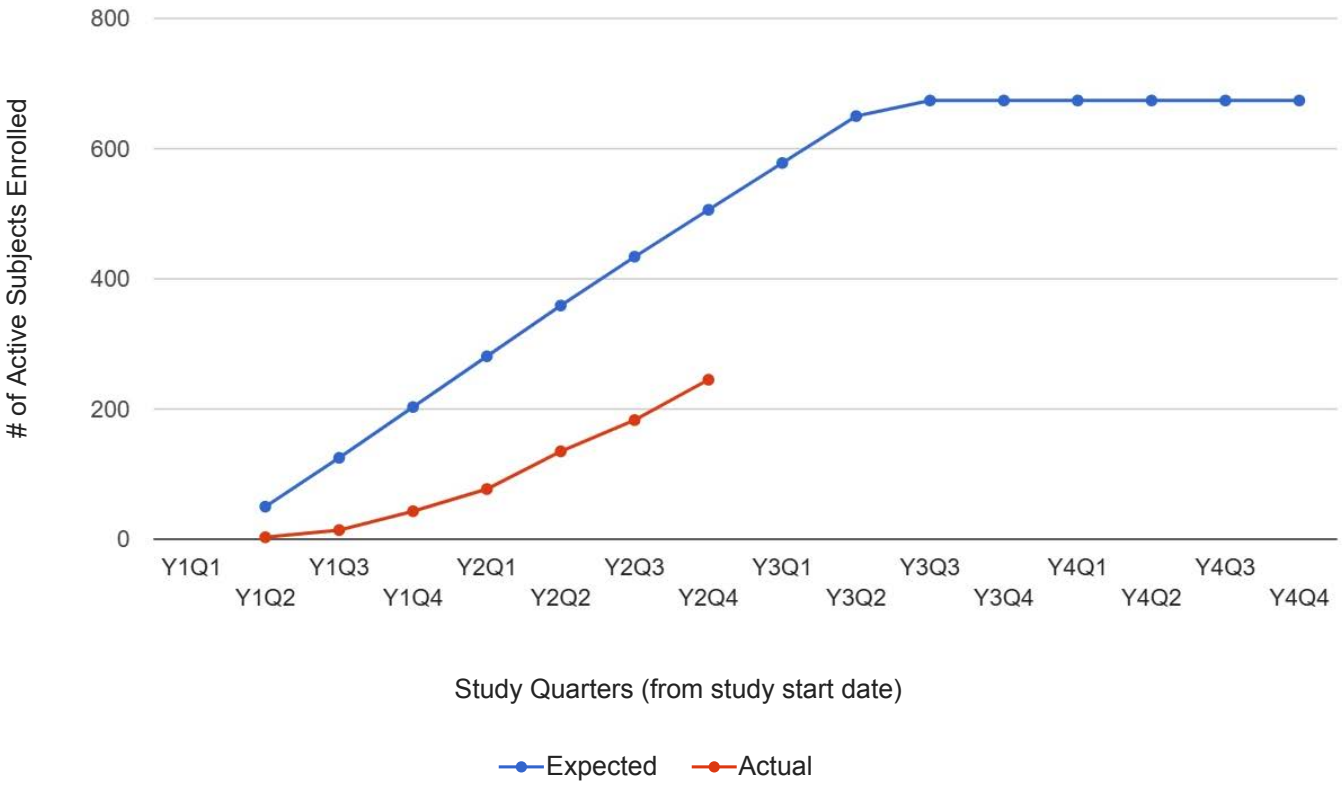
Principal Investigator: Stephanie Fitzpatrick

