Cost-Effectiveness Literature Review

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.

- 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:** Authors showed a health care cost savings of over $100 per medical event in the treatment of non-surgical low back pain when patients saw conservative integrative care providers (acupuncturists/chiropractors/physical therapists) first compared to primary care physicians. There was a $1,000 savings per medical event when patients saw conservative integrative providers first compared to specialist care.

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

- 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.

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.

- Review yielded 16 randomized controlled trials involving 1,308 participants
- Studied involved seven acupuncture and/or moxibustion treatments and two pharmaceutical interventions for peripheral neuropathic pain (PNP)
    - Authors noted that "12.5% [of the trials] were at low risk of bias, 68.75% had some concerns about the risk of bias, and 18.75% were at high risk of bias," with the major source of bias being randomization processes used.
- 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."
- Conclusion: "Acupuncture and moxibustion techniques are beneficial and cost-effective approaches for easing PNP and hence can be considered for PNP management."

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.

- 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 £20k and 99% at £30k
- All individual trials "showed that electroacupuncture was cost effective versus usual care"

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.

- 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, the incremental cost-effectiveness ratio (ICER) and net monetary benefit (NMB)
- 86 participants in control group and 81 in acupuncture group were included
- 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 were shown for three of four of the authors' calculations. At the end of one year (365 days) the incremental cost-effectiveness ratio was "USD -568 per QALY" and the net monetary benefit was "USD 1265, with 95.9% probability of acupuncture being cost-effective."
- Conclusions:
    - Authors conclude "this is the first cost-effectiveness analysis of acupuncture for [acute non-specific low back pain]."
    - "The findings indicate that acupuncture may be cost-effective from a 1-year perspective."

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.

- A pragmatic-open-label randomized controlled trial involving 199 pregnant women from 5 maternity hospitals with pelvic and low back pain

- 96 treated with acupuncture (5 sessions performed by an acupuncturist midwife) and 103 treated with standard care
- Outcome measures included (1) self-assessed pain by numerical rating scale (NRS) ≤ 4/10; (2) cost-effectiveness: incremental cost per days with NRS ≤ 4/10, and (3) indirect non-healthcare costs (daily compensation for sick leave and productivity loss)
- Acupuncture participants had more days with NRS ≤ 4/10 (61% vs 48%, p = 0.007)
- "Mean Oswestry disability score was lower in the acupuncture group than with standard care alone (33 versus 38, Δ = 5, 95% CI: 0.8 to 9, p = 0.02)."
- "Average total costs were higher in the control group (€2947) than in the acupuncture group (€2635, Δ = -€312, 95% CI: -966 to +325), resulting from the higher indirect costs of absenteeism and presenteeism."
- "Costs for the health system (employer and out-of-pocket costs excluded) were slightly higher for acupuncture (€1512 versus €1452, Δ = €60, 95% CI: -272 to +470)."
- 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 per days with pain NRS ≤ 4."

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.

- Authors sought to summarize evidence "regarding the clinical and cost effectiveness of acupuncture for chronic non-cancer pain as well as relevant evidence-based guidelines regarding acupuncture for chronic non-cancer pain."
- Systematic review of existing health technology assessments, systematic reviews, meta-analyses, network meta-analyses, economic studies, and evidence-based guidelines
- 33 publications included for review, 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 the studies evaluated "suggested evidence of effectiveness" of acupuncture when compared with sham acupuncture or medication; however, systematic review results and recommendations from evidence-based guidelines "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.

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

- 88 studies including 7,507 participants were selected for meta-analysis inclusion; analysis was done for all trials and then only for trials with "low risk of selection bias."

- TENS was the most cost-effective per quality-adjusted life-year (QALY) when all studies were considered; when studies were limited to those with low risk of selection bias, acupuncture emerged as the most cost-effective versus TENS. Effectiveness varied among interventions based on intensity modulation.

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

- 29 trials involving 17,922 patients with chronic musculoskeletal pain (low back, neck, and shoulder pain), knee osteoarthritis, and headache/migraine pain
- Analyzed using meta-analysis to compare pre-post treatment pain scores
- Long-term follow-up data located for 20 trials involving 6,376 patients to determine persistence of treatment effects
- Treatment effect persisted at 3 months (95% CI: −0.014 to 0.037, p = 0.4) for trials that compared acupuncture to a no acupuncture 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."

- Trials involving acupuncture compared to 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 conclude:
    - 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."*

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.

