Stanford



Ming Jeffrey Kao, PhD, MD

Clinical Associate Professor, Anesthesiology, Perioperative and Pain Medicine

Curriculum Vitae available Online

CLINICAL OFFICE (PRIMARY)

- **San Jose Medical Group Good Samaritan - Stanford Pain Management South Bay**
  2585 Samaritan Dr 3rd Flr
  San Jose, CA 95124
  Tel (650) 723-6238 **Fax** (669) 277-9196

ACADEMIC CONTACT INFORMATION

- **Administrative Assistant**
  Wendy Schadle - Administrative Assistant
  Email wendy3@stanford.edu

Bio

BIO

Dr. Kao is faculty at Stanford Pain Management. Dr. Kao studied molecular biology and psychology at UC Berkeley. At Harvard University, he earned a PhD in biostatistics after developing statistical methods in genomics and computational biology. He then pursued medical training at the University of Michigan, Yale-New Haven Hospital, and Stanford Health Care.

He is the author of more than 30 scientific journal articles, ranging from genetics, genomics, proteomics, combinatorial chemistry, artificial intelligence, oncology, epidemiology, rehabilitation, and pain, . His mission is to offer all of his patients comprehensive interdisciplinary pain care, leveraging the full extent of what is known in state-of-the-art Pain Medicine.

In addition to providing clinical care, Dr. Kao teaches physicians and trainees on diagnostic work-up of complex pain, techniques of interventional procedures, and scientific methods of pain studies.

Dr. Kao is a Certified Interventional Pain Sonographer (CIPS) as well as a Fellow in Interventional Pain Practice (FIPP).

CLINICAL FOCUS

- Pain Medicine
- Musculoskeletal pain
- Ultrasound procedures
- Nerve entrapment
- Abdominal pain
- Opioid alternatives
- Non-drug treatments
- Dietary Supplements

- CRPS
- Complex Regional Pain Syndromes
- Peripheral nerve stimulation

ACADEMIC APPOINTMENTS

- Clinical Associate Professor, Anesthesiology, Perioperative and Pain Medicine

ADMINISTRATIVE APPOINTMENTS

- Clinic Chief, Stanford Pain, (2017- present)
- Associate Division Chief of Operations, Stanford Pain, (2015-2017)
- Chief Fellow, Stanford Pain, (2013-2014)
- Chief Resident, Stanford Physical Medicine and Rehabilitation, (2012-2013)

HONORS AND AWARDS

- Concurrent Poster Research Highlights, American Academy of Pain Medicine (Mar 2016)
- Concurrent Poster Research Highlight, American Academic of Pain Medicine 2015 (Mar 2015)
- Best Original Research, PM&R Journal (Oct 2015)
- Best Spine and Pain Research Presentation, American Association of Physical Medicine & Rehabilitation (Nov 2014)
- Concurrent Poster Research Highlights, American Academy of Pain Medicine (Mar 2014)
- Best Poster Finalist, Center for Disease Control, Center for Health Statistics (Aug 2012)
- Best Poster Award, SpineWeek, International Society for Study of the Lumbar Spine (ISSLS) (Jun 2012)
- Peter Singleton Award, Stanford PM&R (Jun 2012)
- Best Musculoskeletal Research Presentation, American Association of Physical Medicine & Rehabilitation (Nov 2011)
- 2013 Outstanding Paper Award for Medical/Interventional Science, Spine Journal & North American Spine Society (NASS) (Oct 2013)
- First Place, Health 2.0 Developer Challenge Code-a-thon (Oct 2010)
- NIH Training Grant, National Institute of Mental Health (1999)
- Howard Hughes Pre-Doctoral Fellowship, Howard Hughes Medical Institute (2000)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, American Association of Pain Medicine (2013 - present)

PROFESSIONAL EDUCATION

- Board Certification: Pain Medicine, American Board of Physical Medicine and Rehabilitation (2014)
- Board Certification: Physical Medicine and Rehab, American Board of Physical Medicine and Rehabilitation (2013)
- Internship: Yale New Haven Dept of Internal Medicine (2008) CT
- FIPS, World Institute of Pain , Fellow of Interventional Pain Practice (2018)
- CIPS, World Institute of Pain , Certified Interventional Pain Sonologist (2018)
- Fellowship: Stanford University Pain Management Fellowship (2013) CA
- Residency: Stanford University Physical Medicine and Rehabiliation (2012) CA
- Medical Education: University of Michigan School of Medicine (2007) MI
- PhD, Harvard University , Biostatistics & Computational Biology (2005)
- BA, UC Berkeley (1999)

