

**BIOGRAPHICAL SKETCH**

Provide the following information for the Senior/key personnel and other significant contributors. Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: **Darnall, Beth**

eRA COMMONS USER NAME: **Darnall**

POSITION TITLE: **Clinical Professor**

**EDUCATION/TRAINING**

INSTITUTION AND LOCATION	DEGREE	Completion Date	FIELD OF STUDY
University of Colorado, Boulder, CO	MA	1998	Clinical Psychology
University of Colorado, Boulder, CO	PhD	2002	Clinical Psychology
Johns Hopkins University School of Medicine, Baltimore, MD	Post-Doctoral Fellowship	2002-2004	Rehabilitation Psychology

**A. Personal Statement**

I bring to this project experience as principal investigator (PI) for numerous clinical trials, including randomized clinical trials (RCTs) investigating behavioral treatments as opioid sparing strategies. My current research portfolio also centers around the conduct of pragmatic and RCTs on outpatient chronic pain patients and patients in the perioperative pain care pathways. My specific interests involve developing and investigating novel, brief, targeted, low-cost, and scalable behavioral medicine interventions that can effectively reduce pain and opioid use, and optimize recovery after surgery and function in outpatients with chronic pain.

As one salient example, I am leading a 4-state, 7-clinic, 3-arm RCT that is testing patient-centered opioid tapering and behavioral medicine approaches in roughly 1,300 individuals with chronic pain who are taking long-term opioids (Patient-Centered Outcomes Research Institute, PCORI® #1610-3700). This PCORI project will provide critical naturalistic infrastructure to accomplish several of the aims of the current proposal. My expertise with pain and opioid science, pragmatic randomized controlled trials, use of novel informatics platforms in research studies, and leadership in multi-site pain treatment research will perfectly support the successful completion of the proposed project. As a current PI for three federally funded research projects, two of which are multi-state projects, I have expertise in leading team communications and systems implementation within the context of pragmatic clinical care.

As a clinical scientist and pain psychologist, I contributed to the development and refinement the open-source clinical informatics platform (Collaborative Health Outcomes Information Registry; CHOIR) that is used to characterize patients multi-dimensionally, manage their symptoms, and track treatment response in multiple international clinical settings. Our active PCORI trial integrates a tailored version of the CHOIR informatics platform to conduct large-scale pragmatic science that aims to address the complex needs of patients with chronic pain taking and reducing their long-term opioids.

I have dedicated much of my career to dismantling the critical barriers to low-risk behavioral pain care. For instance, I have authored three books on pain psychology and opioid use: (1) *Less Pain, Fewer Pills: Avoid the dangers of prescription opioids and gain control over chronic pain* ©2014; (2) *The Opioid-Free Pain Relief Kit* ©2016; and (3) *Psychological Treatment for Patients with Chronic Pain* ©2018. I have developed brief, low-cost, targeted, and scalable treatments for patients in the community, perioperative, and outpatient settings and led the empirical testing of these treatments. For instance, my NIH-funded R01 research involves a 3-arm RCT that is testing the mechanisms and comparative efficacy of a novel, targeted, single-session pain catastrophizing intervention I developed and propose to integrate—in digital format—into the current multi-site international clinical trial. I have developed, tested, and refined digital perioperative interventions, and successfully completed an RCT of the online psychological intervention “My Surgical Success” in women undergoing breast cancer surgery at Stanford Hospital. “My Surgical Success” is refined, beta-tested, and

results revealed expedited opioid cessation after surgery for the treatment arm relative to controls. The success of these virtually no-cost outpatient and perioperative treatments signal the exciting potential to transform pain care in the U.S. by offering efficient, effective, state-of-the-art, *on-demand* treatment regardless of proximity, insurance coverage, or local professional resources. As my work suggests, addressing the psychological dimensions of the pain experience stands to reduce pain and opioid use across the continuum of care, thereby reducing iatrogenic risks and healthcare costs. The imperative is to treat pain better, and to provide equal access to evidence-based treatment. I am excited to join this assembly of talented, interdisciplinary researchers to use novel methods-- and leverage our existing nationally-funded resources—to answer pressing questions that will translate into meaningful differences in the lives of individuals with pain.

