

Tele-yoga for Chronic Pain: Current Status and Future Directions

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Abstract

Pain is a pervasive, debilitating disorder that is resistant to long-term pharmacological interventions. Although psychological therapies such as cognitive behavior therapy demonstrate moderate efficacy, many individuals continue to have ongoing difficulties following treatment. There is a current trend to establish complementary and integrative health interventions for chronic pain, for which yoga has been found to have exciting potential. Nevertheless, an important consideration within the field is accessibility to adequate care. Telehealth can be used to provide real-time interactive video conferencing leading to increased access to health care for individuals located remotely or who otherwise have difficulty accessing services, perhaps through issues of mobility or proximity of adequate services. This article assesses the current status and feasibility of implementing tele-yoga for chronic pain. Methodological limitations and recommendations for future research are discussed.

Keywords

chronic pain, yoga, telehealth, telemedicine, telerehabilitation

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Introduction

Pain is the most frequent health complaint in the general population and in primary care.¹ Within the Veterans Affairs health-care system, chronic pain affects 50% to 75% of Veterans^{2,3} with prevalence increasing with number of years postdeployment.⁴ Chronic pain (usually defined as pain persisting for at least 3 months) is the leading cause of work disability worldwide⁵ and costs the United States more than \$500 billion each year in lost productivity and health care.⁶ This viewpoint article explores the use of yoga as a treatment for chronic pain and the exciting potential of telehealth to overcome some of the drawbacks of this intervention.

Chronic pain is treatment-resistant, and pharmaceutical interventions often bring limited benefit and are associated with significant side effects and risks (e.g., addictive properties, stomach or liver problems, or allergies).^{7,8} Indeed, the use and abuse of prescription opiates to treat pain has become a major public health issue.^{9–11} Nonpharmacological management of chronic pain is high on the list of priorities for both the National Institutes of Health¹² and the Department of Veterans

Affairs,¹³ the two largest funding bodies for treatment intervention research in the United States. Cognitive behavior therapy (CBT) is the gold standard psychological intervention for chronic pain.¹⁴ However, effect sizes for CBT for chronic pain are small,¹⁴ with only 43% of CBT trials demonstrating improvements in pain.¹⁵ Furthermore, CBT dropout rates are high,¹⁶ possibly because perceptions and expectations do not always align with treatment outcomes.^{17,18} More holistic, mind–body, complementary and integrative health (CIH) approaches such as yoga are increasing in popularity, perhaps because they may be less stigmatizing than formal mental health interventions such as CBT.¹⁹

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However, these interventions pose greater demands than conventional treatments on the need to travel and attend classes. This may be especially difficult for individuals with chronic pain and those who live in remote areas. Telehealth technology offers one solution to the problem of access to care for those with chronic pain.

Telehealth

Telehealth, also known as telemedicine, is an innovative technology that is designed to provide increased access to health care and containment of treatment costs. The Institute of Medicine (IOM) defines telemedicine as “the use of electronic information and communications technologies to provide and support health care when distance separates participants.”²⁰ “Telemedicine” traditionally refers to direct clinical services while “telehealth” encompasses a broader network of services that includes activities such as education, remote monitoring, and services delivered over the Internet that do not require real-time interaction (i.e., ehealth, including online education and e-mail service delivery).²¹ Within research settings, telemedicine and telehealth are used interchangeably. For the purposes of this article, we use the term “telehealth” to refer to real-time interactive video or telephone conferencing to assess, treat, and/or provide care to an individual remotely.²² Telehealth can play a key role in providing greater access to health care for individuals with reduced mobility due to age or physical restrictions or for individuals in remote, less-populated settings far from health-care facilities, thus allowing more tailored yet cost-effective health-care interventions.^{22–24}

Yoga for Chronic Pain

Despite evidence for successful face-to-face and telehealth interventions for chronic pain, including mentoring, education, and psychological therapy, chronic pain remains relatively intractable to treatment. A recent trend in the field is to establish CIH interventions for a variety of physical and mental conditions, including chronic pain. Yoga represents one such intervention.²⁵ Yoga is an ancient mind–body practice that combines meditation (Dhyana) with controlled mindful breathing (Pranayama), focused attention (Dharana), and physical postures (Asana).^{26,27} The mechanisms of action for yoga and chronic pain are proposed to involve both top-down and bottom-up processes^{28,29} due to the combination of mind and body elements, though remain largely unknown.

Recent data from the Centers for Disease Control and Prevention (CDC) show that almost 1 in 10 individuals from the general US population have tried yoga within a 12-month period, with rates significantly higher among

those with musculoskeletal pain. Furthermore, these rates have increased linearly across the past 15 years.^{30,31} Yoga is also acceptable and efficacious for a broad range of ages, with studies demonstrating improved mental/emotional wellness in older adults (65+ years),^{32,33} and may be less stigmatizing than formal mental health interventions such as CBT.¹⁹ In this way, therapeutic yoga can be easily transferrable from a clinical setting to the community: individuals learn how to modify yoga poses for themselves in a clinical setting so they can later practice safely in a public class setting in their community.

