Yoga and Pain: a Mind-Body Complex System

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Network analysis results

Betweenness

Betweenness is a measure of centrality in a graph based on shortest paths. For every pair of node in a connected network, there exists at least one shortest path between the vertices such that the number of edges that the path passes through.[i] The betweenness for each node is the number of these shortest paths that pass through the node. Betweenness represents the degree to which nodes stand between each other. While other metrics identify nodes that have the greatest input or output, betweenness helps identify the most heavily trafficked pathways.

As seen in Table 1, the nodes with the highest betweenness tended to be STUDIES, with the highest values occurring in nodes about complex systems, followed closely by nodes related to pain pathways and pain management. There are a small number of nodes related to yoga or mind-body interventions No KEYWORDS were in the top 30.

Table 1

Label	Type	Metric	Value
Small Open Chemical Systems Theory and Its Implications to Darwinian Evolutionary Dynamics, Complex Self-Organization and Beyond	**Study**	betweenness	1.76E-05
Extreme value theory of evolving phenomena in complex dynamical systems: firing cascades in a model of neural network	**Study**	betweenness	1.66E-05
Understanding and Modelling the Complexity of the Immune System: Systems Biology for Integration and Dynamical Reconstruction of Lymphocyte Multi-Scale Dynamics	**Study**	betweenness	1.54E-05
Complexity of Model Testing for Dynamical Systems with Toric Steady States	**Study**	betweenness	1.5E-05
Designer dynamics through chaotic traps: Controlling complex behavior in driven nonlinear systems	**Study**	betweenness	7.55E-06
Life as Complex Systems --- Viewpoint from Intra-Inter Dynamics	**Study**	betweenness	6.14E-06
Angiotensin II Triggers Peripheral Macrophage-to-Sensory Neuron Redox Crosstalk to Elicit Pain	**Study**	betweenness	5.35E-06
Common Brain Mechanisms of Chronic Pain and Addiction	**Study**	betweenness	4.44E-06
Immediate preoperative outcomes of pain neuroscience education for patients undergoing total knee arthroplasty: A case series	**Study**	betweenness	4.32E-06
Applying Complexity Theory to a Dynamical Process Model of the Development of Pathological Belief Systems	**Study**	betweenness	4.18E-06
The evolution of self-control	**Study**	betweenness	4E-06
Low- Versus High-Intensity Plyometric Exercise During Rehabilitation After Anterior Cruciate Ligament Reconstruction	**Study**	betweenness	3.95E-06
Forecasting transitions in systems with high dimensional stochastic complex dynamics: A Linear Stability Analysis of the Tangled Nature Model	**Study**	betweenness	3.58E-06
A Mechanism-Based Approach to the Management of Osteoarthritis Pain	**Study**	betweenness	3.53E-06
Influence of a periodized circuit training protocol on intermuscular adipose tissue of patients with knee osteoarthritis: protocol for a randomized controlled trial	**Study**	betweenness	3.33E-06
Psychological processing in chronic pain: a neural systems approach	**Study**	betweenness	3.21E-06
Corticotrophin-releasing factor 1 activation in the central amygdale and visceral hyperalgesia	**Study**	betweenness	3.2E-06
Cultural adaptation framework of social interventions in mental health: Evidence-based case studies from low- and middle-income countries	**Study**	betweenness	3.17E-06
Elite competitive swimmers exhibit higher motor cortical inhibition and superior sensorimotor skills in a water environment	**Study**	betweenness	3.13E-06

Label	Type	Metric	Value
Remote ischemic conditioning as a cytoprotective strategy in vasculopathies during hyperhomocysteinemia: An emerging research perspective	**Study**	betweenness	3.12E-06
Assessing for unique immunomodulatory and neuroplastic profiles of physical activity subtypes: a focus on psychiatric disorders	**Study**	betweenness	3.12E-06
Impact of complex, partially nested clustering in a three-arm individually randomized group treatment trial: A case study with the wHOPE trial	**Study**	betweenness	3.06E-06
Changes of meningeal excitability mediated by corticotrigeminal networks: a link for the endogenous modulation of migraine pain	**Study**	betweenness	3.04E-06
A Dynamical Similarity Approach to the Foundations of Complexity and Coordination in Multiscale Systems	**Study**	betweenness	2.87E-06
Creating Inclusive Physical Activity Spaces: The Case of Body-Positive Yoga	**Study**	betweenness	2.86E-06
Using focus group methods to develop multicultural cancer pain education materials	**Study**	betweenness	2.77E-06
A Randomized, Single-Blind Study Evaluating the Effect of a Bone Pain Education Video on Reported Bone Pain in Patients with Breast Cancer Receiving Chemotherapy and Pegfilgrastim	**Study**	betweenness	2.75E-06
A dynamical model of fast cortical reorganization	**Study**	betweenness	2.74E-06
General Pathways of Pain Sensation and the Major Neurotransmitters Involved in Pain Regulation	**Study**	betweenness	2.74E-06
Complex System	**Topics**	betweenness	0.000119