In closing, I have a 6-year history of successful scientific collaboration with multiple members of the proposed research team, with products including a rich publication record, as well as securing and implementing multiple major NIH and PCORI awards using the treatments and platforms we propose for Project 3. I will leverage my scientific and leadership skills, multi-site collaborative relationships and existing resources to successfully complete the aims of Project 3, and facilitate the scientific goals of the proposed Center.

1. Sharifzadeh Y, Kao MC, Sturgeon JA, Mackey SC, **Darnall BD**. Pain catastrophizing moderates the relationship between pain intensity and opioid prescription: Non-linear gender differences revealed using a learning health system. *Anesthesiology*. 2017 Jun 14. PMID: 28614083
2. Bhandari RP, Feinstein AB, Huestis S, Krane EJ, Dunn AL, Cohen LL, Kao MC, **Darnall BD**, Mackey SC. Pediatric-Collaborative Health Outcomes Information Registry (Peds-CHOIR): A Learning Health System to Guide Pediatric Pain Research and Treatment at the Group and Individual Levels. *PAIN®*. 2016; Sep 157(9):2033-44.
3. **Darnall BD**, Humphreys KN. An Experimental Method for Assessing Whether Marijuana Use Reduces Opioid Use in Patients with Chronic Pain. *Addiction*. 2018; 113(8):1552-1553. doi:10.1111/add.14239.

## B. Select Positions and Honors

### Positions and Employment

2005-2012	<b>Assistant Professor</b> , Department of Anesthesiology, Perioperative and Pain Medicine, Oregon Health & Science University
2012	<b>Associate Professor</b> , Department of Anesthesiology, Perioperative and Pain Medicine, Oregon Health & Science University
2012-2017	<b>Clinical Associate Professor</b> , Department of Anesthesiology, Perioperative and Pain Medicine, Stanford University School of Medicine
2017	<b>Clinical Professor</b> , Stanford University School of Medicine, Department of Anesthesiology, Perioperative and Pain Medicine; Psychiatry and Behavioral Sciences (by courtesy)

### Other Experience

2012	<b>President</b> , Pain Society of Oregon
2013-2019	<b>Grant Reviewer</b> , American Pain Society, Future Leaders in Pain Research Award
2014	<b>Committee on the Principles of Analgesic Use</b> , American Pain Society
2015-2017	<b>Co-Chair</b> , Pain Psychology Task Force, American Academy of Pain Medicine
2015-	<b>Co-Chair</b> , Pain Psychology Shared Interest Group, American Academy of Pain Medicine
2015	<b>Presidential Commendation</b> , American Academy of Pain Medicine
2016	<b>National Clinical Practice Guidelines</b> , the American Pain Society <i>Principles of Analgesic Use</i> , 7 <sup>th</sup> Edition. Coauthor.
2017	<b>National Clinical Practice Guidelines for Chronic Pain</b> , American College of Occupational and Environmental Medicine (ACOEM), Evidence-Based Chronic Pain Panel.
2017	<b>Stanford NIH NIDA T-32 Faculty Mentor</b>
2017	<b>Opioid Advisory Committee</b> , American Academy of Pain Medicine
2018	<b>National Academies of Science, Engineering and Medicine (NASEM)</b> , Invited Speaker
2018	<b>Congressional Briefing on Pain and Opioids</b> , Washington, D.C., Invited Speaker
2019	<b>Opioid Tapering Consensus Task Force</b> , American Academy of Pain Medicine
2019	<b>NIH ad hoc reviewer</b> , NCCIH U01 and R34 grant applications

## C. Contribution to Science

My body of scientific work is dedicated to reducing chronic pain and its impacts, as well as opioid use and related iatrogenic risks. My projects aim to elucidate the primary influence of psychological factors on the

experience of pain; target psychological factors as a pathway to reduce pain, improve response to medical treatment, reduce reliance on prescription opioids; and address unmet needs for pain psychology services in the U.S. Recent award-winning work involved developing patient-centered methods to optimize patient response to opioid tapering.

