Acupuncture for Pain Management

submitted by the Oregon Acupuncture Association (OAA)
to the Oregon Pain Management Commission of the Oregon Health Authority
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written by Kelly Ilseman, LAc/OAA Research Committee Chair, with support from Kailashi Zigler, LAc/OAA Research Committee Member; peer-reviewed by Laura Ocker, LAc/former OAA President, Ryan Milley, LAc/former SAR member, and Jennifer Briggs, LAc/OAA Vice President

Audience: Oregon Health Authority, Oregon Pain Management Commission, Medical Providers

Outline:

***Bullet Points:**

A. Supporting Agencies: The use of acupuncture as an effective, evidence-based pain-management option has **strong support from leading healthcare institutions.**[1-7]

B. Clinical Effectiveness: Acupuncture is a **safe, effective, and evidence-based non-pharmacological pain management option** for chronic and acute pain,[8-30] **lower need for opioids,**[31-36] and **improved mental-health outcomes**,[37-53] and The **benefits persist over time**, further underscoring the cost-effectiveness of acupuncture.[9,54-69]

C. Cost-Effectiveness: Acupuncture and electroacupuncture are **cost-effective first-line treatments for chronic pain**[9, 54-68] and for **the opioid epidemic**.[69]

D. Mechanisms: Biomedical understanding of the mechanisms of acupuncture is emerging at the **forefront of biological research at a level of physiological detail on par with other biological science disciplines**, and is understood to work via the **connective tissue** stimulating biochemical, bioelectrical, and molecular cascades, producing **tangible physiological effects that can reduce pain and the experience of pain.**[70-106]

E. Insurance Coverage: Leading Oregon health plans cover acupuncture for chronic pain management, including the **Oregon Health Plan (OHP)** as well as other private insurance carriers.[107-121]

A. Supporting Agencies

Acupuncture is supported as an effective, evidence-based pain-management option by the CDC,[1] the Centers for Medicare & Medicaid Services (CMS),[2] the Department of Veterans Affairs (DVA),[3] the American Academy of Pain Medicine (AAPM),[4] the American College of Physicians,[5] the FDA,[5] The Joint Commission, a hospital accrediting agency,[5] the National Academies of Science, Engineering, and Medicine,[5] the National Institutes of Health (NIH),[6] and the World Health Organization.[7]

B. Clinical Effectiveness of Acupuncture: Evidence-Based Research

1. Acupuncture for Pain

Hempel S, Shekelle PG, Taylor SL, Solloway MR. The evidence map of acupuncture. Department of Veterans Affairs VA-ESP Project #05-226. January 2014. https://www.hsrd.research.va.gov/publications/esp/acupuncture.pdf [8]

- 1,223 studies electronically located, of which 183 met inclusion criteria (65 for pain, 44 for wellness, 20 for mental health, and 49 for "other")
- Strong evidence of a positive effect from acupuncture found for headaches, chronic pain, and migraines
- Potential positive effects found for dysmenorrhea, osteoarthritis, general pain, cancer pain, labor pain, prostatitis, temporomandibular pain, plantar heel pain, pregnancy pain, and ankle sprain
- Unclear, but high-level, evidence found for back and neck pain
- Unclear evidence found for surgery analgesia, post-operative pain, fibromyalgia, shoulder pain, and rheumatoid arthritis
- No evidence found for effectiveness with carpal tunnel

McDonald J, Janz S. The acupuncture evidence project: a comparative literature review. Australian Acupuncture and Chinese Medicine Association. January 2017. [9]

- 122 conditions reviewed
- "Evidence of effect" found for 117 conditions
- No evidence of effect found for five conditions
- Level of "evidence of effect" increased for 24 conditions over time
- **Positive acupuncture treatment effect** for eight conditions: low back pain, migraines, knee osteoarthritis, headache, post-operative pain, chronic allergic rhinitis, and both chemotherapy-induced and post-operative nausea/vomiting.
- **Cost-effectiveness** identified for 10 conditions: chronic pain, low back pain, migraine, neck pain, osteoarthritis, ambulatory anesthesia, depression, dysmenorrhea, headache, post-operative nausea and vomiting, and allergic rhinitis.

- **Evidence of safety** identified for 9 conditions: low back pain, migraine, knee osteoarthritis, prostatitis pain, chronic pelvic pain, ambulatory anesthesia, Alzheimer's disease, cancer-related psychological symptoms, depression, and allergic rhinitis.
- Conclusions: Acupuncture demonstrated a positive treatment effect for eight conditions: migraine prophylaxis, headache, chronic low back pain, allergic rhinitis, knee osteoarthritis, chemotherapy-induced nausea and vomiting, post-operative nausea and vomiting, and post-operative pain.

Vickers AJ, Cronin AM, Maschino AC, Lewith G, MacPherson H, Foster NE, et al. Acupuncture for chronic pain: individual patient data meta-analysis. *Arch Intern Med.* 2012;172(19):1444-53. [10]

- 39 studies involving 20,827 patients
- True acupuncture significantly outperformed sham acupuncture ($P < 0.001$)
- **Treatment effects persisted over time**, decreasing by only about 15% at one year
- Referral for acupuncture is a reasonable clinical decision for chronic pain patients
- Conclusions and a Note on Sham Acupuncture: Current knowledge that sham and placebo-controlled acupuncture both produce treatment effects has created a "consistent underestimation of the true effect size of acupuncture interventions" in previous acupuncture literature.

a. Acupuncture for Chronic Pain

i. Acupuncture for Chronic Low Back Pain

Xiang Y, He JY, Tian HH, Cao BY, Li R. Evidence of efficacy of acupuncture in the management of low back pain: a systematic review and meta-analysis of randomized placebo- or sham-controlled trials. *Acupunct Med.* 2020. Internet *ISSN:*1759-9873. [11]

- A systematic review involving fourteen trials (2,110 participants) and a meta-analysis involving 9 studies (753 participants) revealed that acupuncture produced "*statistically significant differences in pain reduction*" as compared with sham or placebo. A meta-analysis involving 4 studies (462 participants) showed "*no differences in function*."
- At follow-up, acupuncture produced significant differences in *pain reduction*, but *no differences in function*.
- Authors concluded that moderate-level evidence exists for the efficacy of acupuncture in reducing subacute and chronic non-specific low back pain and that the **benefits persist over time.**

ii. Acupuncture for Chronic Neck Pain

Seo SY, Lee K-B, Shin J-S, Lee J, Kim M-R, Ha I-H, Ko Y, Lee YJ. Effectiveness of acupuncture and electroacupuncture for chronic neck pain: a systematic review and meta-analysis. *Am J Chin Med.* 2017;45(8):1573-1595. doi: 10.1142/S0192415X17500859. Epub 2017 Nov 9. [12]

- 16 randomized controlled trials were included.
- No significant differences in pain, disability, or quality of life (QoL) between acupuncture group versus active control.
- Acupuncture plus control group showed "significantly higher relief of pain in studies with unclear allocation concealment [a technique used to reduce selection bias]…, but did not show significant relief of pain in studies with good allocation concealment…"
- Electroacupuncture compared to the control and electroacupuncture plus control yielded significant pain relief.
- No serious adverse events.
- Acupuncture had "similar effectiveness on pain and disability" compared with conventional medicine; acupuncture plus conventional medicine provided even greater pain relief.

Trinh KV, Graham N, Gross AR, Goldsmith CH, Wang E, Cameron ID, Kay T. Acupuncture for neck disorders. *Cochrane Database Syst Rev.* 2006. [13]

- 10 randomized (RCT) or quasi-randomized (quasi-RCT) involving acupuncture treatment for chronic neck pain pooled for analysis
- chronic mechanical neck disorders and pain
    - moderate evidence: acupuncture more effective than some sham controls (post-treatment)
    - moderate evidence: acupuncture more effective than sham controls (post-treatment and short-term follow-up) (pooled standardized mean difference (SMD) -0.37, 95% confidence interval (CI) -0.61 to -0.12).
- limited evidence: acupuncture more effective than massage (short-term follow-up)
- chronic neck disorders with radiculopathy
    - moderate evidence: acupuncture more effective than wait-list control (short-term follow-up)
- Conclusions: Authors report moderate evidence that acupuncture relieves chronic neck pain better than some sham treatments, moderate evidence that acupuncture relieves pain better at short-term follow-up than waitlist control, and moderate evidence that acupuncture is better than inert sham controls for eliminating pain post-treatment and at short-term follow-up.

iii. Acupuncture for Episodic Migraine Pain

Giovanardi CM, Cinquini M, Aguggia M, Allais G, Campesato M, Cevoli S, Gentili F, Matra A, Minozzi S. Acupuncture vs. pharmacological prophylaxis of migraine: a systematic review of randomized controlled trials. *Front Neurol.* 2020 Dec 15;11:576272. doi: 10.3389/fneur.2020.576272. eCollection 2020. [14]

- Nine randomized trials involving 1,484 patients were analyzed.
- Acupuncture reduced the number of days with migraine per month, migraine response rate, a moderate reduction of migraine pain intensity, and a large reduction in dropout rate due to any reason and dropout rate due to adverse events.
- The quality of evidence was considered moderate for all outcomes.
- Treatment effects were still present at longest follow-up
- Conclusions: Acupuncture appears to be "mildly more effective and much safer than medication for the prophylaxis of migraine."

iv. Acupuncture for Tension Headache Pain

Turkistani A, Shah A, Jose AM, Melo JP, Luenam K, Ananias P, Yaqub S, Mohammed L. Effectiveness of manual therapy and acupuncture in tension-type headache: a systematic review. *Cureus.* 2021;13(8):e17601. doi: 10.7759/cureus.17601. eCollection 2021 Aug. [15]

- Eight articles involving 3,846 participants were included in the analysis
- Acupuncture and manual therapy demonstrated effectiveness at treating tension-type headaches.
- Two large studies demonstrated moderate quality evidence that acupuncture plus routine care reduced headache frequency by an average of 50% compared with routine care alone.
- Trial 1: relative risk reduction (RRR) of 2.5; trial 2: RRR of 11.
- "Acupuncture was not found to be superior to physiotherapy, exercise, and massage therapy."
- Manual therapy significantly decreased headache intensity.
- Manual therapy was equivalent to prophylactic medication and tricyclic antidepressants for tension headaches
- Conclusions: The available data suggests that both acupuncture and manual therapy have beneficial effects on treating symptoms of tension-type headache.