In the past 10 years, multiple systematic reviews and meta-analyses have helped to define the effects of yoga on specific types of pain, particularly musculoskeletal pain, including back or neck pain and rheumatic conditions such as osteoarthritis and rheumatoid arthritis, relative to a variety of control conditions. For example, in a 2011 systematic review that examined the efficacy of yoga for any type of pain (mostly chronic low back pain, but also migraine, irritable bowel syndrome, osteoarthritis, carpal tunnel, labor pain, hemodialysis, and cancer-related pain), 9 of 10 randomized clinical trials (RCTs) demonstrated significant improvement in pain and related symptoms, relative to a variety of control conditions (e.g., standard care, self-care, lifestyle modification, waitlist).³⁴ The 10th study was unable to conduct group analyses due to significant differences in baseline pain intensity between the yoga and waitlist control groups, though the yoga group reported significantly lower condition-related symptoms posttreatment. In a 2013 meta-analysis of yoga for any type of pain (e.g., back pain, rheumatoid arthritis, migraine/headache), all 16 clinical studies (including 4 nonrandomized) demonstrated positive effects for pain and pain-related disability, with an overall moderate effect size.³⁵ Similarly, a 2013 systematic review and meta-analysis of meditative movement therapies for fibromyalgia concluded that yoga (but not tai chi or qigong) significantly improves pain, fatigue, depression, and health-related quality of life.³⁶

Overall, these findings suggest that yoga is an effective treatment for pain and associated symptoms but underscore important limitations, including comparison group choice and inclusion/exclusion criteria for systematic reviews and meta-analyses.

Tele-Yoga for Chronic Pain

Studies suggest that in-person yoga is an effective treatment for chronic pain. Studies also suggest that non-yoga telehealth interventions for chronic pain are feasible and may be effective, including telementoring programs for training and educating primary care,^{37,38} telecare collaborative care management interventions,³⁹ peer telementoring,⁴⁰ pain management,²³ physical exercise,^{41,42} and

psychological interventions.^{15,43} The implementation of tele-yoga for treating chronic pain is a natural progression; however, to date, only one published study has reported using yoga via telehealth, and none have targeted chronic pain. That small study (N=15) investigated the feasibility of yoga for treating cardiac and respiratory issues associated with heart failure and chronic obstructive pulmonary disease.⁴⁴ Tele-yoga involved home-based, 1-h classes twice weekly for 8 weeks delivered by an Iyengar yoga instructor with expertise in working with individuals with chronic illness. Yoga classes were delivered via video conferencing equipment with two-way viewing, allowing for personalized instruction, and participants could not see or hear other participants. A research registered nurse (RN) viewed live video to monitor safety. The active control group received education materials and a follow-up call from the RN, once each per week for 8 weeks. Qualitative data from the pilot study revealed that the tele-yoga intervention was acceptable and appropriate, with participants experiencing physical and psychological benefits, including increased motivation and skills to better deal with shortness of breath and anxiety. The educational control group was acceptable and appropriate and controlled for nonspecific effects including attention, expectation bias, and therapeutic alliance without affecting fitness, relaxation, mindfulness, or breath (i.e., the yoga intervention targets). However, the control group had at least 50% less contact hours per week than the yoga group, and technical difficulties were experienced by 50% of the yoga group, highlighting areas for future improvement.

Another example of tele-yoga is found at the War Related Illness and Injury Study Center (WRIISC) at the Veterans Affairs Palo Alto, which offers a tele-yoga program to Veterans with a wide variety of physical and mental health conditions. Individuals are referred by their primary care provider, and where applicable, cleared by a mental health provider. To date, all tele-yoga classes are provided to the community-based outpatient clinics via a secure video conferencing system simultaneous with an in-person class taught locally by a Yoga Alliance registered yoga instructor located at the Palo Alto facility. The yoga program employs yoga teachers with training based in different lineages within the Hatha yoga umbrella. During the class, the instructor can see the students at the outlying clinics on a screen and provide appropriate feedback. Students at the outlying clinics can see the instructor on their screen. For safety reasons, classes offered as simultaneous in-person and telehealth classes are limited to chair-based yoga. In these classes, the students sit on chairs for the meditation, warm-up, and final relaxation portion of the class, and have the option to sit or stand for the more active portion of class. Recent

preliminary data suggest equivalence to face-to-face yoga in participant satisfaction and improvement in self-reported pain, energy level, depression, and anxiety.⁴⁵ However, formal intervention outcomes or RCT data are currently unavailable. Specific yoga poses that might be beneficial for chronic pain that require the participant to lay in prone or supine positions have not been utilized by the WRIISC program due to concerns about the ability of individuals with musculoskeletal pain and injuries to safely navigate up and down from the floor without supervision by a yoga instructor in the room. Research to identify poses that are effective in reducing pain and are also able to be provided safely via tele-yoga would be a valuable resource for treatment of chronic pain.