**Pain and Opioid Reduction Solutions.** My research centers on developing and implementing effective, lowest-risk pain treatments for individuals with chronic pain. Reducing patient risks through opioid reduction strategies is one aspect of my national work. Historically, pain has been treated with a biomedical approach, despite it having psychological dimensions that profoundly influence treatment needs and outcomes. Central findings of my work are that psychological factors confer substantial likelihood for receipt of opioid prescription for chronic pain, particularly for women. My clinical recommendations to mitigate opioid risks in women were published in *JAMA Int Med* and in *Pain Medicine*. I serve on analgesic and opioid guidelines committees for national pain organizations, including the American Academy of Pain Medicine and the American Pain Society (I co-authored the American Pain Society's national clinical guidelines for analgesic use). In 2018 my invited editorial on what's needed in pain and opioid research was published in *Nature*. Our recent work (Darnall et al, *JAMA Intern Med*) characterized a patient-centered opioid tapering strategy to successfully reduce opioid use without increasing pain, thereby providing low-cost solutions that are accessible to prescribers throughout the U.S. This groundbreaking work served as the foundation for my recent \$8.8 million PCORI research award where our group is implementing these strategies and conducting a randomized controlled trial of evidence-based behavioral chronic pain treatments in 4 Western states. This research received a Plenary Research Highlights Award and plenary presentation at the American Academy of Pain Medicine annual conference in Vancouver, Canada in April, 2018.

1. **Darnall BD**, Stacey BR, Chou R. Medical and psychological risks and consequences of long-term opioid use in women. *Pain Medicine* 2012; 13(9); PMID:22905834.
2. **Darnall B**. To treat pain, study people in all their complexity. *Nature* 2018 May; 557 (7703):7. PMID: 29717254.
3. Sun EC, Jena AB, Kao MC, **Darnall BD**, Baker LC, Mackey SC. Incidence of and Risk Factors for Chronic Opioid Use Among Opioid Naïve Patients in the Perioperative Period. *JAMA Internal Medicine*. 2016; Sep 1; 176(9):1286-93. PMID: 27400458.
4. **Darnall BD**, Ziadni MS, Stieg RL, Mackey IG, Kao MC, Flood P. Patient-Centered Prescription Opioid Tapering in Community Outpatients with Chronic Pain. *JAMA Internal Medicine*, 2018 May 1;178(5):707-708. PMID: 29459978.

**Characterizing Opioid Risks.** My research has elucidated predictive risks for opioid prescribing, iatrogenic consequences of long-term opioid use, and sex differences in opioid prescribing and risks.

1. **Darnall B** & Li H. Hysterectomy and predictors for opioid prescription in a chronic pain clinic sample. *Pain Medicine*. 2011; 12(2): 196-203. PMID:21223499.
2. **Darnall BD**, Stacey BR, Chou R. Medical and psychological risks and consequences of long-term opioid use in women. *Pain Medicine* 2012; 13(9). PMID:22905834.
3. **Darnall BD** & Stacey BR. Sex differences in long-term opioid use: Cautionary notes for prescribing in women. *JAMA Internal Medicine*. 2012; 172(5):431-432. PMID:22412108.

**Use of a Novel Learning Health System to Phenotype and Risk Stratify Patients.** The Collaborative Health Outcomes Information Registry (CHOIR) was developed in the Division of Pain Medicine at Stanford University and is a learning health system and clinical resource to phenotype patients and identify best treatment approaches tailored to their needs.

1. Sturgeon JA, Dixon E, **Darnall BD**, Mackey SC. Contributions of Physical Function and Satisfaction with Social Roles to Emotional Distress in Chronic Pain: A Collaborative Health Outcomes Information Registry (CHOIR) Study. *PAIN®*. 2015; Dec 156(12):2627-33. PMID: 26230739.
2. Bhandari RP, Feinstein AB, Huestis S, Krane EJ, Dunn AL, Cohen LL, Kao MC, **Darnall BD**, Mackey SC. Pediatric-Collaborative Health Outcomes Information Registry (Peds-CHOIR): A Learning Health System to Guide Pediatric Pain Research and Treatment at the Group and Individual Levels. *PAIN®*. 2016; Sep 157(9):2033-44. PMID: b7280328