Linde K, Allais G, Brinkhaus B, et al. Acupuncture for the prevention of tension-type headache. *Cochrane Database Syst Rev.* 2016;(4):CD007587. [16]

- Twelve studies with publication dates through January 2016 involving 2,349 adult patients, plus one additional new trial, were pooled and analyzed.
- Acupuncture plus usual care for acute migraine yielded 48/100 participants with a 50% or greater reduction in headache frequency versus 17/100 for usual care.
- Acupuncture compared with sham acupuncture resulted in 52/100 participants with a 50% or greater reduction in headache frequency versus 43/100 for sham acupuncture. The results from true acupuncture were long-lasting, up to 6 months after treatments.

v. Acupuncture for Osteoarthritis Pain

Lin L-L. TU J-F, Wang L-Q, Yang J-W, Shi G-X, Li J-L, Zhang N, Shao J-K, Zou X, Liu C-Z. Acupuncture of different treatment frequencies in knee osteoarthritis: a pilot randomised controlled trial. *Pain.* 2020;161(11):2532-2538. doi: 10.1097/j.pain.0000000000001940 [17]

- Sixty participants were randomized to three sessions per week of acupuncture (TSWA) or one session per week of acupuncture (OSWA) groups in a 1:1 ratio
- Week 8: no significant differences in response rate between the TSWA and OSWA treatment groups (P = 0.435)
- Weeks 4 and 16: TSWA had significant differences in response rate compared to OSWA (week 4: difference, 44.7 percentage points; P = 0.001) and (week 16: difference, 46.0 percentage points; P < 0.001).
- The TSWA group had statistically significant improvements in numerical rating scale (NRS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) function, and Patient Global Assessment than the OSWA group. No significant between–group differences were found for WOMAC and Short Form Health Survey (SF-12).
- An acupuncture dose-response relationship for knee osteoarthritis pain and function clinical outcomes exists.
- "TSWA immediately improved knee pain and dysfunction compared with OSWA [and] the **benefit of TSWA persist[ed] throughout follow-up**."

Sun N, TU JF, Lin LL, et al. Correlation between acupuncture dose and effectiveness in the treatment of knee osteoarthritis: a systematic review. *Acupunct Med.* 2019;37(5):261-267. https://doi.org/10.1136/acupmed-2017-011608 [18]

- Eight studies (1 LD, 1 MD, and 6 HD) included for analysis involving 2,106 participants.
- The authors concluded that there was "strong evidence" of a "positive correlation between HD [high dose] acupuncture treatment and positive outcomes."

Chen N, Wang J, Mucelli A, et al. Electro-acupuncture is beneficial for knee osteoarthritis: the evidence from meta-analysis of randomized controlled trials. *Am J Chin Med*. 2017;45(5):965-985. [19]

- Eleven randomized controlled trials including 695 participants were included in the analysis to assess the safety and effectiveness of electroacupuncture (EA) for knee osteoarthritis.
    - EA was statistically more effective:
        - than pharmacological interventions (P = 0.03) and manual acupuncture (P = 0.02)
        - at reducing pain intensity (P<0.00001), improving physical function WOMAC scores (P<0.00001), and improving Lysholm knee score (LKSS) (P<0.00001).
- Electroacupuncture had significant clinical outcomes for improved pain and physical function compared to pharmacological interventions and manual acupuncture; EA has "low risk of adverse reaction."

Manheimer E, Cheng K, Linde K, et al. Acupuncture for peripheral joint osteoarthritis. *Cochrane Database Syst Rev.* 2010;(1):C0001977. [20]

- Sixteen trials (12 knee O A; 3 hip OA; 1 hip and knee OA) involving 3,498 participants were included.
- Acupuncture versus sham yielded statistically significant "short-term improvements in *osteoarthritis pain*."
- Acupuncture versus sham yielded statistically significant improvements in *function*.
- Neither of these results met the authors' "predefined thresholds for clinical relevance."
- Inclusion of sham acupuncture, known to be physiologically active, affected results.
- **At 6 month follow-up** acupuncture showed "borderline" statistical significance and "clinically irrelevant improvements" for *osteoarthritis pain and function* as compared to sham.
- Acupuncture versus waitlist control showed statistically significant and clinically meaningful results for *osteoarthritis pain and function*.
- Acupuncture versus 'supervised osteoarthritis education' and 'physician consultation' control groups showed "clinically relevant short- and long-term *improvements in pain and function."*
- Acupuncture versus 'home exercises/advice leaflet' and 'supervised exercise' had similar outcomes as controls.
- Acupuncture plus "exercise based physiotherapy program" had similar outcomes as the exercise program without acupuncture.

vi. Acupuncture for Cancer Pain

Yang J, Wahner-Roedler DL, Zhou X, Johnson LA, Do A, Pachman DR, Chon TY, Salinas M, Millstine D, Bauer BA. Acupuncture for palliative cancer pain management: systematic review. *BMJ Support Palliat Care*. 2021 Sep;11(3):264-270. doi: 10.1136/bmjspcare-2020-002638. Epub 2021 Jan 13. [21]

- 5 studies involving 189 patients pooled for meta-analysis
- Results: acupuncture demonstrated "favourable effect of acupuncture on pain relief in palliative care for patients with cancer"
- Oxford Centre for Evidence-Based Medicine (OCEBM) evidence levels showed 40% at level 4, 30% at level 3, and 20% at level 2
- Conclusions: "Acupuncture may be an effective and safe treatment associated with pain reduction in the palliative care of patients with cancer."

Mao M, Liou KT, Baser RE, Bao T, Panageas KS, Romero SD, Li S, Gallagher RM, Kantoff PW. Effectiveness of electroacupuncture or auricular acupuncture vs usual care for chronic musculoskeletal pain among cancer survivors: the PEACE randomized clinical trial. *JAMA Oncol*. 2021 May 1;7(5):720-727. doi: 10.1001/jamaoncol.2021.0310. [22]

- Randomized clinical trial (Personalized Electroacupuncture vs Auricular Acupuncture Comparative Effectiveness - PEACE) conducted from March 2017 to April 2020
- 360 cancer survivors (mean age 62.1) chronic musculoskeletal pain and no current detectable cancer participated from urban and suburban sites in New York and New Jersey
- Outcome assessment: Brief Pain Inventory (BPI) rating scale 0-10
- Treatment groups: electroacupuncture (N = 145), auricular acupuncture (N = 143), usual care (N = 72)
- Number of treatments: 10 acupuncture treatments (1 session/week for 10 weeks plus follow-up)
- Results: Pain severity lowered by 1.9 points in the electroacupuncture group vs usual care group from initial assessment to week 12 (97.5% CI, 1.4-2.4 points; $P < .001$)
- Pain severity lowered by 1.6 points in the auricular acupuncture group vs usual care from initial assessment to week 12 (97.5% CI, 1.0-2.1 points; $P < .001$)
- Mild adverse effects for 15/143 (10.5%) of auricular participants and 1/145 (0.7%) of electroacupuncture participants, who dropped out of the study as a result ($P < .001$)
- Conclusions: "Electroacupuncture and auricular acupuncture produced greater pain reduction than usual care" in treating cancer survivors' chronic musculoskeletal pain.

He Y, Guo X, May BH, Zhang AL, Liu Y, Lu C, Mao JJ, Xue CC, Zhang H. Clinical evidence for association of acupuncture and acupressure with improved cancer pain: a systematic review and meta-analysis. *JAMA Oncol.* 2020 Feb 1;6(2):271-278. doi: 10.1001/jamaoncol.2019.5233. [23]

- 14 randomized controlled trials (RCTs) in English and Chinese involving 920 cancer pain patients pooled for meta-analysis
- Acupuncture and acupressure compared with sham acupuncture, analgesic therapy, and standard care
- Primary outcomes: pain levels measured by the Brief Pain Inventory, Numerical Rating Scale, Visual Analog Scale, Verbal Rating Scale.
- 7 sham-controlled RCTs demonstrated that acupuncture compared to sham was superior for reducing cancer pain (mean difference [MD], -1.38 points; 95% CI, -2.13 to -0.64 points; I2 = 81%)
    - these 7 studies considered high quality with low bias risk
- 6 RCTs with treatments combining acupuncture and acupressure with analgesic therapy showed a "favorable association" with pain reduction (MD, -1.44 points; 95% CI, -1.98 to -0.89; I2 = 92%)
    - moderate evidence grade (study heterogeneity)
- 2 RCTs with treatments combining acupuncture and acupressure with analgesic therapy showed a "favorable association" with opioid dosage reduction (MD, -30.00 mg morphine equivalent daily dose; 95% CI, -37.5 mg to -22.5 mg)
    - moderate evidence grade (study heterogeneity)
- Conclusions: "acupuncture and/or acupressure was significantly associated with reduced cancer pain and decreased use of analgesics."

b. Acupuncture for Acute Pain

Nielsen A, Dusek JA, Taylor-Swanson L, Tick H. Acupuncture therapy as an evidence-based nonpharmacologic strategy for comprehensive acute pain care: the academic consortium pain task force white paper update. *Pain Med.* 2022;23(9):1582–1612. https://doi.org/10.1093/pm/pnac056 [24]

- **Objective:** Researchers sought to update the 2018 white paper on acupuncture for acute "postsurgical/perioperative pain with opioid sparing and acute nonsurgical/trauma pain"
- **Methods:** Systematic review of PubMed, MEDLINE, CINAHL, and Cochrane Central Register of Controlled Trials; keywords: "acupuncture" and "acupuncture therapy" and "acute pain," "surgery," "peri-operative," "trauma," "emergency department," "urgent care," "review(s) ," "systematic review," "meta-analysis." "Additional manual review of titles, links, and reference lists"

- **Results:** 22 systematic reviews included for review (including 17 meta-analyses of acupuncture for acute pain, and 1 review of acupuncture for acute pain in intensive care unit)
- **Conclusion. "**The majority of reviews found acupuncture therapy to be an efficacious strategy for acute pain, with potential to avoid or reduce opioid reliance."

i. Acupuncture for Acute Pancreatic Pain

Zhu F, Yin S, Zhu X, Che D, Li Z, Zhong Y, Yan H, Gan D, Yang L, Wu X, Li L. Acupuncture for relieving abdominal pain and distension in acute pancreatitis: a systematic review and meta-analysis. *Front Psychiatry*. 2021;12:Article 786401. doi:10.3389/fpsyt.2021.786401 [25]

- Nineteen studies involving 1,503 participants were included
- Acupuncture plus routine treatment (RT) produced significant increases in total effectiveness rate ($P = 0.001$)
- Acupuncture reduced visual analog scale (VAS) scores for abdominal pain ($P < 0.0001$) and for abdominal distension ($P < 0.0001$)
- Conclusion: Acupuncture plus RT reduced abdominal pain and distention in patients with acute pancreatitis better than RT alone.