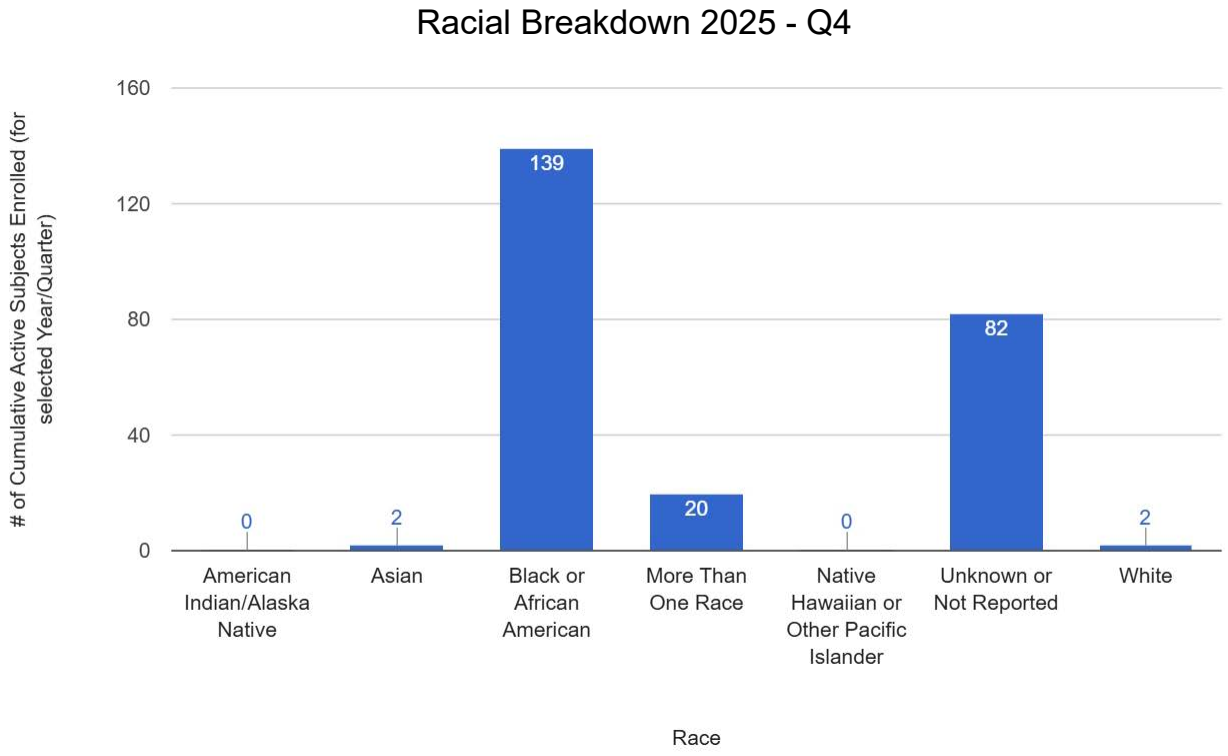
NIH Grant Number: 1R01NR021134-01

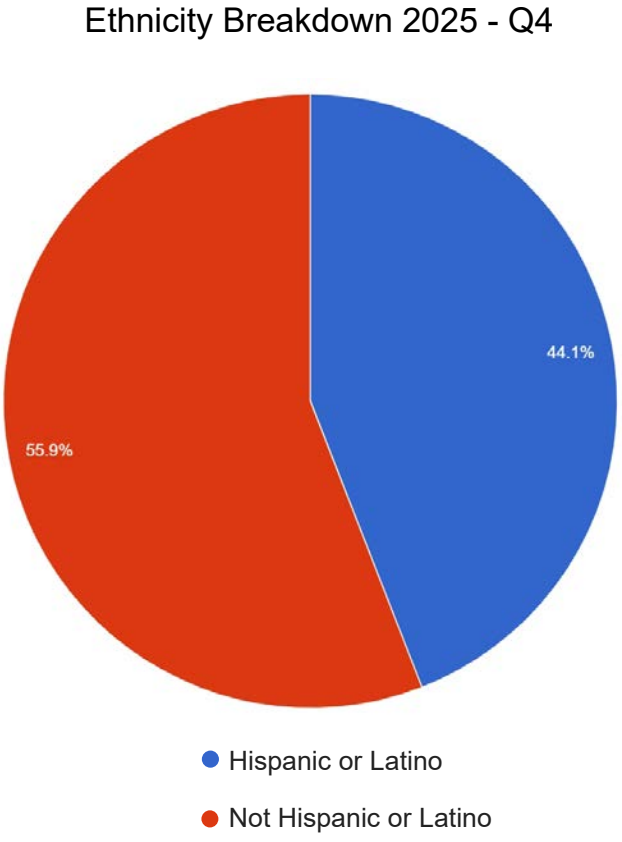
Award Date: 2023-09-22

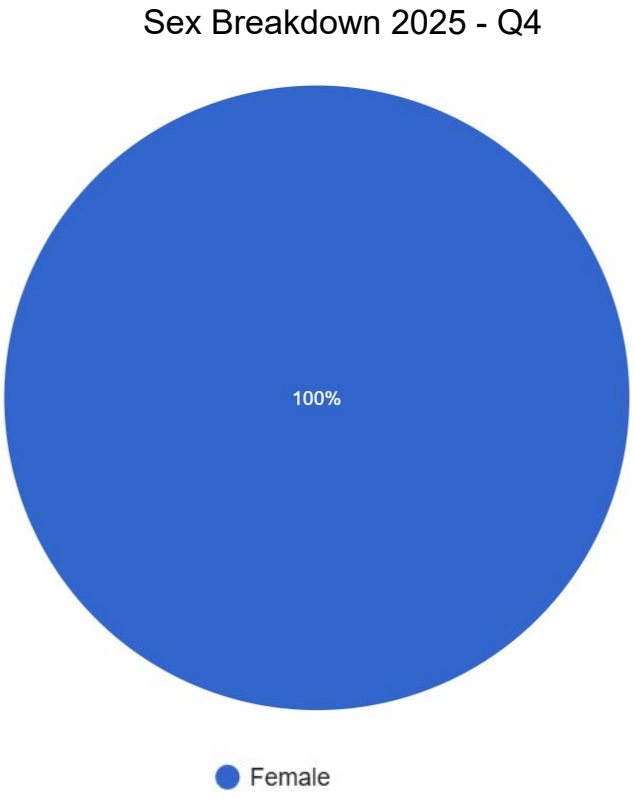
Data Reported as of: 2025 Q4

Total Active Subjects to Date




Racial Breakdown 2025 - Q4
# of Cumulative Active Subjects Enrolled (for selected Year/Quarter)
160
120
80
40
0
0
2
139
20
0
82
2
American Indian/Alaska Native
Asian
Black or African American
More Than One Race
Native Hawaiian or Other Pacific Islander
Unknown or Not Reported
White
Race


Ethnicity Breakdown 2025 - Q4
44.1%
55.9%
Hispanic or Latino
Not Hispanic or Latino


