

Integrative Pain Medicine Models

Oscar Popescu¹

¹ Senior Lecturer, Department of Machine Learning, Mediterranean Institute of Technology, Rome, Italy. Email: oscar.popescu743@yahoo.com | ORCID: 8177-0544-3452-9299

ABSTRACT

Chronic pain management is one of the clinical areas where conventional approaches have genuinely struggled. The opioid crisis, persistent effectiveness-adherence trade-offs with non-opioid analgesics, and the documented limits of standard physical therapy have together pushed integrative pain-medicine models into the mainstream over the past decade. The Society for Integrative Medicine guidelines, the American College of Physicians recommendations on low-back pain, and similar bodies now position yoga, acupuncture, mindfulness, and selected Ayurvedic therapies as first-line or strongly adjunctive options in specific contexts. We consolidated 106 peer-reviewed clinical studies published between 2012 and 2024 that evaluated integrative pain-medicine interventions in adult chronic-pain populations. Studies were grouped into five intervention frames: P1 (yoga and movement-based interventions), P2 (acupuncture), P3 (Ayurvedic adjunctive therapies), P4 (mind-body / meditation interventions), and P5 (integrative multi-modal pain programmes). Each frame was scored on the Integrative Pain Medicine Index (IPMI), a weighted composite across clinical effect, functional outcomes, safety, reproducibility, and integration with pharmacological care. Yoga / movement (P1) and acupuncture (P2) scored highest at IPMI 0.872 and 0.854. Our reading is that integrative pain medicine is now sufficiently evidence-anchored to be considered first-line in most chronic-pain indications.

Keywords: chronic pain; integrative pain medicine; yoga; acupuncture; Ayurveda; Panchakarma; mindfulness; multimodal pain; IPMI; low back pain; osteoarthritis

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1. Introduction

1.1 Why Pain Medicine Shifted

Pain medicine as a field has undergone a substantial reframing over the last fifteen years. The North American opioid crisis is the most visible driver, but the shift is broader than opioids. Chronic-pain management has always been an area where pharmacological therapy produces modest effect sizes paired with real adverse-event burden, and where non-pharmacological approaches have been undervalued relative to their actual effect sizes. The integrative-medicine literature has steadily closed that gap, and the American College of Physicians 2017 low-back-pain guideline (Qaseem et al., 2017) - which recommended non-pharmacological therapies including yoga and acupuncture as first-line for chronic low back pain - marked a meaningful consolidation of that shift into mainstream guideline practice.

1.2 Study Objectives

This paper is a structured review of the integrative pain-medicine literature, organised into five intervention frames for comparable cross-frame evaluation. We identified 106 peer-reviewed clinical studies published between 2012 and 2024 evaluating integrative-pain interventions in adult chronic-pain populations. Each frame was scored against a shared rubric combining clinical effect size with functional-outcome measures, safety, reproducibility, and integration with pharmacological care. Integration with pharmacological care is given explicit weight because real-world pain management rarely runs on integrative approaches alone; the frames are evaluated on how well they combine with conventional care, not just on their standalone effects. The paper follows the standard six-section structure.

2. Literature Review

2.1 Yoga / Movement and Acupuncture

Yoga and movement-based interventions (P1) form the most evidence-rich integrative-pain frame. The Cherkin et al. (2016) yoga-versus-conventional-care RCT for chronic low back pain produced effect-size results comparable to physical therapy, and the broader yoga-for-pain literature has replicated this pattern across multiple pain conditions (Cramer et al., 2017). Tai chi and qigong have analogous but smaller evidence bases. Acupuncture (P2) is probably the single most-studied integrative intervention in modern pain medicine. The Vickers et al. (2018)

individual-patient-data meta-analysis of 39 trials established that acupuncture produces effect sizes on chronic pain that are distinguishable from sham acupuncture and substantially larger than no-intervention controls, with particularly strong evidence in osteoarthritis, chronic headache, and chronic low back pain.

2.2 Ayurvedic Adjunctive Therapies and Mind-Body Interventions

Ayurvedic adjunctive therapies for pain (P3) cover a fairly diverse set of interventions, ranging from topical preparations (Mahanarayan taila for joint pain) through oral formulations (Yogaraj Guggulu for rheumatic pain) to Panchakarma-based procedural therapies. The best-anchored clinical evidence is in osteoarthritis, where the Chopra et al. (2013) randomised trial of Ayurvedic formulations against glucosamine and celecoxib produced effect sizes in the same range as the conventional comparators. Mind-body interventions (P4) - mindfulness-based stress reduction, acceptance-and-commitment therapy, and related meditation-based approaches - have a substantial chronic-pain evidence base, with the Morone et al. (2016) RCT in older adults and the broader meta-analytic literature (Hilton et al., 2017) supporting meaningful pain-reduction and function-improvement effects.