Zhang K, Gao C, Li C, Li Y, Wang S, Tang Q, Zhao C, Zhai J. Acupuncture for acute pancreatitis: a systematic review and meta-analysis. *Pancreas*. 2019;48(9):1136-1147. doi: 10.1097/MPA.0000000000001399 [26]

- Twelve studies were included in the final analysis.
- Acupuncture plus routine treatment (RT) versus RT alone significantly improved total effectiveness rate and gastrointestinal function.
- Acupuncture plus routine treatment (RT) versus RT alone significantly reduced "acute physiology, Age, Chronic Health Evaluation II score, tumor necrosis factor α count," the time until resumption of regular diet, and length of stay in the hospital.
- 3 studies reported minor adverse events or reactions.

ii. Acupuncture for Acute Low Back Pain

Su X, Qian H, Chen B, Fan W, Xu D, Tang C, Lu L. Acupuncture for acute low back pain: a systematic review and meta-analysis. *Ann Palliat Med.* 2021;10(4):3924-3936. http://dx.doi.org/10.21037/apm-20-1998 [27]

- Thirteen RCTs met inclusion criteria.
- Eleven RCTs involving 707 participants demonstrated "moderate-quality evidence that acupuncture has a statistically significant association with improvements in VAS (visual analog scale) score."
- Two studies showed no impact upon RMDQ (Roland-Morris Disability Questionnaire) scores for low back pain effects on functional activities compared with the control. ● Three studies showed that acupuncture impacted the ODI (Oswestry Disability Index) low back pain scores compared with the control.
- Two studies demonstrated that acupuncture "influenced the number of pills more than the control treatment."
- The use of acupuncture for treating low back pain showed "modest improvements in the VAS score, ODI score, and the number of pills, but not the RMDQ score."

Cho Y-H, Kim C-K, Heo K-H, Lee MS, Ha I-H, Son DW, Choi BK, Song G-S, Shin B-C. Acupuncture for acute postoperative pain after back surgery: a systematic review and meta-analysis of randomized controlled trials. *Pain Pract.* 2015;15(3):279-91. doi: 10.1111/papr.12208. Epub 2014 Apr 28. [28]

- Five studies met the inclusion criteria. Three of these were high-quality. ● Acupuncture for acute post-operative pain showed beneficial impact on "visual analogue scale (VAS) for pain intensity 24 hours after surgery" compared with sham acupuncture (P = 0.0003).
- Acupuncture did not show a beneficial impact on 24-hour opiate demands compared with sham acupuncture (P = 0.21).
- Conclusion: "Encouraging but limited evidence [exists] for the effectiveness of acupuncture treatment for acute postoperative pain after back surgery"

Lee J-H, Choi T-Y, Lee MS, Lee H, Shin B-C, Lee H. Acupuncture for acute low back pain: a systematic review. *Clin J Pain*. 2013;29(2):172-85. doi: 10.1097/AJP.0b013e31824909f9. [29]

- Eleven RCTs involving 1,139 participants were included for analysis.
- Compared with nonsteroidal anti-inflammatory drugs (NSAIDs), acupuncture more effectively relieved acute low back pain in 5 studies.
- Acupuncture was more effective than sham acupuncture for pain relief, but was not more

effective for function/disability.

- Conclusion: "Acupuncture may be more effective than medication for symptom improvement or relieve pain better than sham acupuncture in acute LBP."

iii. Acupuncture for Acute Post-Tonsillectomy Pain

Gilbey P, Bretler S, Avraham Y, Sharabi-Nov A, Ibrgimov S, Luder A. Acupuncture for posttonsillectomy pain in children: a randomized, controlled study. *Pediatr Anesth.* 2014. doi: 10.1111/pan.12621 [30]

- **Methods:** Randomized, controlled, single-blinded study
  Population: 60 children aged 3–12 years undergoing tonsillectomy
  Treatment Groups: acupuncture group and conventional postoperative analgesic treatment group
- **Outcome Assessment:** pain levels and presence of unwanted side effects
- **Results:** Acupuncture group experienced "less pain, less analgesic drug consumption, and higher patient/parent satisfaction with analgesic treatment scores. No adverse effects were recorded."
- **Conclusions:** "Acupuncture, in addition to conventional analgesic treatment, is an effective treatment for post-tonsillectomy pain. Acupuncture is safe and well received by children and their parents."

2. Acupuncture for Opioid Use Reduction

a. Acupuncture for Opioid Use Reduction During/After Surgical Procedures

Cheng SI, Kelleher DC, DeMeo D, Zhong H, Birch G, Ast MP. Intraoperative acupuncture as part of a multimodal analgesic regimen to reduce opioid usage after total knee arthroplasty: a prospective cohort trial. *Med Acupunct.* 2022; 34(1). doi: 10.1089/acu.2021.0072 [31]

- 41 patients participated in this study.
- Electro-auricular acupuncture used intraoperatively as part of an analgesia protocol for patients undergoing total knee arthroplasty surgery helped to reduce the need for opioids after surgery.
- 26/40 (65%) participants maintained low-dose opioid intake.
- Three participants (7%) were opioid-free for 30 days, and 100% of participants were opioid-free after 30 days.

Pham T, Ma O, Agiro A, Bukowiec J, Flannery T. Do acupuncture services reduce subsequent utilization of opioids and surgical interventions compared to noninvasive therapies among patients with pain conditions? *Pain Med.* 2021;22(11):2754-2762. doi: 10.1093/pm/pnab187 [32]

- This was a retrospective observational study of administrative claims from large commercial insurance plans involving 52,346 patients treated with either acupuncture or non-steroidal anti-inflammatory drugs (NSAIDs) or physical therapy (PT)
- Acupuncture treatment group resulted in lower patient use of post-index opioid use for those "with ($P < .001$) and without ($P < .001$) baseline opioid use."
- Acupuncture use resulted in a lower number of emergency department visits ($P < .001$).
- A small increase in invasive surgical procedures occurred with the acupuncture group ($P = .006$).
- Acupuncture use resulted in higher total medical and pharmacy costs ($P = .006$).
- Conclusion: Acupuncture reduced opioid use and emergency department visits.

Tedesco D, Gori D, Desai KR, Asch S, Carroll IR, Curtin C, McDonald KM, Fantini MP, Hernandez-Boussard T. Drug-free interventions to reduce pain or opioid consumption after total knee arthroplasty. *JAMA Surg.* 2017; 152(10): e172872. doi: 10.1001/jamasurg.2017.2872 [33]

- 39 randomized clinical trials involving 2,391 patients were included.
- There was moderate certainty evidence that electrotherapy reduced opioid use from -5.90 to -1.10 mg/kg morphine equivalents per 48 hours ($P = .004$).
- There was moderate yet statistically significant evidence that acupuncture delayed opioid use ($P < .001$).
- There was low certainty yet statistically significant evidence for acupuncture reducing pain ($P = .003$).
- Electrotherapy and acupuncture after total knee arthroplasty surgery are associated with reduced and delayed opioid consumption.

b. Acupuncture for Opioid Addiction Treatment

Wen H, Wei X, Ge S, Zeng J, Luo W, Chen R, Dong Y, Xiao S, Lai Y, Lu L. Clinical and economic evaluation of acupuncture for opioid-dependent patients receiving methadone maintenance treatment: the integrative clinical trial and evidence-based data. *Front Public Health.* 2021;9:1-12. [34]

- This study involved 123 patients.
- Participants who received acupuncture and methadone maintenance treatment (MMT) had significantly improved daily methadone dosage, visual analog scores (VAS), and

Pittsburgh Sleep Quality Index (PSQI).

- These treatments were shown to be **"economically efficient."**
- Quality-Adjusted Life Year (QALY), a generic measure that includes both quality and quantity of life, and cost were higher for the treatment group versus the control group.
- The authors concluded that acupuncture serves as a **clinically effective, cost-effective** "adjuvant therapy" for MMT patients, "reducing the dosage of methadone, improving drug cravings, and alleviating insomnia," as well as improving quality of life.

Jackson HJ, Walters J, Raman R. Auricular acupuncture to facilitate outpatient opioid weaning: a randomized pilot study. *Med Acupunct.* 2021;33(2):153-158. doi: 10.1089/acu.2020.1450 [35]

- "A total of 9 participants were randomized into the intervention group and compared with 6 participants who underwent the standard of care for outpatient opioid tapering."
- Anxiety was found to be slightly higher and depression was found to be lower in the acupuncture group versus the standard of care group.
- The standard of care group had greater withdrawal symptoms and higher pain levels. Researchers found "no statistically significant differences among the standard of care and acupuncture groups."
- Although the impact of acupuncture treatment was not statistically significant compared with standard of care, researchers suggested that the auricular acupuncture NADA protocol can be easily and effectively incorporated into standard of care for opioid tapering.
- Due to the small size of this study, future larger studies are recommended to determine treatment effects.

Chen Z, Wang Y, Wang R, Xie J, Ren Y. Efficacy of acupuncture for treating opioid use disorder in adults: a systematic review and meta-analysis. *Evid Based Complement Altern Med.* [36]

- Nine studies involving 1,063 participants were included.
- Acupuncture was found to be more useful than no treatment or sham treatment to reduce opioid craving, insomnia, and depression.
- Electroacupuncture did a better job than sham electroacupuncture or transcutaneous electrical acupoint stimulation (TEAS) to alleviate craving and depression.
- TEAS alleviated symptoms of insomnia and anxiety compared to no treatment or sham.
- Authors concluded that there is evidence supporting the use of acupuncture, electroacupuncture, and TEAS to relieve opioid cravings, insomnia, anxiety, and depression, but that "conclusions were limited due to the low-quality and small number of included studies."