- Authors assessed the cost-effectiveness of acupuncture, acupuncture with standard care, sham acupuncture, and routine care to relieve chronic low back pain via systematic review and meta-analyses
- Participants receiving acupuncture and standard care versus standard care only experienced "a significant improvement in pain"
- For acupuncture with standard care versus standard care with sham acupuncture, "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")
- 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

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.

- **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**

- **Objectives:** "To compare health care expenditures between insured patients with back pain, fibromyalgia syndrome, or menopause symptoms who used complementary and alternative medical (CAM) providers for some of their care to a matched group of patients who did not use any CAM care. Insurance coverage was equivalent for both conventional and CAM providers."

- **Design:** Insurance claims data (2000-2003) was analyzed from Washington state, where coverage for CAM care is required. Patients who used CAM care were matched to non-CAM patients "based on age group, gender, index medical condition, overall disease burden, and prior-year expenditures." Unadjusted tests as well as 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.

Witt CM, Reinhold T, Brinkhaus B, Roll S, Jena S, Willich SN. 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.

- 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 assessed via average pain intensity (NRS 0-10) at baseline and 3 months
- At 3 months, "average pain intensity (NRS 0-10) was lower in the acupuncture compared to the control group: 3.1 (95% CI 2.7; 3.6) vs. 5.4 (4.9; 5.9), difference -2.3 (-2.9; -1.6); P<.001."
- The acupuncture participants reported higher quality of life as well as higher costs (average ICER € 3,011 or $3,285.54 per QALY).
- Conclusion: Acupuncture for dysmenorrhea patients "was associated with improvements in pain and quality of life as compared to treatment with usual care alone and was cost-effective within usual thresholds."

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

- Authors used a randomized controlled trial to assess "quality of life (QoL), costs, and cost-effectiveness of acupuncture treatment plus routine care" for patients with osteoarthritis
- 489 participants with chronic osteoarthritis knee or hip pain from 255 general medical practices in Germany were included

- Outcome measures at baseline and 3 months: QoL and costs based on health insurance funds data and standardized surveys
- Compared with routine care alone, acupuncture patients experienced improved QoL "associated with 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) showed "€17,845 per QALY gained." or $19,472.11 per QALY.
- Females gained higher cost-effectiveness.
- Conclusions: "acupuncture was a cost-effective treatment strategy in patients with chronic osteoarthritis 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

- 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
    - "Beyond the 3 months study duration, acupuncture might be associated with further health economic effects."
    - "According to international cost-effectiveness threshold values, acupuncture is a cost-effective treatment strategy in patients with chronic neck 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

- 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 were assessed
- "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 participants demonstrated improvements on par with the randomized acupuncture treatment group.
- "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."

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.

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

Study Protocol:

Lee S-H, Lee J, Lee YJ, Kim M-R, Cho JH, KIM K-W, Ha I-H. Effectiveness and cost-effectiveness of acupuncture with Doin therapy for chronic neck pain: a study protocol for a multicentre, randomised controlled clinical trial. *BMJ Open*. 2019 May 10;9(5):e026632. doi: 10.1136/bmjopen-2018-026632.

Introduction: Doin therapy is a manual therapy used in Korean rehabilitation medicine. Recently, the use of acupuncture with Doin has increased in clinics and clinical trials have demonstrated its effects. However, well-designed studies examining the efficacy and cost-effectiveness of acupuncture with Doin therapy are rare.

Methods and analysis: A multicentre, assessor-blinded, randomised controlled trial with two parallel groups aims to evaluate the clinical effects and cost-effectiveness of acupuncture with Doin therapy. A total of 124 patients (with a neck pain duration of 6 months or longer and a Numeric Rating Scale ≥5) will be recruited at five Korean medicine hospitals. Patients will be randomly allocated to acupuncture with Doin therapy (n=62) and acupuncture alone (n=62) for 5 weeks of treatment. This study will be carried out with outcome assessor and statistician blinding. The primary outcome measure will consist of improvement in neck pain using the Visual Analogue Scale at 6 weeks. The secondary outcomes including measures of pain, functional disability, health-related quality of life and economic evaluation will be conducted at 6 weeks, and 3, 6, 9 and 12 months after treatment ETHICS AND DISSEMINATION: The project is approved by the Institutional Review Board (IRB) of the Jaseng Hospital of Korean Medicine and the Kyung Hee University Korean Medicine Hospital at Gangdong. Dissemination will occur after the findings from this study are published in other peer reviewed journals.

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