Sex Breakdown 2025 - Q4
100%
Female

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

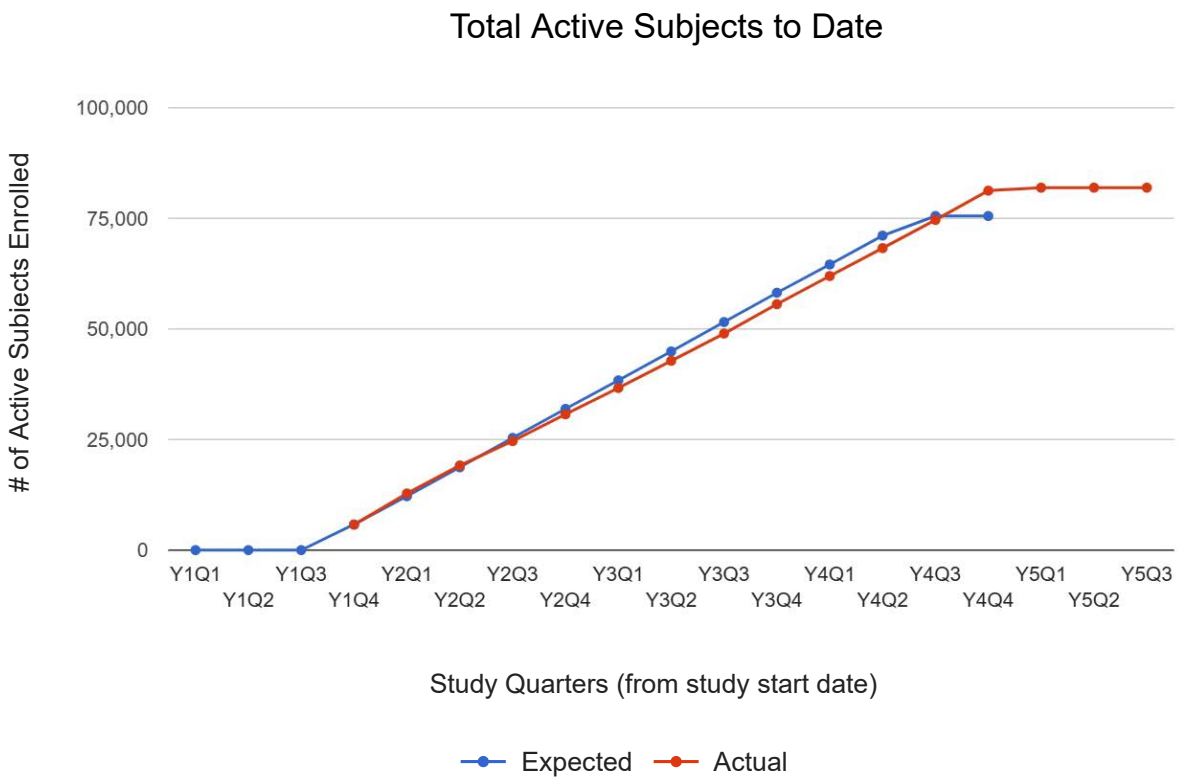
Non-pharmacological Options in Postoperative Hospital-based and Rehabilitation Pain Management (NOHARM)

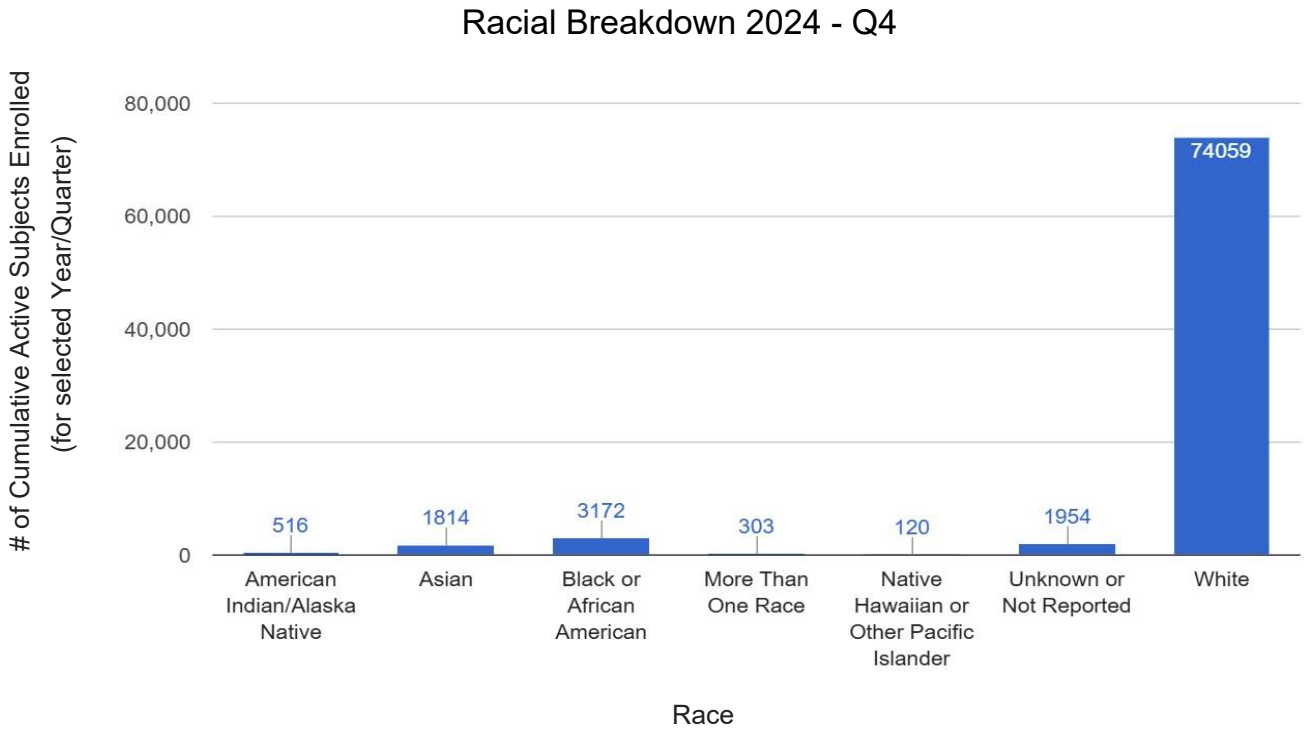
Principal Investigator: Andrea Cheville, Jon Tilburt