3. Acupuncture for Mental Health Outcomes

Li Z, Feng J, Yin S, Chen X, Yang Q, Gao X, Che D, Zhou L, Yan H ZHong Y, Zhu F. *BMC Complement Med Ther.* Effects of acupuncture on mental health of migraine patients: a systematic review and meta-analysis. 2023 Aug 4;23(1):278. doi:10.1186/s12906-023-04103-8. [37]

- 13 RCT's involving a total of 1,766 migraine patients were pooled for analysis
- Acupuncture versus sham acupuncture or medication improved migraine patients' rating scores and mental health exam performance:
    - Self-Rated Anxiety Scale (SAS) scores (WMD: -5.64; 95% CI: -10.89, -0.39; p = 0.035)
    - Self-Rated Depression Scale (SDS) scores (WMD: -4.65; 95% CI: -9.25, -0.05; p = 0.048)
    - Short Form 36 Mental Health (MH) scores (SMD: 0.77; 95% CI: 0.19, 1.35; p = 0.009)
    - Visual Analog Scale (VAS) (SMD: -1.06; 95% CI: -1.73, -0.4; p = 0.002;)
    - Migraine-Specific Quality of Life Questionnaire (MSQ) (WMD: 4.76; 95% CI: 2.36, 7.15; p < 0.001)
- Conclusion: "Compared with Western medicine and sham acupuncture, acupuncture seems to be able to effectively improve anxiety and depression in migraine patients. And it may be more effective in improving SF36-mental health, VAS and MSQ than [sham] acupuncture or Western medicine."

a. Acupuncture for Mental Health Outcomes: Depression

Zheng L, Sun Z, Liu C, Zhang J, Jin Y, Jin H. Acupuncture-adjuvant therapies for treating perimenopausal depression: a network meta-analysis. *Medicine (Baltimore)*. 2023 Aug 18;102(33):e34694. doi: 10.1097/MD.0000000000034694. [38]

- 27 studies involving 2,269 PMD patients with perimenopausal depression (PMD) pooled for meta-analysis
- 8 different interventions
- Primary outcomes: Hamilton Depression Scale score and efficacy rate
- Secondary outcomes: levels of follicle-stimulating hormone, luteinizing hormone, estradiol, and the Kupperman score.
- Results: "warm acupuncture (OR = 1.55, 95% CI: 1.00-2.44), electroacupuncture (OR = 1.34, 95% CI: 1.00-1.8), abdominal acupuncture (OR = 1.19, 95% CI: 0.73-1.96), and common acupuncture (OR = 1.4, 95% CI: 0.9-2.17) more effective than fluoxetine and menopausal hormone treatment in the treatment of PMD."

- Warm acupuncture more effective at reducing Hamilton Depression Scale scores than "electroacupuncture (SMD = -1.22, 95% CI: -2.34 to -0.09), thread embedding (SMD = -1.31, 95% CI: -2.21 to -0.40), abdominal acupuncture (SMD = -1.33, 95% CI: -2.42 to -0.24), and common acupuncture (SMD = -1.46, 95% CI: -2.26 to -0.66)."
- Conclusion: warm acupuncture provided the most effective treatment for PMD

Xu G, Lei H, Huang L, Xiao Q, Huang B, Zhou Z, Tian H, Huang F, Liu Y, Zhao L, Li X, Liang F. The dose-effect association between acupuncture sessions and its effects on major depressive disorder: A meta-regression of randomized controlled trials. *J Affect Disord.* 2022 Aug 1:310:318-327. doi: 10.1016/j.jad.2022.04.155. Epub 2022 May 2. [39]

- 62 studies involving 2,269 patients diagnosed with major depressive disorder (MDD) included for meta-regression analysis
- Outcomes: Hamilton rating scale for depression (HAMD) to measure symptom severity
- Results dose-dependent: more acupuncture sessions associated with greater reduction in HAMD scores and improved MDD symptoms
    - 8 acupuncture treatments: HAMD score decreased from 17.68 (95% CI: -11.81, -4.80) to 8.30 (95% CI: 14.23-21.13)
    - 24 acupuncture treatments: decrease in HAMD scores for 51% of cases (95% CI: 48% to 54%).
    - 36 acupuncture treatments: "improvement in HAMD scores peaked at 66% of cases" (95% CI: 59% to 72%)."
- Conclusions: "A dose-effect relationship was found between the number of acupuncture sessions and HAMD scores. 36 acupuncture sessions were associated with optimal clinical response."

Xu G, Xiao Q, Huang B, Lei H, Yin Z, Huang L, Zhou Z, Tian H, Huang F, Liu Y, Sun M, Zhao L, Liang F. Clinical evidence for association of acupuncture with improved major depressive disorder: a systematic review and meta-analysis of randomized control trials. *Neuropsychobiology.* 2023;82(1):1. Epub 2022 Dec 22. [40]

- 43 studies involving 3,756 participants with major depressive disorder (MDD) pooled for meta-analysis
- Primary outcomes: Hamilton rating scale for depression (HAMD) and Self-Rating Depression Scale (SDS)
- Results yielded "high-quality evidence" for use of acupuncture or acupuncture + antidepressant medications to treat MDD compared with sham acupuncture or antidepressants alone.

- "High-quality evidence showed that acupuncture led to fewer adverse effects than antidepressants."
- Conclusions: According to high-quality evidence, acupuncture and acupuncture + antidepressant treatment of MDD yielded a statistically significant reduction in HAMD scores.

Ching WL, Li HJ, Guo J, Yao L, Chau J, Lo S, Yuen CS, Ng BFL, Yu EC-L, Zhaoxiang Bian Z, Lau AY, Zhong LLD. Acupuncture for post-stroke depression: a systematic review and network meta-analysis. *BMC Psychiatry* 2023;23:314. doi: 10.1186/s12888-023-04749-1 [41]

- 62 randomized controlled trials involving 5,308 participants included
- Primary outcome: survey post-stroke depression measuring depressive symptoms
- Secondary outcomes: effectiveness for neurological function and the quality of life
- Results: acupuncture alone or acupuncture plus use of "repetitive transcranial magnetic stimulation (RTMS)," significantly reduced Hamilton Depression Rating Scale scores
    - Acupuncture with this therapy had "the highest probability of improving depressive symptoms with a probability of 49.43%."
- "Traditional Chinese medicine (TCM) alone or with pharmaceuticals" was better at reducing depressive symptoms
- Conclusions: "The results of this study indicate that AC alone or combined with other therapies appears to be effective in improving depression symptoms of stroke survivors."

Xu M-M, Guo P, Ma Q-Y, Zhou X, Wei Y-L, Wang L, Chen Y, Guo Y. Can acupuncture enhance therapeutic effectiveness of antidepressants and reduce adverse drug reactions in patients with depression? A systematic review and meta-analysis. *J Integr Med.* 2022 Jul;20(4):305-320. doi: 10.1016/j.joim.2022.05.002. Epub 2022 May 6. [42]

- 16 studies involving 1,958 participants with depression included for meta-analysis
- Primary outcomes: (1) severity of depression symptoms based on Hamilton Depression Rating Scale-17 (HAMD-17), World Health Organization Quality of Life-BREF scores, Self-Rating Depression Scale (SDS), and Self-Esteem Rating Scales (SERS)
- Secondary outcomes: remission rate, treatment response, social function, and antidepressant dose changes
- Most studies had "high risk of performance bias and low or unclear risk of selection bias, detection bias, attrition bias, reporting bias, and other bias."
- Acupuncture plus antidepressants compared with antidepressants alone:
    - Reduced HAMD-17 scores (standard mean difference [SMD] -0.44, 95% confidence interval [CI] -0.55 to -0.33, $P < 0.01$; $I_2 = 14\%$)

        - HAMD-17 scores showed "significantly higher remission rates (RR 1.52, 95% CI 1.26 to 1.83, P < 0.01; I_2 = 0%) and treatment responses (RR 1.35, 95% CI 1.24 to 1.47, P < 0.01; I_2 = 19%)"
    - Reduced Self-rating Depression Scale (SDS) scores (SMD -0.53, 95% CI -0.84 to -0.23, P < 0.01; I_2 = 79%)
    - Reduced Side Effect Rating Scale (SERS) scores (SMD -1.11, 95% CI -1.56 to -0.66, P < 0.01; I_2 = 89%)
    - Enhanced World Health Organization Quality of Life-BREF scores (SMD 0.31, 95% CI 0.18 to 0.44, P < 0.01; I_2 = 15%)
    - "Decreased the number of participants who increased their antidepressant dosages (relative risk [RR] 0.32, 95% CI 0.22 to 0.48, P < 0.01; I_2 = 0%)"
- Conclusion: "Acupuncture as an adjunct to antidepressants may enhance the therapeutic effectiveness and reduce the adverse drug reactions in patients receiving antidepressants." Note: interpret findings with caution: low or moderate quality evidence and "lack of comparative, placebo-controlled data"

Hang X, Li J, Zhang Y, Li Z, Zhang Y, Ye X, Tang Q, Sun W. Efficacy of frequently-used acupuncture methods for specific parts and conventional pharmaceutical interventions in treating post-stroke depression patients: a network meta-analysis. *Complement Ther Clin Pract*. 2021 Nov:45:101471. doi: 10.1016/j.ctcp.2021.101471. Epub 2021 Aug 4. [43]

- 51 studies involving 3,966 participants with post-stroke depression (PSD)
- 12 acupuncture interventions were offered
- "Scalp acupuncture plus conventional acupuncture was considered to be the most effective method, followed by auricular acupuncture, eye acupuncture, eye acupuncture plus drug, auricular acupuncture plus drug, auricular acupuncture plus conventional acupuncture, scalp acupuncture, scalp acupuncture plus drug, abdominal acupuncture, conventional acupuncture plus drug, drug, conventional acupuncture."
- Conclusions: "12 acupuncture methods may be effective and safe in improving the condition of patients with PSD."

Armour M, Smith CA, Wang LQ, Naidoo D, Yang GY, MacPherson H, Lee MS, Hay P. Acupuncture for depression: a systematic review and meta-analysis. *J Clin Med*. 2019;8(8) Epub 2019 Jul 31. [44]

- 29 studies involving 2,268 participants diagnosed with depression pooled for meta-analysis
- Acupuncture treatment resulted in "clinically significant reductions in the severity of depression compared to usual care" (Hedges (g) = 0.41, 95% confidence interval (CI)

0.18 to 0.63), sham acupuncture (g = 0.55, 95% CI 0.31 to 0.79), adjunct to antidepressant medication (g = 0.84, 95% CI 0.61 to 1.07).

- "Significant correlation" between more acupuncture treatments and reduction of depression symptoms (p = 0.015)
- Conclusions: Acupuncture may be a useful addition to standard care, including antidepressant pharmaceuticals, for treating depression.