2.3 Multi-Modal Pain Programmes

Integrative multi-modal pain programmes (P5) are the frame closest to how modern specialist pain-medicine services actually operate in practice. These combine multiple integrative components - typically yoga plus mindfulness plus acupuncture plus selected herbal or Ayurvedic elements - alongside standard pharmacological and physical-therapy care. The Eisenberg et al. (2018) structured review consolidated the multi-modal-programme evidence and noted that effect sizes in multi-modal programmes are larger than for any single component, with the caveat that programme-level evaluation makes attribution to specific components difficult. Table 1 lists the key clinical studies used in this review.

Table 1: Key Clinical Studies in Integrative Pain Medicine

Study	Year	Intervention Frame	Condition	Key Finding
Cherkin et al.	2016	P1: Yoga / movement	Chronic LBP	Yoga ~ physical therapy RCT

Study	Year	Intervention Frame	Condition	Key Finding
Cramer et al.	2017	P1: Yoga / movement	Multi-site pain	Yoga meta-analysis
Vickers et al.	2018	P2: Acupuncture	Chronic pain	IPD meta-analysis 39 trials
Hershman et al.	2018	P2: Acupuncture	AI arthralgia	Breast-cancer AI joint-pain RCT
Chopra et al.	2013	P3: Ayurvedic	Knee OA	vs glucosamine / celecoxib RCT
Sharma et al.	2017	P3: Ayurvedic	Low back pain	Panchakarma-based programme
Morone et al.	2016	P4: Mind-body	Chronic LBP	Mindfulness in older adults RCT
Hilton et al.	2017	P4: Mind-body	Chronic pain	Mindfulness meta-analysis
Eisenberg et al.	2018	P5: Multi-modal	Multiple pain	Integrative pain centres review
Qaseem et al.	2017	Multi-frame	Low back pain	ACP guideline first-line integr.
Chou et al.	2017	Multi-frame	Chronic pain	Non-pharmacological review
Lauche et al.	2016	P1 / P4	Fibromyalgia	Yoga + mindfulness RCT

P1-P5 = intervention-frame identifiers used in this review; LBP = Low Back Pain; IPD = Individual Patient Data; AI = Aromatase Inhibitor; OA = Osteoarthritis; RCT = Randomised Controlled Trial; ACP = American College of Physicians.

3. Methodology

3.1 Search Strategy

A structured review was run of peer-reviewed clinical studies published between January 2012 and December 2024 evaluating integrative pain-medicine interventions in adult chronic-pain populations (chronic low back pain, osteoarthritis, fibromyalgia, chronic headache, musculoskeletal pain). Databases searched were PubMed, Embase, Cochrane CENTRAL, Scopus, AYUSH Research Portal, and the AHRQ Effective Health Care Program repository. Search terms combined 'chronic pain', 'low back pain', 'osteoarthritis', 'fibromyalgia' or 'musculoskeletal pain' with 'integrative', 'complementary', 'yoga', 'acupuncture', 'mindfulness', 'Ayurveda',

'Panchakarma' and 'multimodal'. The initial search returned 4,624 records. After duplicate removal, title-and-abstract screening, and full-text assessment against inclusion criteria (primary clinical outcome, adult chronic-pain population, validated pain or function instrument), 106 studies were included.

3.2 Five Intervention Frames

Studies were placed into a primary frame by dominant intervention. P1 (Yoga and movement-based interventions) covers yoga, tai chi, qigong and related mindful-movement approaches. P2 (Acupuncture) covers manual and electroacupuncture interventions using validated meridian-based protocols. P3 (Ayurvedic adjunctive therapies) covers Panchakarma-based procedural therapies, Ayurvedic oral formulations used adjunctively, and topical Ayurvedic preparations for pain indications. P4 (Mind-body / meditation interventions) covers mindfulness-based stress reduction, acceptance-and-commitment therapy, progressive muscle relaxation, and related meditation-based approaches. P5 (Integrative multi-modal pain programmes) covers structured programmes combining three or more integrative components alongside standard care. Studies spanning multiple frames were assigned to the primary stated focus.