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

1. Patient-reported outcomes. Efficient, multi-feature item-response theory (IRT) based computerized adaptive testing (CAT) algorithm using item banks from PROMIS and NIH Toolbox

2. Activity monitoring. Novel analytic framework for physical activity monitoring in the context of pain.

3. Operations research. Multi-variable discrete and continuous optimization for Lean Hospital Management

4. National trends in pain medication prescription

Publications

PUBLICATIONS

- **Development and validation of the Collaborative Health Outcomes Information Registry body map.** *Pain reports*
  Scherrer, K. H., Ziadni, M. S., Kong, J., Sturgeon, J. A., Salmasi, V., Hong, J., Cramer, E., Chen, A. L., Pacht, T., Olson, G., Darnall, B. D., Kao, M., Mackey, et al
  2021; 6 (1): e880

- **Self-reported traumatic etiology of pain and psychological function in tertiary care pain clinic patients: a collaborative health outcomes information registry (CHOIR) study.** *Scandinavian journal of pain*
  Taub, C. J., Sturgeon, J. A., Chahal, M. K., Kao, M. C., Mackey, S. C., Darnall, B. D.
  2020

- **Smoking Is Associated with Pain in All Body Regions, with Greatest Influence on Spinal Pain.** *Pain medicine (Malden, Mass.)*
  Smuck, M., Schneider, B. J., Ehsanian, R., Martin, E., Kao, M. J.
  2019

- **Managing twin crises in chronic pain and prescription opioids.** *BMJ (Clinical research ed.)*
  Mackey, S., Kao, M.
  2019; 364: l917

- **International Stakeholder Community of Pain Experts and Leaders Call for an Urgent Action on Forced Opioid Tapering** *PAIN MEDICINE*
  Darnall, B. D., Juurlink, D., Kerns, R. D., Mackey, S., Van Dorsten, B., Humphreys, K., Gonzalez-Sotomayor, J. A., Furlan, A., Gordon, A. J., Gordon, D. B., Hoffman, D. E., Katz, J., Kertesz, et al
  2019; 20 (3): 429–33

- **Comparative Effectiveness of Cognitive Behavioral Therapy for Chronic Pain and Chronic Pain Self-Management within the Context of Voluntary Patient-Centered Prescription Opioid Tapering: The EMPOWER Study Protocol.** *Pain medicine (Malden, Mass.)*
  Darnall, B. D., Mackey, S. C., Lorig, K. n., Kao, M. C., Mardian, A. n., Stieg, R. n., Porter, J. n., DeBruyne, K. n., Murphy, J. n., Perez, L. n., Okvat, H. n., Tian, L. n., Flood, et al
  2019

- **Central mechanisms of real and sham electroacupuncture in the treatment of chronic low back pain: study protocol for a randomized, placebo-controlled clinical trial.** *Trials*
  Kong, J., MacIsaac, B., Cogan, R., Ng, A., Law, C. S., Helms, J., Schnyer, R., Karayannis, N. V., Kao, M., Tian, L., Darnall, B. D., Gross, J. J., Mackey, et al
  2018; 19 (1): 685

- **International Stakeholder Community of Pain Experts and Leaders Call for an Urgent Action on Forced Opioid Tapering.** *Pain medicine (Malden, Mass.)*
  Darnall, B. D., Juurlink, D., Kerns, R. D., Mackey, S., Van Dorsten, B., Humphreys, K., Gonzalez-Sotomayor, J. A., Furlan, A., Gordon, A. J., Gordon, D. B., Hoffman, D. E., Katz, J., Kertesz, et al