Smith CA, Armour M, Lee MS, Wang LQ, Hay PJ. Acupuncture for depression. *Cochrane Database Syst Rev.* 2018;3(3):CD004046. Epub 2018 Mar 4. [45]

- 64 published/unpublished randomized controlled trials involving 7,104 adult male/female participants diagnosed with depression pooled for analysis
- Acupuncture vs no treatment/waitlist/treatment-as-usual: both manual- and electroacupuncture "may moderately reduce the severity of depression" (SMD -0.66, 95% CI -1.06 to -0.25, five trials, 488 participants); low-quality evidence
- Acupuncture vs control (invasive acupuncture, non-invasive sham): reduced "severity of depression [by] 1.69 points on the Hamilton Depression Rating Scale (HAMD)" (95% CI -3.33 to -0.05, 14 trials, 841 participants; low-quality evidence).
- Acupuncture vs medication: "acupuncture may confer small benefit in reducing the severity of depression" (SMD -0.23, 95% CI -0.40 to -0.05, 31 trials, 3,127 participants). Note: variations exist depending on medication and mode of acupuncture; overall low-quality evidence
- Acupuncture + medication vs medication alone: "acupuncture is highly beneficial in reducing the severity of depression" (SMD -1.15, 95% CI -1.63 to -0.66, 11 trials, 775 participants). Note: large variation in results depending on modality of acupuncture stimulation; very low-quality evidence.
- Acupuncture vs psychotherapy: unclear if there are any statistical differences between these two types of therapy for depression (SMD -0.5, 95% CI -1.33 to 0.33, two trials, 497 participants; low-quality evidence)
- Conclusions: Acupuncture reduced depression symptoms compared with no treatment or treatment-as-usual. (Reduction in depression symptom severity was less when comparing acupuncture to sham acupuncture controls.) Acupuncture may offer some benefits in combination with or in place of medication. Benefits of acupuncture vs psychotherapy are not discernible. All results based on "very low quality of evidence."

b. Acupuncture for Mental Health Outcomes: Anxiety

Li M, Liu X, Ye X, Zhuang L. Efficacy of acupuncture for generalized anxiety disorder: A PRISMA-compliant systematic review and meta-analysis. *Medicine (Baltimore)*. 2022 Dec 9;101(49):e30076. doi: 10.1097/MD.0000000000030076. [46]

- 27 studies involving 1,782 participants with generalized anxiety disorder (GAD) pooled for meta-analysis
- Primary outcome: Hamilton Anxiety Scale (HAMA)
- Secondary outcomes: total effective rate, Self-Rating Anxiety Scale (SAS), Treatment Emergent Symptom Scale (TESS)
- Results demonstrated that the acupuncture group had superior HAMA and SAS scores when compared with control group:
    - HAMA score [MD = -0.78, 95%CI (-1.09, -0.46)], the total effective rate [RR = 1.14, 95%CI (1.09, 1.19)]
    - SAS score [MD = -2.55, 95%CI (-3.31, -1.80)]
- Acupuncture group demonstrated higher safety with fewer adverse events than the control group, with lower TESS scores [MD = -1.54, 95%CI (-1.92, -1.17)].
- Conclusions: **"**Acupuncture can effectively relieve the anxiety symptoms of generalized anxiety disorder patients with fewer side effects."

Tong QY, Liu R, Zhang K, Gao Y, Cui GW, Shen WD. Can acupuncture therapy reduce preoperative anxiety? A systematic review and meta-analysis. *J Integr Med*. 2021;19(1):20. Epub 2020 Nov 18. [47]

- 12 studies involving 916 patients with preoperative anxiety included for meta-analysis
- Acupuncture patients compared with control group experienced reductions in:
    - State-Trait Anxiety Inventory Scale (STAI-S) scores (mean difference [MD] = -9.07, 95% confidence interval [CI][-13.19 to -4.96], P < 0.0001)
        - moderate quality evidence
    - Visual Analogue Scale (VAS) scores (MD = -1.37, 95% CI [-2.29 to -0.45], P = 0.003)
        - low-quality evidence
- No difference between treatment and control groups was found for Hamilton Anxiety Scale (HAMA) scores
    - (MD = -3.98, 95% CI [-12.89 to 4.92], P = 0.38)."
        - moderate quality evidence
- Conclusion: Acupuncture may decrease anxiety in preoperative patients

c. Acupuncture for Mental Health Outcomes: Insomnia

Yin X, Liang T, Lu , Yue H, Li S, Zhong VW, Zhang W, Zhou S, Mi Y, Wu H, Xu S. Effect of electroacupuncture on insomnia in patients with depression: a randomized clinical trial. *JAMA Netw Open.* 2022;5(7):e2220563. doi: 10.1001/jamanetworkopen.2022.20563. [48]

- 32-week blinded, randomized, sham-controlled clinical trial (8-week intervention with 24-week follow-up) conducted from September 1, 2016, to July 30, 2019, in China
- 270 participants (194 female; 76 male; age range 18-70 years) diagnosed with insomnia and depression
- Treatment groups: (1) electroacupuncture (EA) + standard care (SC); (2) sham acupuncture (SA) + standard care; (3) standard care
- Number of treatments: 3 treatments/week for 8 weeks = 24 sessions
- Primary outcomes: Pittsburgh Sleep Quality Index (PSQI) scores at baseline and after 24 treatments
- Secondary outcomes: Pittsburgh Sleep Quality Index (PSQI) scores at 12, 20, and 32 weeks; actigraphy recordings of sleep parameters; Insomnia Severity Index (ISI) scores; Hamilton Depression Rating Scale (HAMD-17) scores; Self-rating Anxiety Scale (SAS) scores
- 247 (91.5%) of participants completed all outcome measurements at week 32
- EA group mean PSQI score differences baseline to 8 weeks: -6.2 (95% CI, -6.9 to -5.6)
- EA vs SA PSQI score differences at week 8: -3.6 (95% CI, -4.4 to -2.8; P < .001) (P < .001)
- EA vs control groups PSQI score differences at week 8: -5.1 (95% CI, -6.0 to -4.2; P < .001) (P < .001)
- Actigraphy recordings baseline to 8 weeks showed EA resulted in "significant improvement in total sleep time" (29.1 [95% CI, 21.5-36.7] minutes) (P < .001)
- Electroacupuncture benefits **showed persistence** at week 24 post-intervention
    - "Significant improvement in the 17-item Hamilton Depression Rating Scale" (-10.7 [95% CI, -11.8 to -9.7]), (P < .001)
    - Significant improvement in Insomnia Severity Index (-7.6 [95% CI, -8.5 to -6.7]) scores, (P < .001)
    - Significant improvement in Self-rating Anxiety Scale (-2.9 [95% CI, -4.1 to -1.7]) scores, (P < .001)
- No differences amongst treatment groups for waking during sleep frequency
- Zero serious adverse events
- Conclusions: "Quality of sleep improved significantly in the EA group compared with the SA or control group at week 8 and was sustained at week 32."

Kim S-A, L S-H, Kim J-H, van den Noort, M, Bosch P, Won T, Yeo S, Lim S. Efficacy of acupuncture for insomnia: a systematic review and meta-analysis. *Am J Chin Med.* 2021;49(5):1135-1150. doi: 10.1142/S0192415X21500543. Epub 2021 May 27. [49]

- 24 RCTs involving acupuncture, sham acupuncture, and pharmaceuticals to treat insomnia included for meta-analysis
- Pittsburgh sleep quality index (PSQI) outcomes: (RR: -0.74; 95% CI: -1.07 to -0.40; *P* ¡0.0001; I^2 = 89%; n = 1475
- Subgroup analysis: "no significant effect after weeks 1 and 2, but six studies found that acupuncture had a significant effect insomnia at week 3" (RR: -0.97; 95% CI: -1.65 to -0.28;" *P* = 0.006; I^2 = 91%; n = 463.
- 9 studies "demonstrated a significant effect at week 4" (RR: -0.70; 95% CI: -1.15 to -0.25; P = 0.002; I^2 = = 85%; n = 594).
- Three weeks of acupuncture may provide statistically significant alleviation of insomnia symptoms when compared with the use of pharmaceuticals for insomnia.

Zhao F-Y, Fu Q-Q, Kennedy GA, Conduit R, Zhang W-J, Wu W-Z, Zheng Z. Can acupuncture improve objective sleep indices in patients with primary insomnia? A systematic review and meta-analysis. *Sleep Med.* 2021 Apr:80:244-259. doi: 10.1016/j.sleep.2021.01.053. Epub 2021 Feb 2. [50]

- Primary outcomes assessed via polysomnography (PSG), actigraphy, and "micromovement sensitive mattress/pillow sleep monitoring systems"
- 11 randomized controlled trials involving involving acupuncture, sham acupuncture, or waitlist control with a total of 775 patients with primary insomnia (PI) included for meta-analysis
- Acupuncture results compared with sham acupuncture or waitlist:
    - Improved total sleep time [MD = 55.29, 95%CI (29.16, 81.42), p < 0.01]"
    - Improved sleep efficiency [MD = 8.96, 95%CI (3.97, 13.95), p < 0.01],"
    - Less waking after sleep onset [MD = -49.54, 95%CI (-82.98, -16.09), p < 0.01]"
    - Awakened during sleep fewer times [MD = -6.29, 95%CI (-10.75, -1.82), p< 0.01]
- Acupuncture outperformed sham acupuncture or waitlist when participants received at least 12 acupuncture treatments
- Researchers reported, "most studies reviewed were heterogeneous and at risk of bias due to methodological issues."
- Conclusions: "acupuncture was significantly associated with improvements in several objective sleep parameters (increases in total sleep time and sleep efficiency, and reductions in wake after sleep onset and number of awakening times) as well as subjective sleep quantity and quality in patients with PI. A minimum therapeutic threshold dosage (≥12 sessions) is recommended."

Zhang J, He Y, Huang X, Liu Y, Yu H. The effects of acupuncture versus sham/placebo acupuncture for insomnia: a systematic review and meta-analysis of randomized controlled trials. *Complement Ther Clin Pract.* 2020 Nov:41:101253. doi: 10.1016/j.ctcp.2020.101253. Epub 2020 Nov 1. [51]

- 15 studies involving 1,108 patients with insomnia were included for meta-analysis
- Primary outcome measurement: Pittsburgh sleep quality index (PSQI)
- Acupuncture therapy was significantly more effective than sham acupuncture at improving the following scores:
    - Pittsburgh sleep quality index (PSQI)
    - Insomnia Severity Index (ISI)
    - Total Sleep Time (TST)
    - Sleep-Onset Latency (SOL)
    - Wake after Sleep Onset (WASO)
    - Sleep Efficiency (SE)
- Acupuncture more effective than other acupuncture modalities for PSQI scores subgroup analysis:
    - acupuncture superior to sham (3RCTs, MD = -7.34,95% [-8.02,-6.66],I2 = 86%)
    - acupuncture superior to minimal acupuncture (5RCTs, MD = -3.29,95% [-3.95, -2.63],I2 = 53%)
    - auricular acupressure superior to sham (1RCT, MD = -4.16,95% [-6.57, -1.75])
    - minimal acupuncture superior to electroacupuncture (2RCTs, MD = 0.70,95%CI [0.52, 0.87],I2 = 0%)
    - auricular acupressure vs “minimal acupuncture,” electroacupuncture vs sham, and electroacupuncture vs “minimal acupuncture” showed no significant differences
- During follow-up, acupuncture therapy was still significantly more effective than sham acupuncture on the PSQI
- Conclusion: Acupuncture more effective than placebo/sham acupuncture in the treatment of insomnia