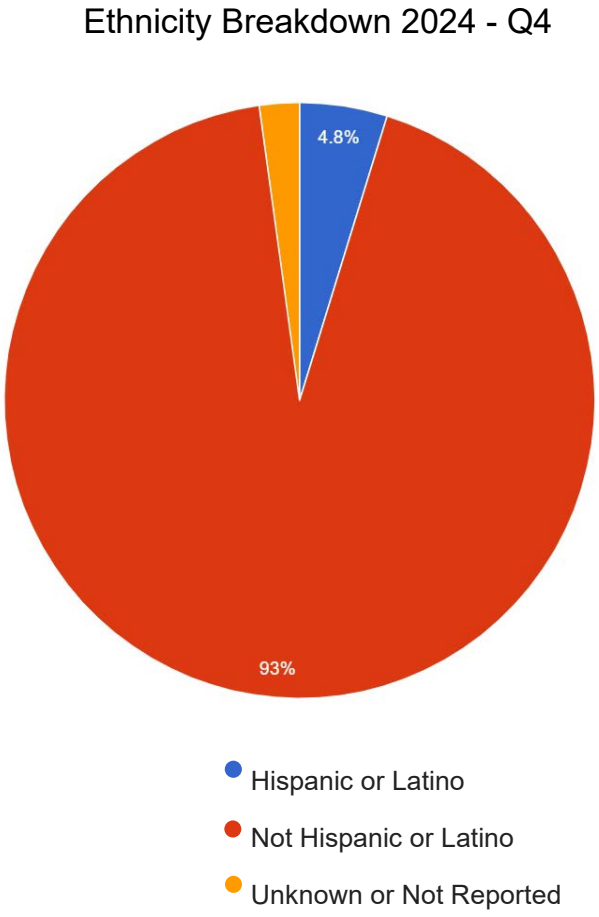
NIH Grant Number: UH3AG067593

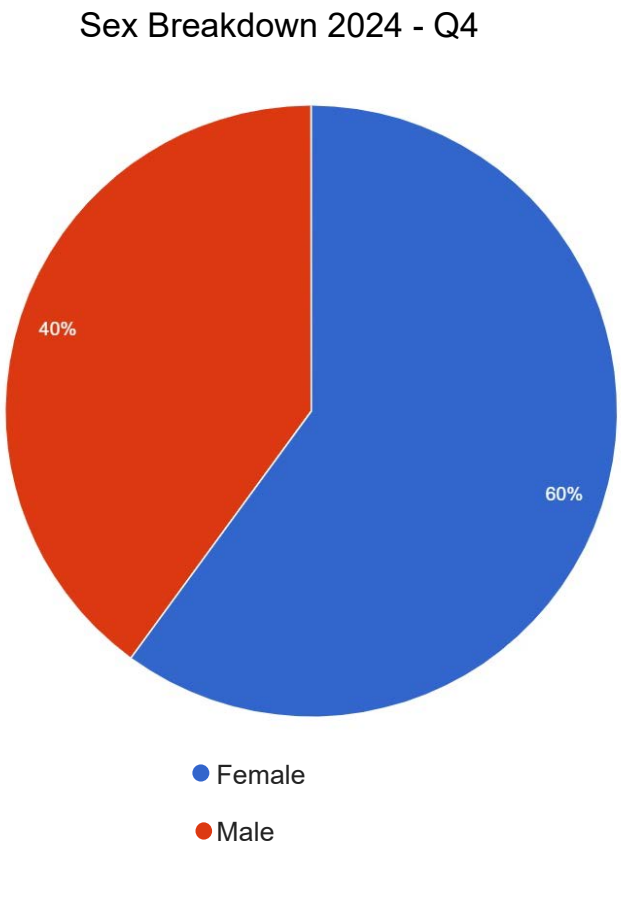
UH3 Award Date: 2020-09-14

Data Reported as of: 2024 Q4




Racial Breakdown 2024 - Q4
# of Cumulative Active Subjects Enrolled (for selected Year/Quarter)
80,000
60,000
40,000
20,000
0
516
1814
3172
303
120
1954
74059
American Indian/Alaska Native
Asian
Black or African American
More Than One Race
Native Hawaiian or Other Pacific Islander
Unknown or Not Reported
White
Race


Ethnicity Breakdown 2024 - Q4
4.8%
93%
Hispanic or Latino
Not Hispanic or Latino
Unknown or Not Reported