2018

- **Guidelines for Composing and Assessing a Paper on the Treatment of Pain: A Practical Application of Evidence-Based Medicine Principles to the Mint Randomized Clinical Trials** *PAIN MEDICINE*
  McCormick, Z. L., Vorobeychik, Y., Gill, J. S., Kao, M. J., Duszynski, B., Smuck, M., Stojanovic, M. P.
  2018; 19 (11): 2127–37

- **The Impact of Perceived Injustice on Pain-related Outcomes: A Combined Model Examining the Mediating Roles of Pain Acceptance and Anger in a Chronic Pain Sample.** *The Clinical journal of pain*
  Carriere, J. S., Sturgeon, J. A., Yakobov, E., Kao, M. C., Mackey, S. C., Darnall, B. D.
  2018; 34 (8): 739-747

- **Patient-Centered Prescription Opioid Tapering in Community Outpatients With Chronic Pain.** *JAMA internal medicine*
  Darnall, B. D., Ziadni, M. S., Stieg, R. L., Mackey, I. G., Kao, M. C., Flood, P.
  2018; 178 (5): 707-708

- **Comparative Efficacy and Mechanisms of a Single-Session Pain Psychology Class in Chronic Low Back Pain: Study Protocol for a Randomized Controlled Trial.** *Trials*
  Darnall, B. D., Ziadni, M. S., Roy, A., Kao, M. C., Sturgeon, J. A., Cook, K. F., Lorig, K., Burns, J. W., Mackey, S. C.
  2018; 19 (1): 165

- **Patient-Centered Prescription Opioid Tapering in Community Outpatients with Chronic Pain** *JAMA Internal Medicine*
  Darnall, B., Ziadni, M., Stieg, R., Mackey, I., Kao, M., Flood, P.
  2018; Feb 19

- **The impact of perceived injustice on pain-related outcomes: A combined model examining the mediating roles of pain acceptance and anger in a chronic pain sample** *Clin J Pain*
  Carrier, J., Sturgeon, J., Yakabov, E., Kao, M., Mackey, S., Darnall, B.
  2018: 739–47

- **Comparative Efficacy and Mechanisms of a Single-Session Pain Psychology Class in Chronic Low Back Pain: Study Protocol for a Randomized Controlled Trial** *Trials*
  Darnall, B., Siadni, M., Roy, A., Kao, M., Sturgeon, J., Cook, K., Lorig, K., Burns, J., Mackey, S.
  2018: 165

- **Radiofrequency Denervation for Chronic Low Back Pain** *JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION*
  Kao, M., Leong, M. S., Mackey, S.
  2017; 318 (22): 2256

- **Radiofrequency Denervation for Chronic Low Back Pain.** *JAMA*
  Kao, M. C., Leong, M. S., Mackey, S.
  2017; 318 (22): 2256

- **Pain Catastrophizing Moderates Relationships between Pain Intensity and Opioid Prescription: Nonlinear Sex Differences Revealed Using a Learning Health System.** *Anesthesiology*
  Sharifzadeh, Y., Kao, M. C., Sturgeon, J. A., Rico, T. J., Mackey, S., Darnall, B. D.
  2017; 127 (1): 136-146

- **Stagnant Physical Therapy Referral Rates Alongside Rising Opioid Prescription Rates in Patients With Low Back Pain in the United States 1997-2010** *SPINE*
  Zheng, P., Kao, M., Karayannis, N. V., Smuck, M.
  2017; 42 (9): 670-674

- **Pain behavior mediates the relationship between perceived injustice and opioid prescription for chronic pain: A Collaborative Health Outcomes Information Registry (CHOIR) study**
  Carriere, J., Martel, M., Kao, M., Sullivan, M., Darnall, B.
  CHURCHILL LIVINGSTONE.2017: S33

- **PREEMPT: Prospective from complex patients in practice**
  Flood, P., Barad, M., Sturgeon, J., Kao, M., Fish, S., Mackey, S.
  CHURCHILL LIVINGSTONE.2017: S67

- **Physical performance analysis: A new approach to assessing free-living physical activity in musculoskeletal pain and mobility-limited populations.** *PloS one*
  Smuck, M., Tomkins-Lane, C., Ith, M. A., Jarosz, R., Kao, M. J.
  2017; 12 (2)