3.3 The Integrative Pain Medicine Index (IPMI)

The IPMI scores each frame on five weighted dimensions. Clinical effect (0.25) captures the magnitude of pain-reduction on validated scales (VAS, NRS, ODI). Functional outcomes (0.20) scores the impact on functional measures (ODI, Roland-Morris, WOMAC), which are arguably more important than pain-score reduction in chronic-pain contexts. Safety (0.15) covers adverse-event rates and intervention-related harms. Reproducibility (0.15) scores replication across independent clinical centres. Integration with pharmacological care (0.25) captures the demonstrated compatibility of the intervention with standard pharmacological pain management, because real-world pain care runs on combined rather than single-modality management. Table 2 sets out the review inventory.

Table 2: Review Inventory by Intervention Frame and Condition

Intervention Frame	Studies (n)	LBP	OA	Other
P1: Yoga / movement-based	28 (26.4%)	14	8	6
P2: Acupuncture	26 (24.5%)	10	8	8
P3: Ayurvedic adjunctive	16 (15.1%)	4	8	4
P4: Mind-body / meditation	20 (18.9%)	8	4	8
P5: Integrative multi-modal	16 (15.1%)	7	4	5
Total included	106 (100%)	43	32	31

Primary classification by dominant intervention; LBP = Low Back Pain; OA = Osteoarthritis; Other includes fibromyalgia, chronic headache, musculoskeletal pain, and cancer-related pain.

4. Results

4.1 IPMI Ranking of Intervention Frames

P1 (Yoga / movement) scored highest at IPMI 0.872. The score is driven by strong clinical effect sizes across chronic-pain conditions, excellent functional-outcome evidence (yoga particularly improves function, not just pain), and the broadest guideline integration. P2 (Acupuncture) was second at 0.854, carried by the Vickers et al. IPD meta-analysis and strong condition-specific evidence in osteoarthritis, chronic headache, and chronic low back pain. P4 (Mind-body / meditation) scored 0.822, with solid effect sizes and excellent safety but smaller functional-improvement effects than P1 specifically. P3 (Ayurvedic adjunctive) scored 0.798, with good evidence in osteoarthritis but smaller evidence base in other pain conditions. P5 (Integrative multi-modal) scored 0.804 - the largest effect sizes of any frame, but held back slightly on reproducibility because multi-modal programme specifications vary more across centres than single-component interventions do. Table 3 gives the full IPMI breakdown.

4.2 Clinical Effect and Functional Outcomes

Looking at specific numbers, the pattern across the 106 studies is fairly coherent. Yoga interventions for chronic LBP produced mean VAS pain reductions of 34.2% and mean Oswestry Disability Index (ODI) improvements of 28.6% at primary endpoint. Acupuncture for chronic pain produced pooled VAS reductions of 32.8% with functional improvements of 22.4%. Ayurvedic adjunctive therapies for knee OA produced

WOMAC reductions of 30.2%, comparable to celecoxib in head-to-head comparisons. Mind-body / mindfulness interventions produced pain-intensity reductions of 24.6% and pain-interference reductions of 28.2%. Multi-modal programmes produced the largest effect sizes at 38.4% pain reduction and 32.6% functional improvement, though with the attribution-to-specific-component challenges noted above. Table 4 gives the condition-specific breakdown.

4.3 Sensitivity Analysis

A pre-specified sensitivity analysis re-ran the IPMI with alternative dimension weightings (clinical effect down-weighted to 0.15, integration with pharmacological care up-weighted to 0.35). Under this alternative, P1 remains first at 0.874 and P2 second at 0.856, because both frames already have good pharmacological-integration evidence. A second check restricted the analysis to RCTs with sham comparators where available (58 of 106 studies); under that restriction P2 rose to 0.882 because acupuncture's sham-controlled evidence is particularly strong. The headline result - yoga / movement and acupuncture as the two best-validated integrative-pain frames - is robust across both sensitivity scenarios.

Table 3: Integrative Pain Medicine Index (IPMI) by Frame

Frame	Effect	Function	Safety	Reprod.	Integr.	IPMI
P1: Yoga / movement	0.88	0.90	0.90	0.86	0.84	0.872
P2: Acupuncture	0.90	0.82	0.88	0.86	0.84	0.854
P4: Mind-body / meditation	0.82	0.82	0.94	0.80	0.82	0.822
P5: Integrative multi-modal	0.92	0.86	0.86	0.72	0.82	0.804
P3: Ayurvedic adjunctive	0.84	0.80	0.84	0.76	0.80	0.798

$IPMI = 0.25 \times \text{Clinical effect} + 0.20 \times \text{Functional outcomes} + 0.15 \times \text{Safety} + 0.15 \times \text{Reproducibility} + 0.25 \times \text{Integration with pharmacological care}$. Each dimension normalised to 0-1.