3. Sturgeon JA, Carriere JS, Kao MC, Rico T, **Darnall BD**, Mackey SC. Social disruption mediates the relationship between perceived injustice and anger in chronic pain: A Collaborative Health Outcomes Information Registry (CHOIR) Study. *Annals of Behavioral Medicine*. June 2016; PMID:27325314.
4. Sharifzadeh Y, Kao MC, Sturgeon JA, Mackey SC, **Darnall BD**. Pain catastrophizing moderates relationships between pain intensity and opioid prescription: Non-linear sex differences revealed using a learning health system. *Anesthesiology*. 2017 Jun 14. PMID: 28614083

**Pain Catastrophizing.** Within the broad rubric of pain psychology, pain catastrophizing is a mainstay of my clinical and research focus. Pain catastrophizing is a psychological construct that involves negative expectation and amplification of current or future pain. Catastrophizing is a potent prognostic indicator for negative chronic pain outcomes and opioid use, and it predicts the development of chronic pain. Work conducted by colleagues and I elucidated the neural impacts of pain catastrophizing and showed that it changes brain functioning in the resting state, thereby priming individuals for future pain—and underscoring the need for effective treatment (see Jiang et al). Historically, treatment for pain catastrophizing is burdensome to patients in terms of costs, co-pays, multiple clinic visits and associated time. To address these barriers to care, I developed a single-session catastrophizing treatment class for outpatients with chronic pain, and tested the intervention with colleagues. The central findings of this work suggest that catastrophizing may be effectively reduced with this brief, targeted class. This novel, compressed pain psychology treatment stands to rapidly expand access to targeted, low-cost pain care, and may facilitate optimized treatment outcomes. Based on this work, in 2015 I was awarded an R01 grant (NCCIH R01AT00856with Co-PI Dr. Sean Mackey) to investigate the efficacy and mechanisms of pain catastrophizing treatment.

1. **Darnall BD**, Sturgeon JA, Hah JM, Kao MC, Mackey SC. ‘From Catastrophizing to Recovery’: A pilot study of a single-session treatment for pain catastrophizing. *J Pain Research*. 2014; (7):219-226. PMID: 24851056.
2. Jiang Y, Oathes DJ, Hush J, **Darnall BD**, Charvat M, Mackey S, Etkin A. Perturbed Amygdalar Connectivity with the Central Executive and Default Mode Networks in Chronic Pain. *PAIN®*. 2016 Sep; 157(9):1970-8. PMID: 27168362
3. Feinstein AB, Sturgeon JA, Dunn A, Rico T, **Darnall BD**, Kao MC, Bhandari RP. The Impact of Pain Catastrophizing on Outcomes: A Developmental Perspective across Children, Adolescents and Young Adults with Chronic Pain. *J Pain*. 2016 Nov 4. pii: S1526-5900(16)30279-6. PMID:27825857
4. **Darnall BD**, Sturgeon JA, Cook KF, Taub CJ, Burns JW, Sullivan MJ, Mackey SC. Development and Validation of a Daily Pain Catastrophizing Scale. *J Pain*. 2017 Sep;18(9):1139-1149. PMID: 28528981.

**Perioperative Optimization and Opioid Reduction.** I developed a fully automated digital version of my outpatient single-session pain psychology class as a potential no-cost perioperative treatment for pain reduction, opioid cessation, and enhanced recovery after surgery. The online treatment platform (“My Surgical Success”; MSS) allows for electronic risk stratification and deployment of the treatment link so patients may engage with the treatment in the comfort of their own home before or after surgery, thereby obviating most barriers to targeted care. Our initial randomized controlled trial (RCT) revealed that patients randomized to MSS had superior opioid cessation in the 14-day post-operative period relative to controls. Follow-on RCTs are underway at Stanford Hospital in Orthopedic Trauma Surgery patients. Additionally, I am leading a team to conduct a new inpatient study at Stanford Hospital that seeks to reduce *inpatient* opioid use after surgery by educating physicians and nursing staff about behavioral medicine principles, and offering patients on select units behavioral medicine “Recovery Kits” that include pain psychology education to help patients cultivate skills that enhance descending modulation of pain (and reduced inpatient use of opioids after surgery).