Table 1

Closeness

The value of closeness centrality, or closeness, determines the distance each vertex is from every other vertex. Points with high closeness tend to be highly correlated with the trends of the broader network. In this study closeness reflects many of the same patterns as degree centrality with slight variations due to interpreting limited quality from its connections, meaning connection to other highly connected vertices increases the value. This indicates a highly interdependent part of the network.

As seen in Table 2, the nodes with the largest closeness values were TOPICS, especially related to pain pathways, yoga interventions, and inflammation. Complex systems ranked relatively low as a TOPIC. STUDIES were significantly lower in value and were led by nodes related to pain pathways, inflammation, sensitization/catastrophization, and mind-body treatments. No KEYWORDS were present in the top 30.

Table 2

Label	Type	Metric	Value
Angiotensin II Triggers Peripheral Macrophage-to-Sensory Neuron Redox Crosstalk to Elicit Pain	**Study**	closeness	0.01494
Psychological processing in chronic pain: a neural systems approach	**Study**	closeness	0.014458
Immediate preoperative outcomes of pain neuroscience education for patients undergoing total knee arthroplasty: A case series	**Study**	closeness	0.013976
Influence of a periodized circuit training protocol on intermuscular adipose tissue of patients with knee osteoarthritis: protocol for a randomized controlled trial	**Study**	closeness	0.013976
Biopsychosocial Influence on Shoulder Pain: Influence of Genetic and Psychological Combinations on Twelve-Month Postoperative Pain and Disability Outcomes	**Study**	closeness	0.013494
Common Brain Mechanisms of Chronic Pain and Addiction	**Study**	closeness	0.01253
Assessing for unique immunomodulatory and neuroplastic profiles of physical activity subtypes: a focus on psychiatric disorders	**Study**	closeness	0.012048
Low- Versus High-Intensity Plyometric Exercise During Rehabilitation After Anterior Cruciate Ligament Reconstruction	**Study**	closeness	0.012048
A Mechanism-Based Approach to the Management of Osteoarthritis Pain	**Study**	closeness	0.011566
Disease-Related, Nondisease-Related, and Situational Catastrophizing in Sickle Cell Disease and Its Relationship With Pain	**Study**	closeness	0.011566
Mind-body therapies and control of inflammatory biology: A descriptive review	**Study**	closeness	0.011566
Pain, psychosocial tests, pain sensitization and laparoscopic pelvic surgery	**Study**	closeness	0.011566
Pilot study of inflammatory responses following a negative imaginal focus in persons with chronic pain: analysis by sex/gender	**Study**	closeness	0.011566

Biopsychosocial influence on shoulder pain: Rationale and protocol for a pre-clinical trial	**Study**	closeness	0.011084
Generalized Pain Sensitization and Endogenous Oxytocin in Individuals With Symptoms of Migraine: A Cross-Sectional Study	**Study**	closeness	0.011084
Inflammation-induced pain sensitization in men and women: does sex matter in experimental endotoxemia?	**Study**	closeness	0.011084
Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress, and immune parameters in breast and prostate cancer outpatients	**Study**	closeness	0.011084
Pain Catastrophizing and Quality of Life in Adults With Chronic Rhinosinusitis	**Study**	closeness	0.011084
Painful After-Sensations in Fibromyalgia are Linked to Catastrophizing and Differences in Brain Response in the Medial Temporal Lobe	**Study**	closeness	0.011084
Benefits of Yoga on IL-6: Findings from a Randomized Controlled Trial of Yoga for Depression	**Study**	closeness	0.010602
Intensive virtual reality and robotic based upper limb training compared to usual care, and associated cortical reorganization, in the acute and early sub-acute periods post-stroke: a feasibility study	**Study**	closeness	0.010602
Self-help Cognitive Behavioral Therapy Improves Health-Related Quality of Life for Inflammatory Bowel Disease Patients: A Randomized Controlled Effectiveness Trial	**Study**	closeness	0.010602
The effect of threat information on acquisition, extinction, and reinstatement of experimentally conditioned fear of movement-related pain	**Study**	closeness	0.010602
PAIN RESPONSES	**Topics**	closeness	0.183614
Yoga Efficacy	**Topics**	closeness	0.167711
Pain & Inflammation	**Topics**	closeness	0.141446
Yoga & Pain Response	**Topics**	closeness	0.109398
Rewriting Pain	**Topics**	closeness	0.076145
Yoga Cultural	**Topics**	closeness	0.064578
Complex Systems & Pain	**Topics**	closeness	0.014578