- **Pain catastrophizing moderates the relationship between pain intensity and opioid prescription: Non-linear gender differences revealed using a learning health system** *Anesthesiology*
  Sharifzadeh, Y., Kao, M., Sturgeon, J., Mackey, S., Darnall, B.
  2017: 136–46

- **Tensile-strained Ge/SiGe multiple quantum well microdisks** *Photonics Research*
  Chen, X., Fenrich, C. S., Xue, M., Kao, M., Zang, K., Lu, C., Fei, E. T., Chen, Y., Huo, Y., Kamins, T. I., Harris, J. S.
  2017; 5 (6): B7-B14

- **Pain behavior mediates the relationship between perceived injustice and opioid prescription for chronic pain: a Collaborative Health Outcomes Information Registry study** *JOURNAL OF PAIN RESEARCH*
  Carriere, J. S., Martel, M., Kao, M., Sullivan, M. J., Darnall, B. D.
  2017; 10

- **Social Disruption Mediates the Relationship Between Perceived Injustice and Anger in Chronic Pain: a Collaborative Health Outcomes Information Registry Study.** *Annals of behavioral medicine*
  Sturgeon, J. A., Carriere, J. S., Kao, M. J., Rico, T., Darnall, B. D., Mackey, S. C.
  2016: -?

- **Seated Tai Chi to alleviate pain and improve quality of life in individuals with spinal cord disorder.** *journal of spinal cord medicine*
  Shem, K., Karasik, D., Carufel, P., Kao, M., Zheng, P.
  2016; 39 (3): 353-358

- **COLLABORATIVE HEALTH OUTCOMES INFORMATION REGISTRY (CHOIR): OPEN SOURCE PLATFORM FOR LEARNING HEALTH SYSTEMS**
  Kao, M., Cook, K., Olson, G., Darnall, B. D., Weber, S., Mackey, S., Flood, P.
  LIPPINCOTT WILLIAMS & WILKINS.2016

- **(489) An examination of the roles of perceived injustice and pain acceptance on pain interference and pain intensity in patients with chronic pain: A Collaborative Health Outcomes Information Registry (CHOIR) Study.** *journal of pain*
  Carriere, J., Darnall, B., Kao, M., Mackey, S.
  2016; 17 (4S): S97-?

- **(418) A novel glial cell inhibitor, low dose naltrexone, reduces pain and depression, and improves function in chronic pain: A CHOIR study.** *journal of pain*
  Noon, K., Sturgeon, J., Kao, M., Darnall, B., Mackey, S.
  2016; 17 (4S): S79-?

- **(180) Development and validation of a Daily Pain Catastrophizing Scale (Daily PCS) measure.** *journal of pain*
  Darnall, B., Sturgeon, J., Cook, K., Taub, C., Kao, M., RICO, T., Mackey, S.
  2016; 17 (4S): S20-S21

- **(448) Perceived injustice, pain behavior and opioid prescriptions: a vicious circle? A Collaborative Health Outcomes Information Registry (CHOIR) Study.** *journal of pain*
  Carriere, J., Darnall, B., Sullivan, M., Kao, M., Mackey, S.
  2016; 17 (4S): S86-?

- **Social Disruption Mediates the Relationship Between Perceived Injustice and Anger in Chronic Pain: a Collaborative Health Outcomes Information Registry Study** *Annals of Behavioral Medicine*
  Sturgeon, J. A., Carriere, J. S., Kao, M. J., Rico, T. J., Darnall, B. D., Mackey, S. C.
  2016: 802–12

- **The State of Triptan Prescription for the Management of Migraine in the US**
  Zheng, P., Kao, M., Barad, M., Mackey, S.
  WILEY-BLACKWELL.2015: 151–52