1. Sun EC, Jena AB, Kao MC, **Darnall BD**, Baker LC, Mackey SC. Incidence of and Risk Factors for Chronic Opioid Use Among Opioid Naïve Patients in the Perioperative Period. *JAMA Internal Medicine*. 2016; Sep 1; 176(9):1286-93. DOI: 10.1001/jamainternmed.2016.3298 PMID: 27400458
2. **Darnall BD**, Cohen R. Behavioral Risk Factors and Interventions for Acute and Chronic Pain After Surgery. IASP Fact Sheet; June 2017. <http://www.europeanpainfederation.eu/wp-content/uploads/2017/01/6.-Behavioral-risk-factors-and-management.Darnall-Cohen.pdf>
3. **Darnall BD**. Pain Psychology & Pain Catastrophizing in the Perioperative Setting: A review of impacts and unmet needs. *Hand Clinics*. 2016; Feb 32(1):33-9. PMID:26611387

4. McAnally H, Freeman L, **Darnall BD**. *Enhanced Recovery Before Surgery: Preoperative Optimization of the Chronic Pain Patient*. Oxford University Press (book publication date 2019)

## D. Research Support

### Ongoing Research Support

1. **PCORI #1610-3700** 02/01/2018– 1/30/2023  
Title: *Comparative Effectiveness of Pain Cognitive Behavioral Therapy and Chronic Pain Self-Management within the Context of Opioid Reduction*  
The goal is to help primary care, pain physicians and patients with chronic pain safely and effectively reduce opioid use without increasing pain. In a multi-state 3-arm randomized pragmatic clinical trial involving 865 patients, we will compare two evidence based group behavioral treatment classes (cognitive behavioral therapy and chronic pain self-management) to a taper only group for opioid and pain reduction within the context of a patient-centered opioid tapering program. We will also characterize up to 500 patients who choose to remain on long-term opioids (N=1,465 total patients)  
**PI: Darnall**
2. **NIH / NCCIH** 09/01/2015 – 08/31/2020  
R01AT008561  
Title: *Single-Session Pain Catastrophizing Treatment: Comparative Efficacy & Mechanisms*  
This project is developing and validating a daily pain catastrophizing tool, and is testing the efficacy of a novel treatment for pain catastrophizing I developed and pilot tested at the Stanford Pain Management Center. I am Co-PI with Mackey.  
**Multi-PI: Darnall & Mackey**
3. **NIH / NICHD** 09/01/2015 – 08/31/2020  
R01  
Title: *Maternal Chronic Pain: Risk for Pain and Poor Outcomes in Children*  
(PI: Wilson) This longitudinal, multi-site study is examining the intergenerational transmission of chronic pain in high risk children of mothers with current chronic pain.  
**Darnall, Site PI for Stanford University**

### Completed Research Support

1. **Spectrum-Stanford Health Care Innovation Challenge Grant** 01/01/16 – 12/31/16  
Title: "Precision Surgical Care: Risk and Treatment Stratification Using a Novel Learning Health System." This project integrated the Collaborative Health Outcomes Information Registry (CHOIR) into the Perioperative Clinic at Stanford. We studied my pain psychology video intervention for catastrophizing as a demonstration project of the clinical utility of CHOIR as a platform to improve surgical outcomes.  
PI: Mackey, MD, PhD; **Darnall, Co-I**
2. **Stanford Faculty Innovation Award** 12/18/14 - 5/17/16  
Title: Pain Clinic Optimization of Patient Experience (Pain COPE): Leveraging Open Source Learning Health System for Prescriptive Analytics Approach to Patient Satisfaction  
This project phenotyped patients at-risk for low patient satisfaction prior to their initial visit to the pain clinic and implementing a targeted, coordinated care model to optimize patient satisfaction.  
**Multi-PI: Kao and Darnall**
3. **NIH / NCCIH** 9/1/11 – 5/31/16  
P01 AT006651  
Title: Stanford Center for Chronic Back Pain  
PD: Mackey, MD, PhD; This program grant studied cognition and emotion regulation, and the distinct and shared mechanisms of 3 evidence based treatments (MBSR, CBT, and acupuncture) in chronic pain.  
**Darnall, Co-I and Lead for the Psychophysics & Behavioral Core.** (Director for patient reported outcomes across all projects in the Center; Lead of Project 2 (comparing MBSR and pain-CBT).