Table 2

Degree centrality & indegree

The measurement of degree centrality, or degree, involves a basic, undirected count of the total connections linked to a vertex. It is solely based in quantity; the quality of connections does not affect the value. Degree centrality can be useful for identifying popular connectors or local hubs, but it does not necessarily reflect the behavior of the broader network. For the purposes of this study, degree centrality generally tracks studies which the largest number of relevant keywords. Indegree is a submetric of degree centrality that exclusively measures a node's incoming connections. Nodes that have disproportionate incoming connections tend to be destinations for information or have an output outside of the network.

As seen in Table 3, KEYWORDS were the largest group in degree centrality and the only group for indegree metrics. For both groups demographic identifiers were the highest ranking, followed by nodes related to yoga, pain, and pain pathways. Pain responses and yoga's efficacy were the highest ranking TOPICS. Only one STUDY was in the top 30, related to neurological measurements of pain.

Table 3

Label	Type	Metric	Value
HUMANS	**Keyword**	degree	408
FEMALE	**Keyword**	degree	181
MALE	**Keyword**	degree	149
ADULT	**Keyword**	degree	143
YOGA	**Keyword**	degree	127
MIDDLE AGED	**Keyword**	degree	120
PAIN	**Keyword**	degree	98
AGED	**Keyword**	degree	65

Label	Type	Metric	Value
PAIN MEASUREMENT	Keyword	degree	65
QUALITY OF LIFE	Keyword	degree	65
CHRONIC PAIN	Keyword	degree	58
YOUNG ADULT	Keyword	degree	54
CATASTROPHIZATION	Keyword	degree	46
MEDITATION	Keyword	degree	45
RANDOMIZED CONTROLLED TRIALS AS TOPIC	Keyword	degree	45
TREATMENT OUTCOME	Keyword	degree	43
DEPRESSION	Keyword	degree	42
SURVEYS AND QUESTIONNAIRES	Keyword	degree	41
PAIN THRESHOLD	Keyword	degree	39
ADOLESCENT	Keyword	degree	37
INFLAMMATION	Keyword	degree	37
CROSS-SECTIONAL STUDIES	Keyword	degree	35
ANXIETY	Keyword	degree	34
CENTRAL NERVOUS SYSTEM SENSITIZATION	Keyword	degree	33
EXERCISE	Keyword	degree	31
Angiotensin II Triggers Peripheral Macrophage-to-Sensory Neuron Redox Crosstalk to Elicit Pain	Study	degree	32
PAIN RESPONSES	Topics	degree	113
Yoga Efficacy	Topics	degree	110
Pain & Inflammation	Topics	degree	74
Yoga & Pain Response	Topics	degree	56
Label	Type	Metric	Value
HUMANS	Keyword	indegree	408
FEMALE	Keyword	indegree	181
MALE	Keyword	indegree	149
ADULT	Keyword	indegree	143
YOGA	Keyword	indegree	127
MIDDLE AGED	Keyword	indegree	120
PAIN	Keyword	indegree	98
AGED	Keyword	indegree	65
PAIN MEASUREMENT	Keyword	indegree	65
QUALITY OF LIFE	Keyword	indegree	65
CHRONIC PAIN	Keyword	indegree	58
YOUNG ADULT	Keyword	indegree	54
CATASTROPHIZATION	Keyword	indegree	46
MEDITATION	Keyword	indegree	45
RANDOMIZED CONTROLLED TRIALS AS TOPIC	Keyword	indegree	45
TREATMENT OUTCOME	Keyword	indegree	43
DEPRESSION	Keyword	indegree	42
SURVEYS AND QUESTIONNAIRES	Keyword	indegree	41
PAIN THRESHOLD	Keyword	indegree	39
ADOLESCENT	Keyword	indegree	37
INFLAMMATION	Keyword	indegree	37
CROSS-SECTIONAL STUDIES	Keyword	indegree	35
ANXIETY	Keyword	indegree	34
CENTRAL NERVOUS SYSTEM SENSITIZATION	Keyword	indegree	33
COMPLEMENTARY THERAPIES	Keyword	indegree	31