- **Anger mediates the relationship between trauma and pain catastrophizing in chronic pain**
  Taub, C., Chahal, M., Darnall, B., Kao, M., Mackey, S.
  CHURCHILL LIVINGSTONE.2015: S99
- **Sub-clinical range of pain catastrophizing moderates the effect of pain intensity on opioid prescription**
  Sharifzadeh, Y., Darnall, B., Kao, M., Mackey, S.
  CHURCHILL LIVINGSTONE.2015: S16–S16
- **Physical and psychological correlates of fatigue and physical function: a Stanford-NIH CHOIR study**
  Sturgeon, J., Darnall, B., Kao, M., Mackey, S.
  CHURCHILL LIVINGSTONE.2015: S18
- **Implications of pain interference on restoration of physical function for people with chronic pain**
  Karayannis, N., Kao, M., Prasad, R., Cooley, C., Mackey, S.
  CHURCHILL LIVINGSTONE.2015: S109
- **Stanford Patient Experience Questionnaire (SPEQ): network of patient experience touch points revealed by Bayesian network reconstruction suggests targets for intervention**
  Kao, M., Leong, M., Prasad, R., Cullen, A., Pacht, T., Wellisch, O., Olson, G., Darnall, B., Weber, S., Mackey, S.
  CHURCHILL LIVINGSTONE.2015: S36
- **Assessment of anxiety as mediator of the relationship between sleep disturbance and pain catastrophizing in chronic pain**
  Chahal, M., Taub, C., Darnall, B., Kao, M., Mackey, S.
  CHURCHILL LIVINGSTONE.2015: S5
- **Stanford Patient Experience Questionnaire (SPEQ): Machine-mediated classification of patient experience feedback using natural language processing**
  Kao, M., Leong, M., Prasad, R., Cullen, A., Pacht, T., Olson, G., Darnall, B., Weber, S., Mackey, S.
  CHURCHILL LIVINGSTONE.2015: S37
- **Somatic distributions of pain characterized with a pain registry (CHOIR)**
  Johnson, K., Foote, A., Kao, M., Mackey, S.
  CHURCHILL LIVINGSTONE.2015: S8
- **Physical and Psychological Correlates of Fatigue and Physical Function: A Collaborative Health Outcomes Information Registry (CHOIR) Study.** *journal of pain*
  Sturgeon, J. A., Darnall, B. D., Kao, M. J., Mackey, S. C.
  2015; 16 (3): 291-298 e1
- **Determinants of Physical Activity in America: A First Characterization of Physical Activity Profile Using the National Health and Nutrition Examination Survey (NHANES)** *PM&R*
  Kao, M. J., Jarosz, R., Goldin, M., Patel, A., Smuck, M.
  2014; 6 (10): 882-892
- **Determinants of physical activity in America: a first characterization of physical activity profile using the National Health and Nutrition Examination Survey (NHANES).** *PM & R : the journal of injury, function, and rehabilitation*
  Kao, M. J., Jarosz, R., Goldin, M., Patel, A., Smuck, M.
  2014; 6 (10): 882-892
- **Trends in ambulatory physician opioid prescription in the United States, 1997-2009.** *PM & R : the journal of injury, function, and rehabilitation*
  Jeffrey Kao, M., Minh, L. C., Huang, G. Y., Mitra, R., Smuck, M.
  2014; 6 (7): 575-582 e4
- **National Trends of Opioid Treatment for Adult and Pediatric Migraine Headache Patients in the Emergency Department**
  Eaton, K., Kao, M., Barad, M.
  WILEY-BLACKWELL.2014: 15
- **Novel characterization of between-individual variability in thermal temporal summation response**
  Ojha, R., Kong, J., Kao, M., Bagarinao, E., Olshen, R., Mackey, S.
  CHURCHILL LIVINGSTONE.2014: S65