Sex Breakdown 2024 - Q4
40%
60%
Female
Male

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

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

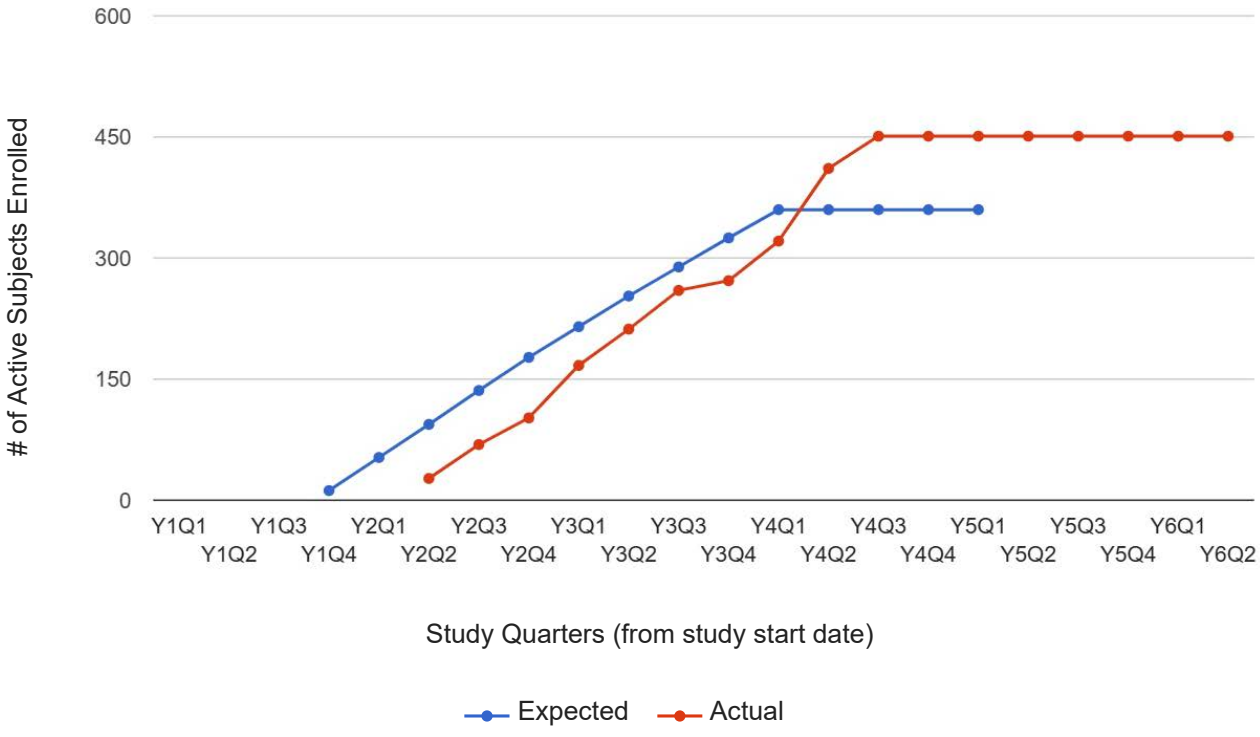
Principal Investigator: Natalia Morone

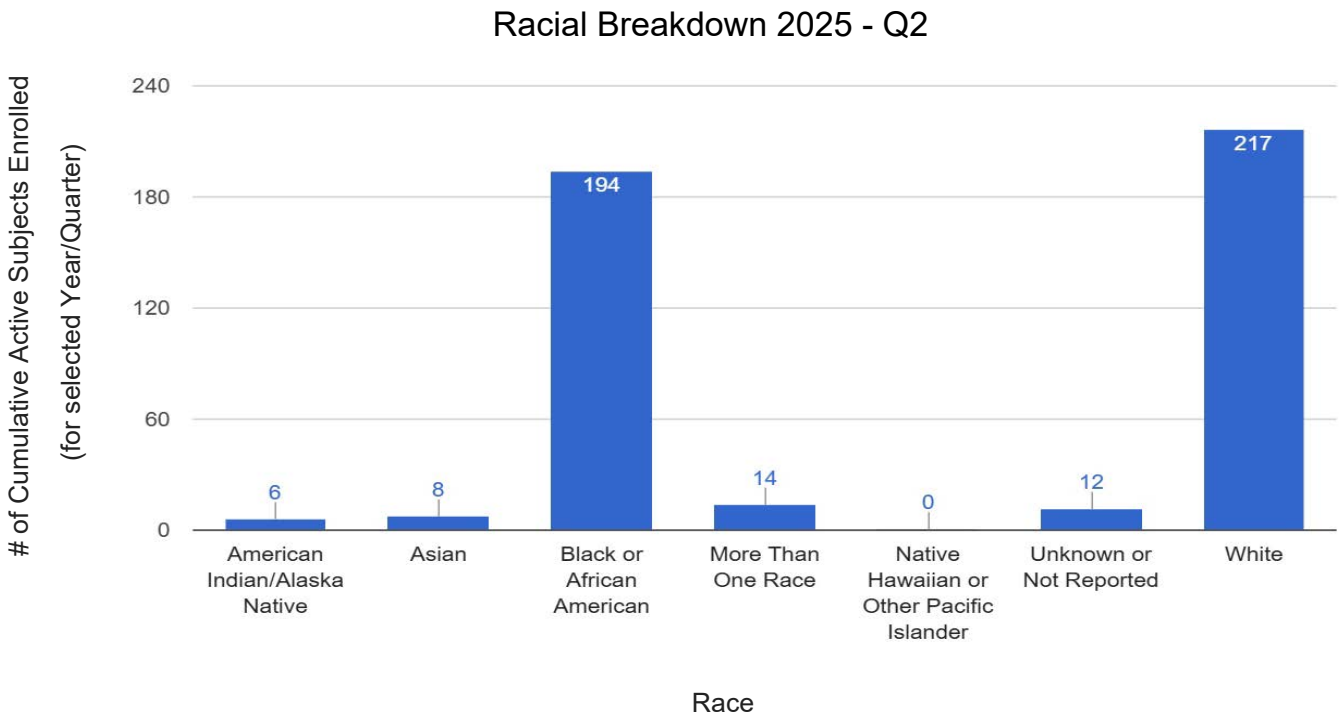
NIH Grant Number: 4UH3AT010621-02

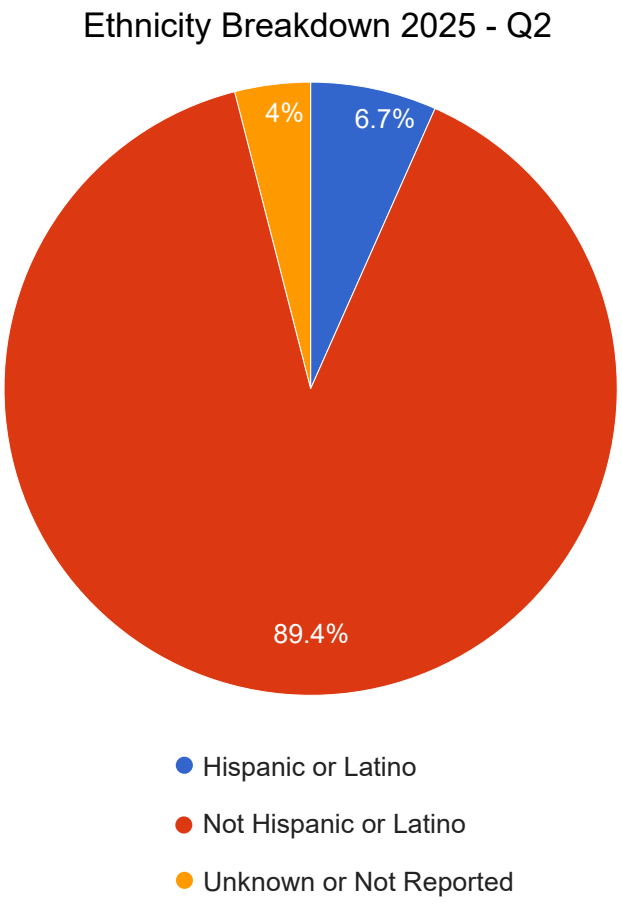
UH3 Award Date: 2020-09-1

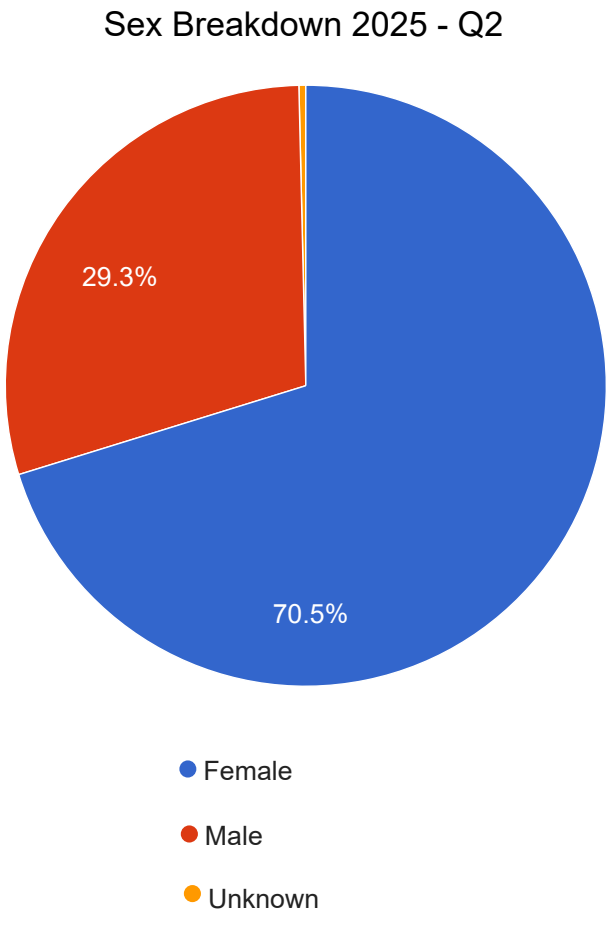
Data Reported as of: 2025 Q2

Total Active Subjects to Date




Racial Breakdown 2025 - Q2
# of Cumulative Active Subjects Enrolled (for selected Year/Quarter)
240
180
120
60
0
6
8
194
14
0
12
217
American Indian/Alaska Native
Asian
Black or African American
More Than One Race
Native Hawaiian or Other Pacific Islander
Unknown or Not Reported
White
Race


Ethnicity Breakdown 2025 - Q2
4%
6.7%
89.4%
Hispanic or Latino
Not Hispanic or Latino
Unknown or Not Reported