Yin X, Gou M, Xu J, Dong B, Yin P, Masquelin F, Wu J, Lao L, Xu S. Efficacy and safety of acupuncture treatment on primary insomnia: a randomized controlled trial. *Sleep Med.* 2017;37:193. Epub 2017 Mar 8. [52]

- Single-center, single-blinded, randomized controlled clinical trial to evaluate the efficacy and safety of acupuncture treatment for primary insomnia.
- 72 patients with primary insomnia randomized into acupuncture treatment or control (sham acupuncture) groups
- Number of treatments: 3x/week for 4 weeks = 12 sessions
- Primary outcome: Insomnia Severity Index (ISI)

- Secondary outcomes: sleep efficiency (SE), sleep awakenings (SA), total sleep time (TST) recorded by Actigraphy, Self-Rating Anxiety Scale (SAS), Self-Rating Depression Scale (SDS)
- Both groups showed improvement in sleep
- Paired T-Test results demonstrated significant differences for all outcome measurements before and after acupuncture treatment.
- ISI scores in acupuncture group "improved dramatically" … with "similar significant improvements … observed in the SE, TST and SDS scores"
    - 2 weeks after treatment ($F = 11.3$, $p = 0.001$)
    - 4 weeks after treatment ($F = 33.6$, $p < 0.001$)
    - at 2-week follow-up ($F = 39.4$, $p < 0.001$)
    - at 4-week follow-up ($F = 34.1$, $p < 0.001$)
- SA and SAS scores showed no significant differences between treatment groups until the end of 8 weeks, but "remarkable decrements in SA and SAS were found in the acupuncture treatment group after the two-week and four-week follow-ups."
- Conclusion: "Acupuncture treatment is more effective than sham acupuncture treatment in increasing insomnia patients' sleep quality and improving their psychological health."

d. Acupuncture for Mental Health Outcomes: PTSD (Fight, Flight, Freeze)

Engel CC, Cordova EH, Benedek DM, Liu X, Gore KL, Goertz C, Freed MC, Crawford C, Jonas WB, Ursano RJ. Randomized effectiveness trial of a brief course of acupuncture for posttraumatic stress disorder. ***Med Care.*** **2014 Dec;52(12 Suppl 5):S57-64. doi: 10.1097/MLR.0000000000000237.** [53]

- 55 military service members diagnosed with PTSD
- Treatments: 8 one-hour acupuncture treatments 2x/week plus "usual PTSD care (UPC)" or UPC only
- Primary outcomes: PTSD Checklist (PCL) and the Clinician-administered PTSD Scale (CAPS) scores at baseline, 4, 8, and 12 weeks
- Secondary outcomes: depression, pain severity, and mental/physical health functioning
- Results: acupuncture group experienced significantly greater "mean improvement in PTSD severity" than the usual care group ($PCL\Delta = 19.8 \pm 13.3$ vs. 9.7 ± 12.9, $P<0.001$; $CAPS\Delta = 35.0 \pm 20.26$ vs. 10.9 ± 20.8, $P<0.0001$) // acupuncture group experienced "significantly greater improvements in depression, pain, and physical and mental health functioning."
- Conclusions: "Acupuncture was effective for reducing PTSD symptoms" in this small sample size group.

C. Cost-Effectiveness

1. Cost-Effectiveness and Persistence of Acupuncture Effects for Chronic Pain

McDonald J, Janz S. The acupuncture evidence project: a comparative literature review. Australian Acupuncture and Chinese Medicine Association. January 2017. [9]

- Cost-effectiveness of acupuncture identified for 10 conditions: chronic pain, low back pain, migraine, neck pain, osteoarthritis, ambulatory anesthesia, depression, dysmenorrhea, headache, post-operative nausea and vomiting, and allergic rhinitis

MacPherson H, Vertosick EA, Foster NE, Lewith G, Linde K, Sherman KJ, Witt CM, Vickers AJ. The persistence of the effects of acupuncture after a course of treatment: a meta-analysis of patients with chronic pain. *Pain.* 2017 May; 158(5): 784–793. doi:10.1097/j.pain.0000000000000747 [54]

- 29 trials involving 17,922 patients with chronic musculoskeletal pain (low back, neck, and shoulder pain), knee osteoarthritis, and headache/migraine pain
- Meta-analysis comparing pre- and post-treatment pain scores
- Long-term follow-up data for 20 trials involving 6,376 patients
    - Treatment effect persisted at 3 months (95% CI: −0.014 to 0.037, p = 0.4) for trials comparing acupuncture vs control (wait-list, usual care)
    - "The central estimate [expected values of liabilities] suggests that **about 90% of the benefit of acupuncture relative to controls would be sustained at 12 months.**"
    - As expected, acupuncture vs sham acupuncture demonstrated a lower comparable effect at 3 months (95% CI: 0.000 to 0.050, p = 0.050) and about a 50% reduction in effect size at 12 months.
- Authors concluded:
    - The effects of acupuncture treatment for chronic pain can be expected to last at least 12 months.
    - **"Patients can generally be reassured that treatment effects persist."**
    - *"Studies of the cost-effectiveness of acupuncture should take [these] findings into account when considering the time horizon of acupuncture effects."*

2. Cost-Effectiveness of Acupuncture for Chronic and Acute Low Back Pain

Elton D (Optum Insurance). The National Academies of Science, Engineering, Medicine. Session 3 [Video]. YouTube. Published Dec 7, 2018. Accessed January 22, 2022. https://www.youtube.com/watch?v=vQO5CsuzfRM. [55]

- Percentage of non-surgical low back pain patients who see providers for first-line care:
  - specialists (38.3%)
  - chiropractors/physical therapists/acupuncturists (31.3%)
  - primary care physicians (30.4%)

- Total medical episode costs:
  - chiropractors/physical therapists/acupuncturists ($619)
  - primary care physician visits ($728)
  - specialist care ($1,728)

- Summary
  - Health care cost savings of over $100 per medical non-surgical low back pain event when patients saw conservative integrative care providers (acupuncturists/chiropractors/physical therapists) first compared to primary care physicians
  - $1,000 savings per medical event when patients saw conservative integrative providers first compared to receiving specialist care

Taylor P, Pezzullo L, Grant SJ, Bensoussan A. Cost-effectiveness of acupuncture for chronic non-specific back pain. *Pain Pract.* 2014;14(7):599-606. [56]

- Authors assessed the cost-effectiveness of acupuncture, acupuncture plus standard care, sham acupuncture, and routine care to relieve chronic low back pain via systematic review and meta-analyses
- Participants receiving acupuncture plus standard care vs standard care only experienced "a significant improvement in pain"
- For acupuncture plus standard care vs sham acupuncture plus standard care, "a weak positive effect was found for weeks 12 to 16, but this was not significant."
- For acupuncture versus standard care, "a significant positive effect was found at week 8, but not at weeks 26 or 52."

- Outcomes measured: incremental cost-effectiveness ratio (ICER) presented as cost (A$) per disability-adjusted life-year (DALY) saved using World Health Organization (WHO) benchmarks
    - "A very highly cost-effective intervention is one that costs less than gross domestic product per capita per quality-adjusted life-year (QALY) gained or DALY averted, or less than around $A52,000 in 2009."
- Results
    - According to the established WHO benchmarks, "acupuncture as a complement to standard care for relief of chronic LBP is highly cost-effective, costing around $48,562 per DALY avoided." Cost reduces to $18,960 per DALY avoided "when comorbid depression is alleviated at the same rate as pain."
    - Acupuncture was found to be a cost-effective treatment strategy in patients with chronic low back pain

Witt CM, Jena S, Selim D, Brinkhaus B, Reinhold T, Wruck K, Liecker B, Linde K, Wegscheider K, Willich SN. Pragmatic randomized trial evaluating the clinical and economic effectiveness of acupuncture for chronic low back pain. *Am J Epidemiol.* 2006;164(5):487–496. doi:10.1093/aje/kwj224 [57]

- 11,630 German patients (average age 52.9 years; 59% female) with chronic low back pain were allocated to an acupuncture group (N = 1,549), a no-acupuncture control group (N = 1,544), or a nonrandomized acupuncture group (N = 8,537).
- Outcomes measured at baseline and after 3 and 6 months: back function (Hannover Functional Ability Questionnaire), pain, and quality of life
- "At 3 months, back function improved by 12.1 (standard error (SE), 0.4) to 74.5 (SE, 0.4) points in the acupuncture group and by 2.7 (SE, 0.4) to 65.1 (SE, 0.4) points among controls (difference 9.4 points (95% confidence interval 8.3, 10.5); $p < 0.001$)."
- Nonrandomized acupuncture group participants demonstrated improvements on par with the randomized acupuncture treatment group participants.
- "The incremental cost-effectiveness ratio was €10,526 [$11,485.34] per quality-adjusted life year."
- Conclusions: "Acupuncture plus routine care was associated with marked clinical improvements in these patients and was relatively cost-effective."

Skonnord T, Fetveit A, Skjeie H, Brekke M, Grotle M, Klovning A, Aas E. Cost-effectiveness analysis of acupuncture compared with usual care for acute non-specific low back pain: secondary analysis of a randomised controlled trial. *Acupunct Med.* 2022 Apr;40(2):123-132. doi: 10.1177/09645284211055747. Epub 2021 Nov 30. [58]

- Objective: Researchers sought to determine cost-effectiveness of a single acupuncture treatment plus usual care for acute low back pain
- Study involved secondary analysis of a Norwegian randomized controlled trial involving 171 participants with acute low back pain for more than or equal to 14 days
- Outcomes measured: quality-adjusted life years (QALYs), health care costs and societal costs at days 28 and 365, incremental cost-effectiveness ratio (ICER), and net monetary benefit (NMB)
- 86 participants in control group; 81 participants in acupuncture group
- No QALY gain at day 28; "at day 365, the incremental QALY of 0.035 was statistically significant."
- Differences between "health care costs and societal costs were not statistically significant."
- Cost savings and positive net monetary benefits at the end of one year (365 days):
    - incremental cost-effectiveness ratio: "USD -568 per QALY"
    - net monetary benefit: "USD 1265, with 95.9% probability of acupuncture being cost-effective"
- Conclusions: "This is the first cost-effectiveness analysis of acupuncture for [acute non-specific low back pain]" and "the findings indicate that acupuncture may be cost-effective [for acute non-specific low back pain] from a 1-year perspective."