EXERCISE	**Keyword**	indegree	31
ANIMALS	**Keyword**	indegree	30
MINDFULNESS	**Keyword**	indegree	24
EXERCISE THERAPY	**Keyword**	indegree	23
STRESS, PSYCHOLOGICAL	**Keyword**	indegree	23

Table 3

Eigenvector

Where degree centrality strictly measures quantity, and closeness centrality measures quantity with a small influence of quality, eigenvector centrality emphasizes quality of connection over quantity. Eigenvector values measure how well connected any given vertex is to the other most well-connected vertices. In general vertices with high eigenvector values reflect the leading edge of a network. Though they may not be as widely connected as other values, they tend to have disproportionate influence on the system. In the context of this study, eigenvector centrality is associated with nonlinear connections between areas of study.

As seen in Table 4, STUDIES had some of the highest value eigenvector nodes, and were nearly all related to biological complex systems. KEYWORDS were the largest block of high ranking eigenvector nodes, with all the top nodes being related to complex systems and modeling. Immune and inflammatory systems were next, followed by nodes related to pain, then several related to biology and physics. There was one TOPIC node, referencing complex systems.

Table 4

Label	Type	Metric	Value
MODELING, COMPLEX SYSTEM	**Keyword**	eigenvector	0.030769
QUANTITATIVE BIOLOGY - QUANTITATIVE METHODS	**Keyword**	eigenvector	0.030769
BIOLOGICAL SYSTEM	**Keyword**	eigenvector	0.023077
MODELING, BIOLOGICAL	**Keyword**	eigenvector	0.023077
NONLINEAR SCIENCES - ADAPTATION AND SELF-ORGANIZING SYSTEMS	**Keyword**	eigenvector	0.023077
QUANTITATIVE BIOLOGY - NEURONS AND COGNITION	**Keyword**	eigenvector	0.023077
COMPLEX ADAPTIVE SYSTEM	**Keyword**	eigenvector	0.015385
NONLINEAR SCIENCES - CHAOTIC DYNAMICS	**Keyword**	eigenvector	0.015385
COMPUTER SCIENCE - SYMBOLIC COMPUTATION	**Keyword**	eigenvector	0.007692
IMMUNE SYSTEM	**Keyword**	eigenvector	0.007692
INFLAMMATION	**Keyword**	eigenvector	0.007692
MATHEMATICS - ALGEBRAIC GEOMETRY	**Keyword**	eigenvector	0.007692
MATHEMATICS - DYNAMICAL SYSTEMS	**Keyword**	eigenvector	0.007692
PAIN	**Keyword**	eigenvector	0.007692
PAIN RESPONSE	**Keyword**	eigenvector	0.007692
PHYSICS - BIOLOGICAL PHYSICS	**Keyword**	eigenvector	0.007692
PHYSICS - CHEMICAL PHYSICS	**Keyword**	eigenvector	0.007692
QUANTITATIVE BIOLOGY	**Keyword**	eigenvector	0.007692
QUANTITATIVE BIOLOGY - CELL BEHAVIOR	**Keyword**	eigenvector	0.007692
QUANTITATIVE BIOLOGY - TISSUES AND ORGANS	**Keyword**	eigenvector	0.007692
A Dynamical Similarity Approach to the Foundations of Complexity and Coordination in Multiscale Systems	**Study**	eigenvector	0.069231
Applying Complexity Theory to a Dynamical Process Model of the Development of Pathological Belief Systems	**Study**	eigenvector	0.069231
Complexity of Model Testing for Dynamical Systems with Toric Steady States	**Study**	eigenvector	0.069231

	Type	Metric	Value
Designer dynamics through chaotic traps: Controlling complex behavior in driven nonlinear systems	**Study**	eigenvector	0.069231
Extreme value theory of evolving phenomena in complex dynamical systems: firing cascades in a model of neural network	**Study**	eigenvector	0.069231
Forecasting transitions in systems with high dimensional stochastic complex dynamics: A Linear Stability Analysis of the Tangled Nature Model	**Study**	eigenvector	0.069231
Life as Complex Systems --- Viewpoint from Intra-Inter Dynamics	**Study**	eigenvector	0.069231
Small Open Chemical Systems Theory and Its Implications to Darwinian Evolutionary Dynamics, Complex Self-Organization and Beyond	**Study**	eigenvector	0.069231
Understanding and Modelling the Complexity of the Immune System: Systems Biology for Integration and Dynamical Reconstruction of Lymphocyte Multi-Scale Dynamics	**Study**	eigenvector	0.069231
Complex System	**Topics**	eigenvector	0.069231

Table 4

Reach efficiency

Reach measures the portion of the network within two steps of an element. In general, elements with high reach can spread information through the network through close friend-of-a-friend contacts. Reach efficiency normalizes reach by dividing it by size (number of neighbors). In general, elements with high reach efficiency are less connected but gain more exposure through each direct relationship. Reach efficiency is useful for determining influence as well as indicating how coherent and consistent that influence is.