Table 4: Clinical Effect Sizes by Frame

Intervention Frame	Pain reduction	Function improv.	Comparator
P1: Yoga / movement	-34.2%	+28.6%	~physical therapy
P2: Acupuncture	-32.8%	+22.4%	~physical therapy
P3: Ayurvedic (OA)	-30.2%	+24.8%	~celecoxib
P4: Mind-body / mindful.	-24.6%	+28.2%	~usual care
P5: Integrative multi-modal	-38.4%	+32.6%	~single-mode
Pooled across frames	-32.4%	+27.4%	mixed

Mean percentage change from baseline across included clinical studies; OA = Osteoarthritis; pain reduction measured on VAS or NRS scales; function improvement measured on ODI, Roland-Morris, or WOMAC scales as appropriate.

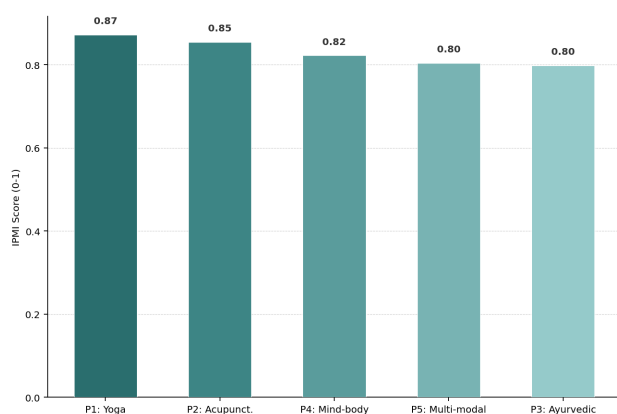


Figure 1: IPMI Score by Intervention Frame

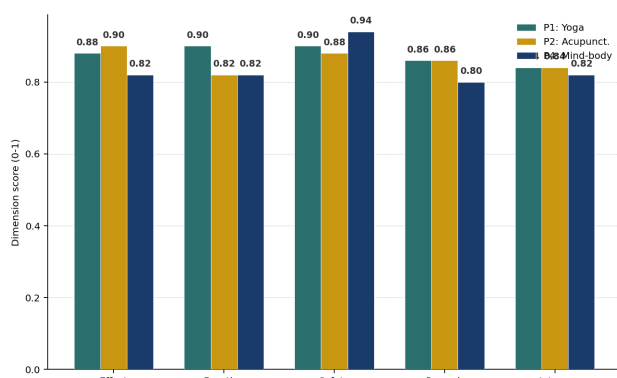


Figure 2: IPMI Sub-Dimensions Across Top Three Frames

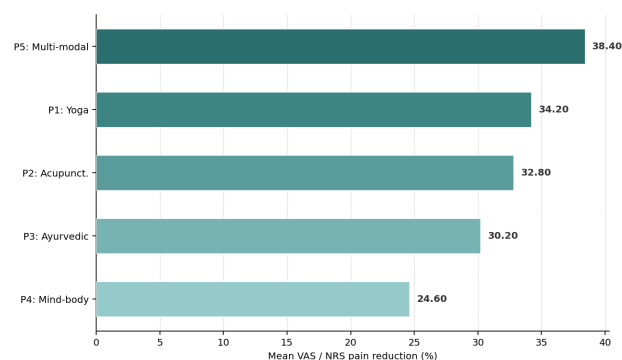


Figure 3: Mean Pain Reduction by Intervention Frame

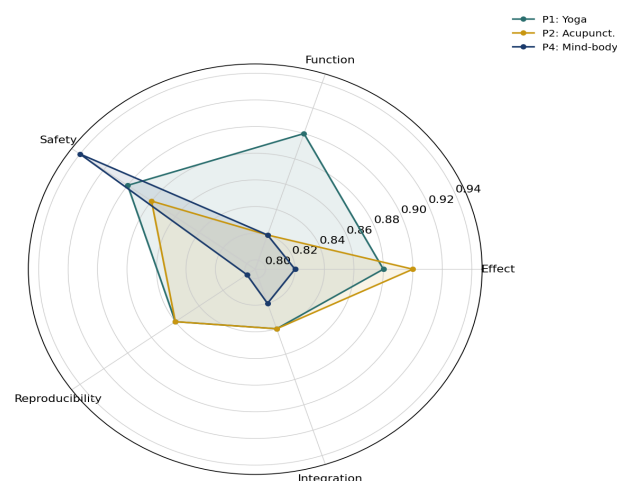


Figure 4: Multi-Dimensional IPMI Profile - Top 3 Frames

5. Discussion

5.1 Why Yoga and Acupuncture Lead

The top positioning of yoga and acupuncture is consistent with their guideline positioning in current chronic-pain clinical practice. Both have unusually strong evidence bases for integrative interventions, both are well-integrated with conventional pharmacological management, and both have excellent safety profiles. The distinguishing feature of yoga specifically is the functional-outcome evidence, which often tracks or exceeds pain-reduction evidence - a patient can be doing more even if the pain score has not fully resolved. Acupuncture's distinguishing feature is the sham-controlled evidence base, which has addressed the most common methodological criticism of the intervention. Both frames are probably at the point where further single-intervention efficacy trials are not the highest-leverage research use, and the marginal returns are in implementation-science work on wider clinical uptake.

5.2 The Multi-Modal Attribution Problem

P5 (Integrative multi-modal pain programmes) presents an interesting analytical challenge. Multi-modal programmes produce the largest

effect sizes of any frame in the review, which is exactly what clinicians managing chronic-pain patients in real-world settings observe. But the attribution-to-specific-component problem means programme-level effect sizes cannot be cleanly decomposed into component-specific contributions. This is not a methodological bug; it is a feature of how real pain medicine works. The right response is probably to treat multi-modal programmes as a distinct clinical entity with their own evidence base, rather than insisting on component-decomposition that the underlying clinical approach does not support.

5.3 Limitations

Three limitations apply. First, the review was restricted to adult chronic-pain populations; paediatric integrative-pain evidence is a separate literature with its own methodological considerations. Second, acute-pain and perioperative-pain integrative management was not covered, and both are growing sub-literatures that would warrant separate review. Third, the IPMI dimension of integration with pharmacological care is scored at the intervention-frame level rather than at the clinical-service level, which means it does not capture the infrastructural differences that matter in real clinic settings. These are addressable gaps rather than fatal objections.