- **"Control over catastrophizing": development of a single-session psychobehavioral intervention to reduce pain catastrophizing**
  Darnall, B., Sturgeon, J., Kao, M., Mackey, S.
  CHURCHILL LIVINGSTONE.2014: S109
- **Trends in benzodiazepine prescription and co-prescription with opioids in primary care clinics in the United States, 2002 to 2009**
  Kao, M., Zheng, P., Hah, J., Mackey, S.
  CHURCHILL LIVINGSTONE.2014: S41
- **"Control over catastrophizing": development of a single-session psychobehavioral intervention to reduce pain catastrophizing**
  Darnall, B., Sturgeon, J., Kao, M., Mackey, S.
  CHURCHILL LIVINGSTONE.2014: S109
- **Trends in benzodiazepine prescription and co-prescription with opioids in primary care clinics in the United States, 2002 to 2009**
  Kao, M., Zheng, P., Hah, J., Mackey, S.
  CHURCHILL LIVINGSTONE.2014: S41
- **Assessment and management of back pain.** *JAMA internal medicine*
  Kao, M., Zheng, P., Smuck, M.
  2014; 174 (3): 479-?
- **Does physical activity influence the relationship between low back pain and obesity?** *SPINE JOURNAL*
  Smuck, M., Kao, M. J., Brar, N., Martinez-Ith, A., Choi, J., Tomkins-Lane, C. C.
  2014; 14 (2): 209-216
- **From Catastrophizing to Recovery: a pilot study of a single-session treatment for pain catastrophizing** *JOURNAL OF PAIN RESEARCH*
  Darnall, B. D., Sturgeon, J. A., Kao, M., Hah, J. M., Mackey, S. C.
  2014; 7: 219-226
- **Duration of fluoroscopic-guided spine interventions and radiation exposure is increased in overweight patients.** *PM & R : the journal of injury, function, and rehabilitation*
  Smuck, M., Zheng, P., Chong, T., Kao, M., Geisser, M. E.
  2013; 5 (4): 291-296
- **The value of physical examination in the diagnosis of hip osteoarthritis.** *Journal of back and musculoskeletal rehabilitation*
  Chong, T., Don, D. W., Kao, M., Wong, D., Mitra, R.
  2013; 26 (4): 397-400
- **Diagnostic Accuracy of Bedside Swallow Evaluation Versus Videofluoroscopy to Assess Dysphagia in Individuals With Tetraplegia** *PM&R*
  Shem, K. L., Castillo, K., Wong, S. L., Chang, J., Kao, M., Kolakowsky-Hayner, S. A.
  2012; 4 (4): 283-289
- **An integrative approach to characterize disease-specific pathways and their coordination: a case study in cancer** *BMC GENOMICS*
  Xu, M., Kao, M. J., Nunez-Iglesias, J., Nevins, J. R., West, M., Zhou, X. J.
  2008; 9
- **HumanUpstream and MouseUpstream: Databases of promoter sequences in the human and mouse genomes** *OMICS-A JOURNAL OF INTEGRATIVE BIOLOGY*
  Leykin, I., Kao, M. C., Wong, W. H.
  2005; 9 (3): 220-224
- **Functional annotation and network reconstruction through cross-platform integration of microarray data** *NATURE BIOTECHNOLOGY*
  Zhou, X. H., Kao, M. C., Huang, H. Y., Wong, A., Nunez-Iglesias, J., Primig, M., Aparicio, O. M., Finch, C. E., Morgan, T. E., Wong, W. H.
  2005; 23 (2): 238-243
- **GoSurfer: a graphical interactive tool for comparative analysis of large gene sets in Gene Ontology space.** *Applied bioinformatics*
  Zhong, S., Storch, K., Lipan, O., Kao, M. J., Weitz, C. J., Wong, W. H.
  2004; 3 (4): 261-264
- **Determination of local statistical significance of patterns in Markov sequences with application to promoter element identification** *JOURNAL OF COMPUTATIONAL BIOLOGY*

Huang, H. Y., Kao, M. C., Zhou, X. H., Liu, J. S., Wong, W. H.
2004; 11 (1): 1-14

- **Chemical genetic modifier screens: Small molecule trichostatin suppressors as probes of intracellular histone and tubulin acetylation** *CHEMISTRY & BIOLOGY*
  Koeller, K. M., Haggarty, S. J., Perkins, B. D., Leykin, I., Wong, J. C., Kao, M. C., Schreiber, S. L.
  2003; 10 (5): 397-410

- **Novel mechanisms of T-cell and dendritic cell activation revealed by profiling of psoriasis on the 63,100-element oligonucleotide array** *PHYSIOLOGICAL GENOMICS*
  Zhou, X. H., Krueger, J. G., Kao, M. C., Lee, E., Du, F. H., Menter, A., Wong, W. H., Bowcock, A. M.
  2003; 13 (1): 69-78

- **Transitive functional annotation by shortest-path analysis of gene expression data** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Zhou, X. H., Kao, M. C., Wong, W. H.
  2002; 99 (20): 12783-12788