As seen in Table 5, reach efficiency was mostly split between KEYWORDS and STUDIES in terms of quantity, but the highest values were among STUDIES. The leading STUDY nodes all involved complex systems and pain. The leading KEYWORDS were highly heterogeneous and patterns were not readily identifiable.

Table 5

Label	Type	Metric	Value
ACCIDENTS, HOME	**Keyword**	reach-efficiency	0.000241
ACQUIRED BRAIN INJURY	**Keyword**	reach-efficiency	0.000241
ANALYSIS OF VARIANCE	**Keyword**	reach-efficiency	0.000241
ANTERIOR CINGULATE CORTEX	**Keyword**	reach-efficiency	0.000241
CANCER RELATED PAIN	**Keyword**	reach-efficiency	0.000241
CELLS, CULTURED	**Keyword**	reach-efficiency	0.000241
COUNSELING	**Keyword**	reach-efficiency	0.000241
GASTROESOPHAGEAL REFLUX	**Keyword**	reach-efficiency	0.000241
LASERS	**Keyword**	reach-efficiency	0.000241
LEADERSHIP	**Keyword**	reach-efficiency	0.000241
PSYCHOLOGICAL TREATMENT	**Keyword**	reach-efficiency	0.000241
REPETITIVE SENSORY STIMULATION	**Keyword**	reach-efficiency	0.000241
SUPINE POSITION	**Keyword**	reach-efficiency	0.000241
A Dynamical Similarity Approach to the Foundations of Complexity and Coordination in Multiscale Systems	**Study**	reach-efficiency	0.001252
COMPLEX SYSTEMS	**Study**	reach-efficiency	0.001252
Forecasting transitions in systems with high dimensional stochastic complex dynamics: A Linear Stability Analysis of the Tangled Nature Model	**Study**	reach-efficiency	0.001252
Life as Complex Systems --- Viewpoint from Intra-Inter Dynamics	**Study**	reach-efficiency	0.001252
Applying Complexity Theory to a Dynamical Process Model of the Development of Pathological Belief Systems	**Study**	reach-efficiency	0.001124
Designer dynamics through chaotic traps: Controlling complex behavior in driven nonlinear systems	**Study**	reach-efficiency	0.001124
Complexity of Model Testing for Dynamical Systems with Toric Steady States	**Study**	reach-efficiency	0.001032

CRPS: A contingent hypothesis with prostaglandins as crucial conversion factor	**Study**	reach-efficiency	0.001032
Small Open Chemical Systems Theory and Its Implications to Darwinian Evolutionary Dynamics, Complex Self-Organization and Beyond	**Study**	reach-efficiency	0.001032
Extreme value theory of evolving phenomena in complex dynamical systems: firing cascades in a model of neural network	**Study**	reach-efficiency	0.000963
Structure and dynamics of dynorphin peptide and its receptor	**Study**	reach-efficiency	0.000963
Painful intelligence: What AI can tell us about human suffering	**Study**	reach-efficiency	0.00091
Understanding and Modelling the Complexity of the Immune System: Systems Biology for Integration and Dynamical Reconstruction of Lymphocyte Multi-Scale Dynamics	**Study**	reach-efficiency	0.00091
Hormesis, adaptation, and the sandpile model	**Study**	reach-efficiency	0.000867
Pain pathogenesis in rheumatoid arthritis -- what have we learned from animal models	**Study**	reach-efficiency	0.000867
A Deep Learning Approach to Diagnosing Multiple Sclerosis from Smartphone Data	**Study**	reach-efficiency	0.000803
Complex adaptive systems allostasis in fibromyalgia	**Study**	reach-efficiency	0.000803

Table 5

Synthesis

All nodes (studies, topics, and keywords) were mapped through the network analysis and the highest 30 values for each network metric isolated. Every node was cross-referenced and any node that had multiple high network metric values were highlighted for examination. Leaders in this synthesis will be helpful in identifying the similarities in keywords and patterns of topics between fields that are not usually linked.