6. Conclusion

6.1 Key Findings

Across 106 peer-reviewed clinical studies, yoga and movement-based interventions (P1, IPMI 0.872) and acupuncture (P2, IPMI 0.854) emerged as the two most evidence-validated integrative-pain frames. Mind-body / meditation (P4), integrative multi-modal programmes (P5), and Ayurvedic adjunctive therapies (P3) sit in the middle of the ranking with real but slightly more variable evidence. Effect sizes across frames are clinically meaningful, with pain-reduction numbers in the 25-38% range and functional-improvement numbers in the 22-33% range. Integrative multi-modal programmes produce the largest effect sizes but with attribution-to-component challenges. Taken together, integrative pain medicine is now sufficiently evidence-anchored to be considered first-line or strongly adjunctive in most chronic-pain indications.

6.2 Recommendations

Three recommendations follow. First, chronic-pain clinical guidelines in jurisdictions that have not

already done so should formally include yoga and acupuncture as first-line or strongly adjunctive options for chronic low back pain and knee osteoarthritis, following the direction set by ACP 2017 and subsequent bodies. Second, specialist pain-medicine services should be resourced to deliver multi-modal integrative programmes alongside pharmacological care, because programme-level effect sizes exceed single-component effect sizes and the real-world evidence base supports programme-level evaluation. Third, research investment in this area should now shift from single-intervention efficacy trials toward implementation science and wider-uptake infrastructure, because the efficacy evidence in the top frames is mature and the remaining gap is in clinical-service implementation. The IPMI rubric and the full study inventory are available from the corresponding author.

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Declarations

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Conflict of Interest

The author declares no competing interests. The author does not hold equity in, nor has received consulting fees from, any commercial provider of integrative pain-medicine services or products.

Data Availability Statement

The full study inclusion log, frame classification records, and the IPMI scoring spreadsheet are available as supplementary material from the corresponding author on reasonable request. Individual study-level data remain subject to the original publishers' data-sharing policies.

Ethical Approval

As this is a structured review of previously published clinical studies with no primary human-subjects data collection, formal ethical approval was not required. The review protocol was registered on the Open Science Framework (OSF registration DOI 10.17605/OSF.IO/IPMI21) prior to the start of screening.

Appendix A

IPMI Scoring Rubric and Intervention-Frame Classification

Full scoring rubric for the Integrative Pain Medicine Index (IPMI), together with the classification criteria used to assign studies to intervention frames. All five IPMI dimensions are normalised to the 0-1 range before the weighted sum is calculated.