Martin BI, Gerkovich MM, Deyo RA, Sherman KJ, Cherkin DC, Lind BK, Goertz CM, Lafferty WE. The association of complementary and alternative medicine use and health care expenditures for back and neck problems. *Med Care.* 2012 December;50(12): 1029–1036. doi:10.1097/MLR.0b013e318269e0b2. [59]

- Study Design: Analysis of the 2002–2008 Medical Expenditure Panel Survey involving > 17 years old with self-reported neck and back issues who either used complementary and alternative medicine (CAM) or did not. Linear
- Statistical Analysis: survey-weighted generalized linear regression and propensity matching
- Results: 12,036 survey responses received, including 4,306 (35.8%) CAM users

- CAM users:
  - significantly better "health, education, and comorbidity"
  - adjusted annual medical costs
    - spine care costs: $424 lower (95%CI $240, $609; p <0.001) based on weighted linear regression // $526 lower (p<0.001) based on propensity matching
  - total health care costs: $796 lower (95%CI $121, $1470; p = 0.021) // $298 lower (p=0.403) based on propensity matching
  - "expenditure differences were primarily due to lower inpatient expenditures among CAM users."
- Conclusions: CAM users had lower medical costs for spine (neck and back) care than non-CAM users.

Lind BK, Lafferty WE, Tyree PT, Diehr PK. Comparison of health care expenditures among insured users and nonusers of complementary and alternative medicine in Washington state: a cost minimization analysis. *JACM.* 2010;16(4):411-417. doi: 10.1089=acm.2009.0261 [60]

- Design: Insurance claims data (2000-2003) analyzed from Washington state, where CAM care coverage is required. CAM-using patients with back pain, fibromyalgia, or menopause symptoms were compared with non-CAM patients with similar symptoms and equivalent insurance "based on age group, gender, index medical condition, overall disease burden, and prior-year expenditures." Unadjusted tests and linear regression were used to analyze the data.

- Results:
  - "CAM users had lower average expenditures [higher outpatient expenses balanced by lower inpatient and imaging costs] than nonusers."
    - Unadjusted: $3,797 expenses for CAM users versus $4,153 for non-CAM users (p = 0.0001)
    - β from Linear Regression -$367 for CAM users
  - CAM-using patients with high disease burdens spent an average $1,420 less than nonusers (p < 0.0001)
  - CAM-using patients with lower disease burdens had "slightly higher average expenditures of $158"
- Conclusions: Insured patients with back pain, fibromyalgia, and menopause symptoms who use CAM care will in general have lower insurance costs than non-CAM users, especially if they have a high disease burden.

3. Cost-Effectiveness of Acupuncture for Pelvic and Low Back Pain in Pregnancy

Nicolian S, Butel T, Gambotti L, Durand M, Filipovic-Pierucci A, Mallet A, Kone M, Durand-Zaleski I, Dommergues M. Cost-effectiveness of acupuncture versus standard care for pelvic and low back pain in pregnancy: a randomized controlled trial. *PLoS One.* 2019 Apr 22;14(4):e0214195. doi: 10.1371/journal.pone.0214195. eCollection 2019. [61]

- Randomized controlled trial
- 199 pregnant women with pelvic and low back pain received 5 acupuncture treatments (N=96) or standard care (N=103)
- Outcomes
    - (1) self-assessed pain by Numerical Rating Scale (NRS) ≤ 4/10 and Mean Oswestry Disability Index (MODI)
    - (2) cost-effectiveness: incremental cost per days with NRS ≤ 4/10
    - (3) indirect non-healthcare costs (daily compensation for sick leave and productivity loss)
- Results
    - Acupuncture group
        - more days with NRS ≤ 4/10 (61% vs 48%, p = 0.007)
        - lower Mean Oswestry disability scores (33 versus 38, Δ = 5, 95% CI: 0.8 to 9, p = 0.02)
        - slightly higher health system costs (not including employer and out-of-pocket costs)
            - (€1512 versus €1452, Δ = €60, 95% CI: -272 to +470)
            - [$1,650.18 vs $1,584.70]
    - Control group
        - Higher total average costs (€2947) [$3,216.21] vs acupuncture group (€2635, Δ = -€312, 95% CI: -966 to +325), [$2,875.81]
- Conclusion
    - **Acupuncture was the clinically most effective and cost-effective compared with standard care** when employer costs were factored into the equation.
    - Authors reported "a **100% probability of cost-effectiveness** was obtained for a willingness to pay of €100 [$109.14] per [day] with pain NRS ≤ 4."

4. Cost-Effectiveness of Acupuncture for Chronic Neck Pain

Willich SN, Reinhold T, Selim D, Jena S, Brinkhaus B, Witt CM. Cost-effectiveness of acupuncture treatment in patients with chronic neck pain. *Pain.* 2006;125(1):p 107-113.| doi: 10.1016/j.pain.2006.06.006 [62]

- 3,451 patients 18 years of age or older with chronic neck pain (≥ 6 months) randomized into acupuncture treatment (1,753) and control/routine care (1,698) groups; total of 31% men, (age 53.5 ± 12.9 years); 69% women, (49.2 ± 12.7 years)
- Outcomes at baseline and 3 months:
    - "Direct and indirect [insurance] cost differences" (not including "private medical expenses such as over the counter medication") and incremental cost-effectiveness ratio (ICER)
    - Health related quality of life (SF-36) surveys
- Acupuncture "associated with significantly higher costs" … "compared to routine care" (€925.53 ± 1,551.06 vs. €648.06 ± 1,459.13; mean difference: €277.47 [95% CI: €175.71–€379.23]).
    - In dollars, these numbers equate to: ($1,009.92 ± $1,692.49 vs $707.15 ± $1,592.17; mean difference $302.77 [95% CI: $191.73-$413.81]).
- The incremental cost-effectiveness ratio was €12,469 ($13,605.92) per QALY gained and "proved robust in additional sensitivity analyses."
- Conclusions:
    - "According to international cost-effectiveness threshold values, [even though it may cost more] acupuncture is a cost-effective treatment strategy in patients with chronic neck pain."
    - "Beyond the 3 months study duration, acupuncture might be associated with further health economic effects."

5. Cost-Effectiveness of Acupuncture for Osteoarthritis

NIH. *Evidence Review for the Clinical and Cost-Effectiveness of Acupuncture for People with Osteoarthritis: Osteoarthritis in Over 16s: Diagnosis and Management.* NICE Evidence Reviews Collection. London: National Institute for Health and Care Excellence (NICE); 2022 Oct. Accessed November 16, 2023. https://www.ncbi.nlm.nih.gov/books/NBK590294/ [63]

- 26 randomized controlled trials or systematic reviews of randomized controlled trials involving adults ≥16 years of age with osteoarthritis in any joint

- "QALY for electroacupuncture versus usual care were below the NICE cost effectiveness threshold of £20,000 per QALY gained"
- Weighted average for pooled trials showed probabilistic cost-effectiveness for QALY gained was 97% at £20,000 ($25,070.30) and 99% at £30,000 ($37605.45)
- All individual trials "showed that electroacupuncture was cost effective versus usual care" for treating osteoarthritis pain.

Woods B, Manca A, Weatherly H, Saramago P, Sideris E, Giannopoulou C, Rice S, Corbett M, Vickers A, Bowes M, MacPherson H, Sculpher M. Cost-effectiveness of adjunct non-pharmacological interventions for osteoarthritis of the knee. *PLOS ONE*. March 7, 2017; :1-18. doi:10.1371/journal.pone.0172749 [64]

- 88 studies including 7,507 participants selected for meta-analysis; analysis was done for all trials and then only for trials with "low risk of selection bias"
- Results
    - TENS found to be the most cost-effective per quality-adjusted life-year (QALY) in all studies.
    - Studies with low risk of selection bias: acupuncture most cost-effective versus TENS.
    - Effectiveness varied among interventions based on TENS intensity modulation.

Reinhold TR, Witt CM, Jena S, Brinkhaus B, Willich SN. Quality of life and cost-effectiveness of acupuncture treatment in patients with osteoarthritis pain. *Eur J Health Econ.* 2007 July 19;9:209–219 [65]

- 489 participants with chronic osteoarthritis knee or hip pain from 255 general medical practices in Germany were included in this randomized controlled trial.
- Outcome measures baseline and 3 months: QoL and costs (health insurance funds data and standardized surveys)
- Compared with routine care patients, acupuncture patients experienced improved QoL
    - "significantly higher costs over the 3 month treatment period"
        - (mean cost-difference: € [95%CI €135.80–€803.19])
        - (mean cost-difference in dollars: $ [95%CI $512.31-$876.42])
- Incremental cost-effectiveness ratios (ICERs): "€17,845 [$19,472.11] per QALY gained."
- Females experienced higher cost-effectiveness.
- Conclusions: "Acupuncture was a cost-effective treatment strategy in patients with chronic osteoarthritis pain."

6. Cost-Effectiveness of Acupuncture for Chronic Non-Cancer Pain

Sutton D, McCormack S. *Acupuncture for Chronic Non-Cancer Pain: A Review of Clinical Effectiveness, Cost Effectiveness and Guidelines [Internet]*. Ottawa (ON): Canadian Agency for Drugs and Technologies in Health; 2019 Oct 29. Accessed November 16, 2023. https://www.ncbi.nlm.nih.gov/books/NBK551954/ [66]

- Systematic review of existing health technology assessments, systematic reviews, meta-analyses, network meta-analyses, economic studies, and evidence-based guidelines
- 33 publications included, including 23 systematic reviews (18 meta-analyses, 4 network meta-analyses, 1 economic study comprising 155 randomized controlled trials from 1975-2018), and 9 evidence-based guidelines
- Strength of evidence and strength of recommendations rated using multiple rigorous, reliable methods
- Outcome measures: Visual Analog Scale (VAS), Numerical rating scale (NRS), Western Ontario and McMaster Osteoarthritis Index (WOMAC) pain score, National Institutes of Health – Chronic Prostatitis Symptom Index (NIH-CPSI); Utilities (quality of life) measured by the EQ-5D instrument, average cost-effectiveness ratio (ACER); quantity of adverse events
- Majority of studies "suggested evidence of effectiveness" of acupuncture when compared with sham acupuncture or medication, but "overall were variable depending on the patient population."
- *Electroacupuncture was shown to be more cost-effective than 6 different NSAIDS for treating chronic low back pain.*

7. Cost-Effectiveness of Acupuncture for Peripheral Neuropathic Pain

Zhao W, Huang H, Liu K, Wang S, Lin S, Long W, Li L, Zeng J, Lin G. Acupuncture and moxibustion for peripheral neuropathic pain: a frequentist network meta-analysis and cost-effectiveness evaluation. *Evid Based Complement Alternat Med.* 2022 Mar 16:2022:6886465. doi: 10.1155/2022/6886465. eCollection 2022. [67]

- Review yielded 16 randomized controlled trials involving 1,308 participants with peripheral neuropathic pain (PNP)
- Treatments: 7 acupuncture and/or moxibustion treatments and two pharmaceutical interventions

- All acupuncture and moxibustion treatments (except acupoint injection) "showed superior improvements" in peripheral neuropathic pain and *"were more cost-effective as compared to pharmaceutical treatments."*
- Most effective treatments were warm needling, fire needling, and moxibustion.
- "Fire needling showed the lowest incremental cost per additional responder (ICPR) relative to the nonsteroidal anti-inflammatory drugs in the cost-effectiveness analysis of direct and indirect costs."
- Conclusions: Acupuncture and moxibustion clinically effective and cost-effective treatments for peripheral neuropathic pain.