Sex Breakdown 2025 - Q2
29.3%
70.5%
Female
Male
Unknown

NIH PRAGMATIC TRIALS COLLABORATORY
Rethinking Clinical Trials®

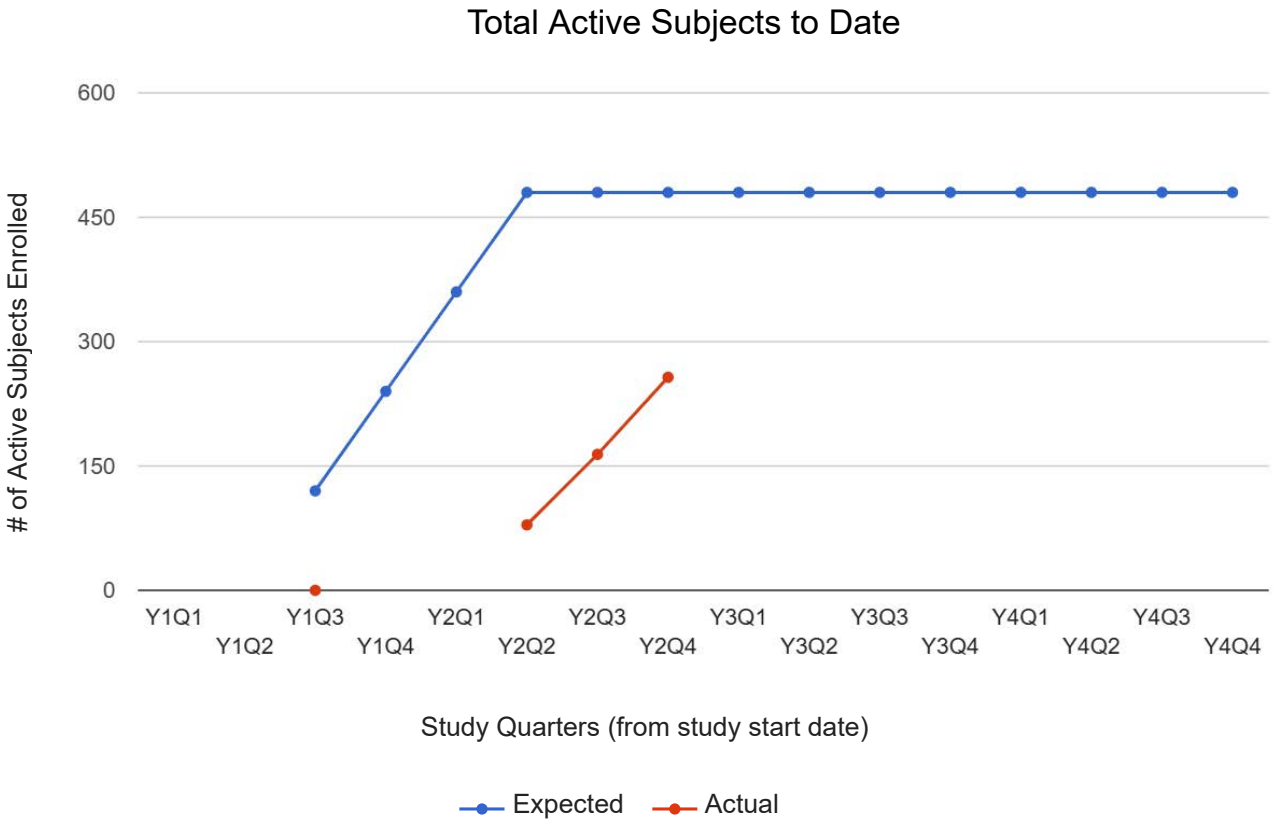
Remote Tai Chi for Knee Osteoarthritis: an Embedded Pragmatic Trial (TAICHIKNEE)

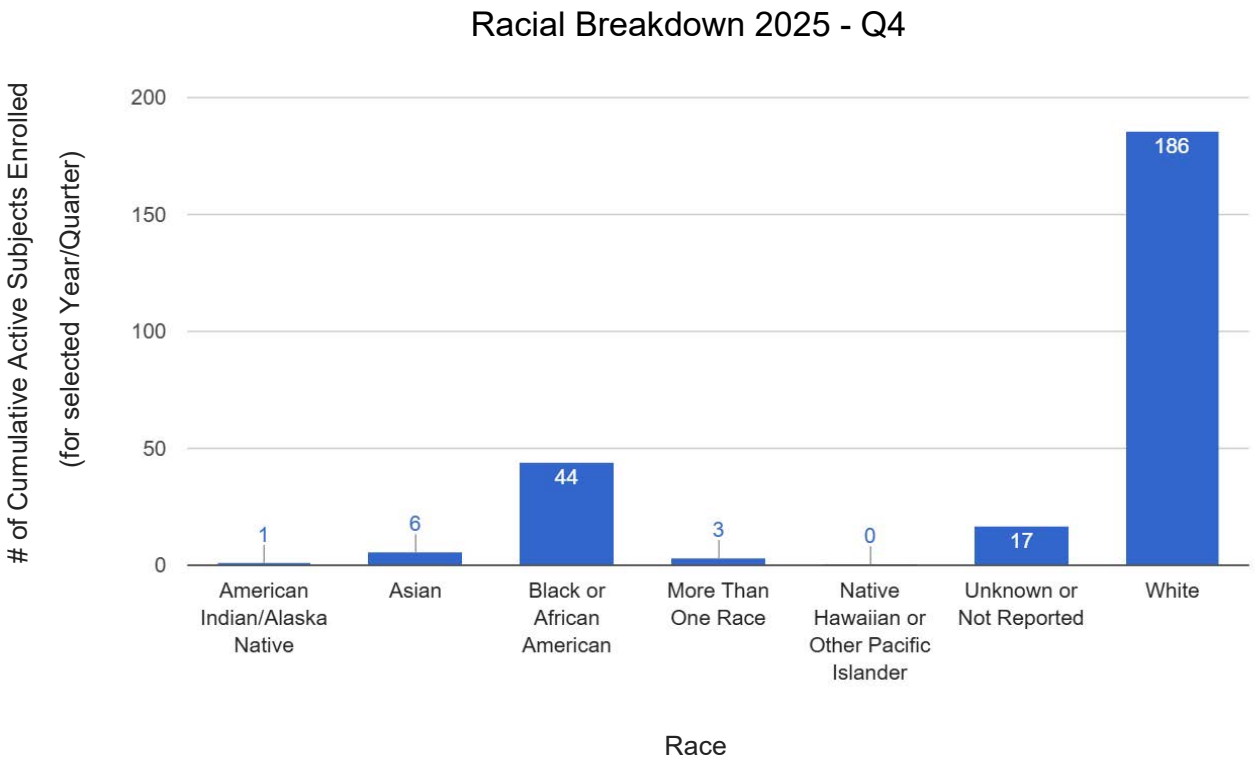
Principal Investigator: ChenChen Wang, Eric Roseen, Robert Saper, Helen Lavretsky