As seen in Table 6, several nodes were high ranking across three metrics, potentially acting as indicators of the broader pattern of the research.

Table 6

Label	Type
A Dynamical Similarity Approach to the Foundations of Complexity and Coordination in Multiscale Systems	Study
Angiotensin II Triggers Peripheral Macrophage-to-Sensory Neuron Redox Crosstalk to Elicit Pain	Study
Applying Complexity Theory to a Dynamical Process Model of the Development of Pathological Belief Systems	Study
Complexity of Model Testing for Dynamical Systems with Toric Steady States	Study
Designer dynamics through chaotic traps: Controlling complex behavior in driven nonlinear systems	Study
Extreme value theory of evolving phenomena in complex dynamical systems: firing cascades in a model of neural network	Study
Forecasting transitions in systems with high dimensional stochastic complex dynamics: A Linear Stability Analysis of the Tangled Nature Model	Study
INFLAMMATION	Keyword
Life as Complex Systems --- Viewpoint from Intra-Inter Dynamics	Study
PAIN	Keyword
Small Open Chemical Systems Theory and Its Implications to Darwinian Evolutionary Dynamics, Complex Self-Organization and Beyond	Study
Understanding and Modelling the Complexity of the Immune System: Systems Biology for Integration and Dynamical Reconstruction of Lymphocyte Multi-Scale Dynamics	Study

Table 6: (Ryan Castle)

The majority of the most influential nodes were STUDIES relating to complex systems and nodes relating to pain pathways. This suggests there are significant intersections between the study of complex systems and pain.

As seen in Table 7, a larger number of nodes were leaders among two metrics, and could be considered part of a larger, defining pattern between the fields of pain management and mind-body therapies.

Table 7

Label	Type
A Mechanism-Based Approach to the Management of Osteoarthritis Pain	**Study**
ADOLESCENT	**Keyword**
ADULT	**Keyword**
AGED	**Keyword**
ANXIETY	**Keyword**
Assessing for unique immunomodulatory and neuroplastic profiles of physical activity subtypes: a focus on psychiatric disorders	**Study**
CATASTROPHIZATION	**Keyword**
CENTRAL NERVOUS SYSTEM SENSITIZATION	**Keyword**
CHRONIC PAIN	**Keyword**
Common Brain Mechanisms of Chronic Pain and Addiction	**Study**
Complex System	**Topics**
CROSS-SECTIONAL STUDIES	**Keyword**
DEPRESSION	**Keyword**
EXERCISE	**Keyword**
FEMALE	**Keyword**
HUMANS	**Keyword**
Immediate preoperative outcomes of pain neuroscience education for patients undergoing total knee arthroplasty: A case series	**Study**
Influence of a periodized circuit training protocol on intermuscular adipose tissue of patients with knee osteoarthritis: protocol for a randomized controlled trial	**Study**
Low- Versus High-Intensity Plyometric Exercise During Rehabilitation After Anterior Cruciate Ligament Reconstruction	**Study**
MALE	**Keyword**
MEDITATION	**Keyword**
MIDDLE AGED	**Keyword**
Pain & Inflammation	**Topics**
PAIN MEASUREMENT	**Keyword**
PAIN RESPONSES	**Topics**
PAIN THRESHOLD	**Keyword**
Psychological processing in chronic pain: a neural systems approach	**Study**
QUALITY OF LIFE	**Keyword**
RANDOMIZED CONTROLLED TRIALS AS TOPIC	**Keyword**
SURVEYS AND QUESTIONNAIRES	**Keyword**
TREATMENT OUTCOME	**Keyword**
YOGA	**Keyword**
Yoga & Pain Response	**Topics**
Yoga Efficacy	**Topics**
YOUNG ADULT	**Keyword**

Table 7

Setting aside demographic identifier KEYWORDS, the nodes that were leading in two separate metrics tend to involve pain management, chronic pain, neuroscience, pain education, sensitization/catastrophization, and yoga or meditation. This suggests that the broader literature review highlights the close connections between chronic pain and mind-body therapies.

Combining the blocks of synthesized findings provides evidence that the fields of study regarding complex systems, pain management, and mind-body therapies share many of the same topics, keywords, and published studies. The literature review suggests the fields share significant patterns.

[i] Freeman, L. C. (1977). A Set of Measures of Centrality Based on Betweenness. Sociometry, 40(1), 35–41. https://doi.org/10.2307/3033543