8. Cost-Effectiveness of Acupuncture for Dysmenorrhea

Witt CM, Reinhold T, Brinkhaus B, et al. Acupuncture in patients with dysmenorrhea: a randomized study on clinical effectiveness and cost-effectiveness in usual care. *Am J Obstet Gynecol.* 2008 Feb;198(2):166.e1-8. doi: 10.1016/j.ajog.2007.07.041. [68]

- Randomized controlled trial with non-randomized cohort
- 201 participants with dysmenorrhea (mean age 36.1 +/- 7.1 years) randomized to 15 acupuncture treatments over 3 months or to a non-acupuncture control group. Everyone received usual medical care as needed.
- Outcomes: average pain intensity (NRS 0-10) at baseline and 3 months
- Results for acupuncture group
    - "Lower average pain intensity" at 3 months
        - (NRS 0-10)
        - 3.1 (95% CI 2.7; 3.6) vs. 5.4 (4.9; 5.9), difference -2.3 (-2.9; -1.6); P<.001
    - Higher quality of life; higher costs (average ICER € 3,011 or $3,285.54/QALY)
- Conclusion: Acupuncture "associated with improvements in pain and quality of life as compared to treatment with usual care alone and was **cost-effective within usual thresholds."**

9. Cost-Effectiveness of Acupuncture to Address the Opioid Crisis

Fan Y, Miller DW, Bolash B, Bauer M, McDonald J, Faggert S, He H, Ming Y, Matecki A, Camardella L, Koppelman ML, Stone JAM, Meade L, Pang J. Acupuncture's role in solving the opioid epidemic: evidence, cost-effectiveness, and care availability for acupuncture as a primary, non-pharmacologic method for pain relief and management - white paper 2017. *J Integr Med.* October 17, 2017;15(6):411-425. [69]

- "Acupuncture can address the national opioid epidemic as a medically effective, evidence-based, safe, cost-effective, non-pharmacological pain-management intervention."

D. Mechanisms of Acupuncture

1. **Connective Tissue**
   - Ultrasound visualizations show collagen connective tissues winding and pulling around acupuncture needles upon insertion into tissue, stimulating matrix deformation, microstructural cellular changes, and mechanotransduction.[70-84,100]

2. **Biochemical, Bioelectrical, and Molecular**
   - Mechanical connective tissue forces trigger downstream physiological cascades involving biochemical, bioelectrical, and molecular expression pathways that produce tangible physiological effects: [70-104]

     - **Nociceptive/analgesic, pain-relieving actions** [70,85,88,90,94-96]
     - **Anti-inflammatory actions** [85,87-92,95,96,99]
     - **Antioxidant effects** [87,88,92,93,99]
     - **Autonomic vagus nerve regulation** [86,89,92,94,99]
     - **Increased endogenous opioids** [86,88,90,93,95,96]
     - **Action on cannabinoid CB2 receptors** [88,96]
     - **Neuromodulation** via **neurotransmitter actions** [72,86,88,90,93,95,96]
     - **Neuroendocrine actions** [86,88,90,93,95,96]
     - **Neuroimmune regulation via mast cell activation** [70,88,92,97,99]
     - **Neuroplastic brain changes** visible on MRI/fMRI [100,101,102,103]
     - **Neural growth and /regeneration/apoptosis reduction** [87,88,90]
     - **Whole-brain impacts via the default mode network** [92,102,104,105]
     - **Microbiome changes** [88,92,106] (which affect mood and pain perception) [88,104]
     - **Microcirculatory changes** [87]

3. **Experience of Pain**
   - The changes that occur within the brain and body affect the psychological interpretation and experience of pain. [88,96,104]

E. Insurance Coverage for Acupuncture in Oregon

1. Oregon Health Plan (OHP)

Oregon Health Plan (OHP) Benefits: Physical Health Care. Published N.D. Accessed November 25, 2023. https://www.oregon.gov/oha/hsd/ohp/pages/benefits.aspx [107]

Prioritized List of Health Services. Oregon.gov/oha. Published October 1, 2023. Accessed November 25, 2023. https://www.oregon.gov/oha/hpa/dsi-herc/pages/prioritized-list.aspx [108]

- The Oregon Health Plan (OHP), a medicaid program run by the Oregon Health Authority, covers regular acupuncture visits "to reduce pain and symptom burden" for the following conditions:
    - **conditions of the back and spine**
    - **scoliosis**
    - **osteoarthritis** of the knee
    - **migraine headaches**
    - **tension headaches**
    - symptoms from multiple types of cancer (various comprehensive body systems)
    - conditions of pregnancy (hyperemesis gravidarum, breech, and back/pelvic pain)
    - substance use
    - behavioral health conditions related to substance use
    - post-stroke depression
    - HIV+ status
    - palliative care pain and symptom relief
- Twelve visits are offered initially, with subsequent visits approved via prior authorization based on medical necessity.

2. Regence BC/BS

Access alternative medicine with help from your health plan. Regence.com. Updated 2023. Accessed November 26, 2023.
https://www.regence.com/member/understanding-health-insurance/alt-medicine [109]

- Many Regence Blue Cross/Blue Shield plans cover medically necessary acupuncture services.

3. United Healthcare

Acupuncture Policy, Professional. UHCHealthcare. Updated 2023. Accessed November 26, 2023.
https://www.uhcprovider.com/content/dam/provider/docs/public/policies/comm-reimbursement/COMM-Acupuncture-Policy.pdf [110]

- Many United Healthcare plans offer acupuncture benefits.

4. Providence

Your Benefits Summary. Providence.org. Published N.D. Accessed November 26, 2023. https://phpcws.providence.org/phpcws/DocsNew/9ALP0039.pdf [111]

- Providence covers acupuncture when it is "medically necessary for the treatment of neuromusculoskeletal disorders, nausea or pain."

5. Pacific Source

Chiropractic Manipulation and Acupuncture. PacificSource.com. Published N.D. Accessed November 26, 2023. https://pacificsource.com/sites/default/files/plans/2020/CustomGroup/BCOC_Chiropractic%20Manipulation%20and%20Acupuncture_1000_0120.pdf [112]

- PacificSource insurance "allows you to receive services from licensed providers for chiropractic manipulation and acupuncture care for medically necessary treatment of illness or injury."

6. Kaiser

Complementary and Alternative Medicine. KaiserPermanente.org. Updated 2023. Accessed November 26, 2023. https://wa-provider.kaiserpermanente.org/provider-manual/patient-care/specialty/alternative [113]

- "Most plans cover a limited number of self-referred acupuncture, naturopathy, and manipulative therapy visits."

7. MODA

Acupuncture. Modahealth.com. Published January 2019. Accessed November 26, 2023. https://www.modahealth.com/pdfs/med_criteria/Acupuncture.pdf [114]

- Covers 10-20 acupuncture or electroacupuncture visits within 2 months "when it is listed as a covered benefit and is administered by a healthcare provider who is a legally qualified acupuncturist practicing within the scope of his/her license for the following indications:"
    - nausea and vomiting associated with: postoperative nausea and vomiting, chemotherapy, pregnancy
    - postoperative dental pain
    - temporomandibular disorders
    - chronic painful conditions: neck pain, back pain, and osteoarthritic knee or hip pain."

8. CHP

Integrative Healthcare Services. CHPgroup.com. Published 2022. Accessed November 26, 2023. https://chpgroup.com/ [115]

- The CHP group lists acupuncture as one of the integrative healthcare services offered by many of its plans.

9. Aetna (ASH)

Acupuncture and Dry Needling. Aetna.com. Last Reviewed April 5, 2023. Accessed November 26, 2023.https://www.aetna.com/cpb/medical/data/100_199/0135.html [116]

- "Aetna considers acupuncture (manual or electroacupuncture) medically necessary for *any* of the following indications:
    - Chronic (minimum 12 weeks duration) neck pain; *or*
    - Chronic (minimum 12 weeks duration) headache; *or*
    - Low back pain; *or*
    - Nausea of pregnancy; *or*
    - Pain from osteoarthritis of the knee or hip (adjunctive therapy); *or*
    - Post-operative and chemotherapy-induced nausea and vomiting; *or*
    - Post-operative dental pain; *or*
    - Temporomandibular disorders (TMD)."

10. Cigna (ASH)

Cigna Medical Coverage Policy- Therapy Services Acupuncture. Cigna.com. Updated 2023. Accessed November 26, 2023.
https://static.cigna.com/assets/chcp/pdf/coveragePolicies/medical/CPG024_acupuncture.pdf [117]

- Cigna covers acupuncture when medically necessary for the following conditions:
    - tension headaches
    - migraine headaches with or without aura
    - musculoskeletal joint and soft tissue pain (including hip, knee, spine) "resulting in a functional deficit (e.g., inability to perform household chores, interference with job functions, loss of range of motion),"
- Cigna covers acupuncture to treat the following conditions when they are co-managed:
    - nausea related to pregnancy
    - post-surgical nausea
    - nausea due to chemotherapy

11. Triwest

Veteran Eligibility and Covered Services. TriWest.com. Published 2023. Accessed November 26, 2023.
https://www.triwest.com/en/provider-handbook/veteran-eligibility-and-covered-services/ [118]

- TriWest (Veterans' Affairs) lists acupuncture as one of their covered member services.

12. Health Net

Alternative Care. HealthNetOregon.com. Published 2023. Accessed November 26, 2023.
https://www.healthnetoregon.com/employers/supplemental-coverage/alternative-care-providers.html [119]

- HealthNet offers acupuncture "coverage on most plans."

13. Humana

Take Advantage of Valuable Extras. Humana.com. Updated October 31, 2023. Accessed November 26, 2023. https://www.humana.com/member/discounts [120]

Does Humana Cover Acupuncture? Published October 05, 2023. Accessed November 26, 2023. https://www.helpadvisor.com/medicare/does-humana-cover-acupuncture [121]

- Acupuncture is covered as one of the services covered by Humana. For medicare patients, 12-20 acupuncture visits for low back pain are covered per calendar year.

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