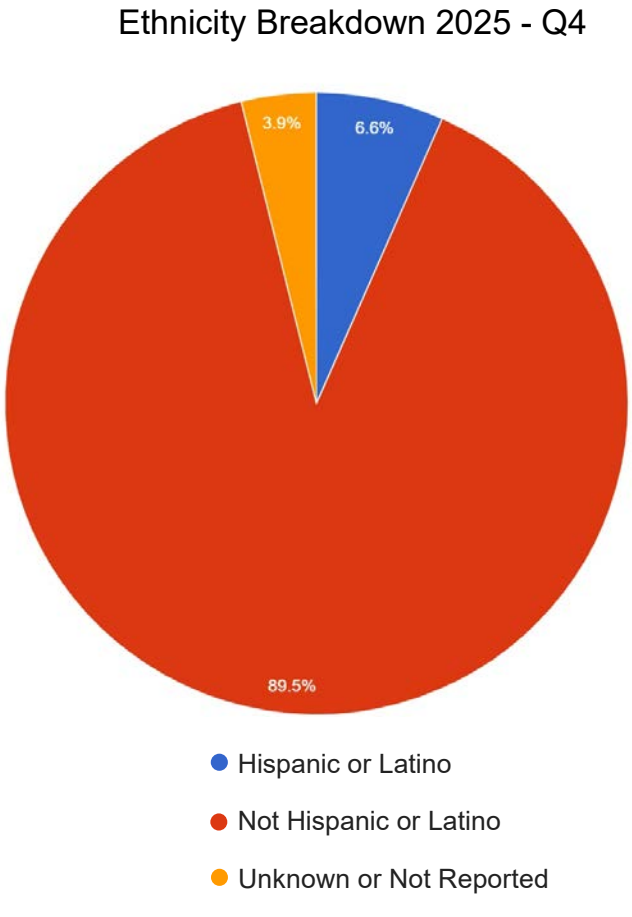
NIH Grant Number: UH3AT012413

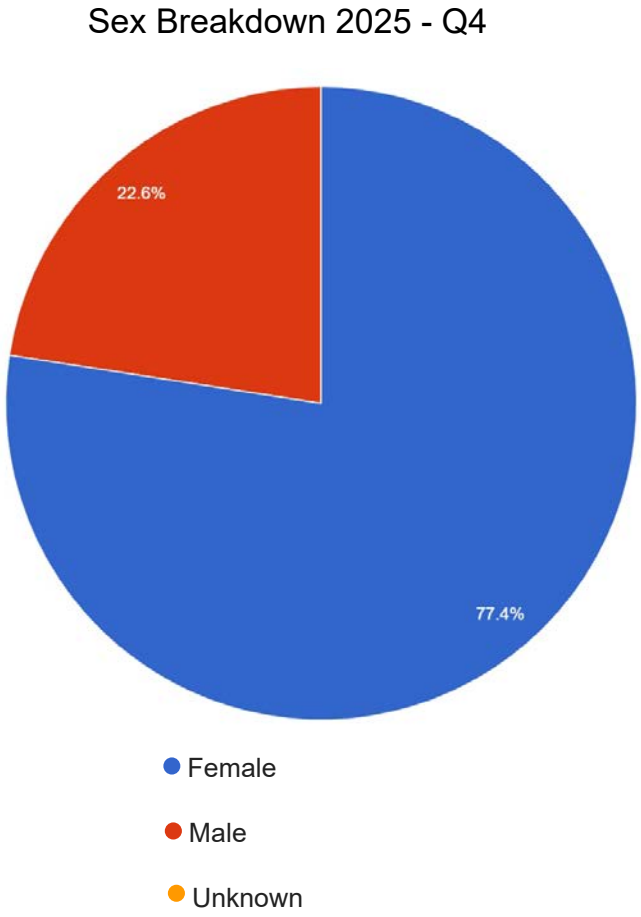
UH3 Award Date: 2024-10-01

Data Reported as of: 2025 Q4




Racial Breakdown 2025 - Q4
# of Cumulative Active Subjects Enrolled
(for selected Year/Quarter)
200
150
100
50
0
1
6
44
3
0
17
186
American Indian/Alaska Native
Asian
Black or African American
More Than One Race
Native Hawaiian or Other Pacific Islander
Unknown or Not Reported
White
Race


Ethnicity Breakdown 2025 - Q4
3.9%
6.6%
89.5%
Hispanic or Latino
Not Hispanic or Latino
Unknown or Not Reported


Sex Breakdown 2025 - Q4
22.6%
77.4%
Female
Male
Unknown

NIH PRAGMATIC TRIALS COLLABORATORY

Rethinking Clinical Trials®

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