Remaining Methodological Questions

There are several methodological issues associated with yoga interventions and telehealth that require attention. First, there is large heterogeneity in yoga styles (e.g., Vinyasa, Iyengar, Kundalini), as well as dosage and appropriate comparison group (see Mathersul & Rosenbaum⁴⁶ for further discussion). This impedes identification of the mechanisms that are having a positive effect (e.g., meditation/mindfulness, physical activity, regular meeting, social aspects, unique features of the yoga style), and whether these mechanisms are unique to yoga or equivalent to other interventions such as physical activity or support groups. Second, in telehealth, removing the face-to-face presence of a therapist or instructor has the potential to both quantitatively and qualitatively alter the intervention and treatment outcome. Yoga helps the individual connect to their own inner capacity for healing; the instructor guides the student to become aware of what is already deep inside them. It is unknown whether this is altered in telehealth. Preliminary data from nonyoga studies suggest that therapeutic alliance is equivalent in telehealth versus face-to-face therapies⁴⁷⁻⁴⁹; however, overall, there is more investigation into ehealth than telehealth.⁵⁰ Although less is known about physical therapies and the impact of therapist proximity, some preliminary data demonstrate that telehealth is equivalent to face-to-face physical therapy rehabilitation⁵¹ and exercise intervention.⁵² In addition, there is a non-inferiority design RCT currently underway investigating telehealth tai chi versus in-home tai chi.⁵³ Finally, one recent study demonstrated equivalency between an Internet-delivered mindfulness-based cognitive therapy and psychoeducation for pain.⁵⁴ Although these findings suggest that neither the physical nor the mindfulness elements of yoga necessarily preclude tele-delivery, more conclusive evidence is needed to confirm efficacy for pain treatment.

Feasibility. Pilot studies of the feasibility and efficacy of tele-yoga for pain are warranted. Safety is an important first consideration for telehealth feasibility studies. Delivery of physical tele-therapies (e.g., yoga, exercise) may require subtle alterations by the instructor, for example, a greater reliance on verbal rather than physical cues for movement, or modifications of poses to avoid frequently getting up and down from the floor (e.g., chair-based seated postures or standing poses only, as delivered by the WRIISC clinical yoga program; in this way, if done properly, at-home yoga has less potential for injury than more active physical interventions). Video quality is essential to ensure that the instructor can adequately view the student and provide feedback on form and technique. Population demographics also interact with safety, such that certain physical (e.g., pain) or mental health (e.g., risk to self or others) conditions may require additional support or supervision before they can be modified for home delivery. For some populations, telehealth interventions may be feasible when delivered to participants in outlying community clinics where available resources are (in theory) similar to those in face-to-face settings but may not be feasible for home telehealth. These safety issues highlight the need for carefully designed feasibility studies of tele-yoga for pain to establish safety for delivery in remote clinics or at home.

Acceptance of telehealth interventions is another important methodological consideration for feasibility and may be influenced by target group demographics. In particular, older adults, while open to the use of technology in health care, may prefer technological interventions to be complementary or supplementary, rather than substitutional.⁵⁵ Preliminary studies have demonstrated that delivery of an information video prior to treatment can significantly increase acceptance of Internet-based pain interventions,⁵⁶ which may be worth considering in the dissemination of telehealth interventions, particularly if older adults are among the target population. Telehealth may also be a useful tool for ongoing treatment maintenance following in-person interventions.⁴² Acceptability studies are needed to ensure adequate uptake of telehealth services.

Study design. Once preliminary studies have established the feasibility (can it be done safely and is it acceptable to those seeking treatment) and efficacy (does it provide beneficial results for chronic pain) of tele-yoga for pain, future studies should consider the use of an adequate control/comparison group and appropriate experimental design. The standardization of both treatment intervention and control comparison group is an important consideration when evaluating telehealth for chronic pain. Noninferiority and equivalence designs are relevant when a novel treatment (e.g., tele-yoga) has certain

advantages over an established standard treatment (e.g., CBT), such as lower cost, ease of access, and so on. It should be emphasized that such designs are only possible when a standard, well-established treatment is available as a comparison group. If the research goal is to show that the novel modality is no worse than the standard treatment, a noninferiority design can be used.⁵⁷ If the goal is to further allow for the possibility that the novel intervention is no better than the standard one, an equivalence design can be used. This is complicated in the pain literature where there is a lack of consensus over the recommended balance of evidence-based treatments such as physical therapy, psychological therapy, or medical/pharmaceutical.⁵⁸ Even less is known about the mechanisms or content of nonspecific interventions such as “pain management” or “supportive care”.²³ Depending on the research question being posed, telehealth may introduce an additional component, in that the novel intervention must be validated against both face-to-face and tele-intervention treatment modalities. For example, in the case of yoga for pain, is tele-yoga equivalent to face-to-face yoga in reducing chronic pain (preliminary data⁴⁵ suggest yes)? At the same time, is tele-yoga equivalent to other evidence-based interventions, such as CBT, delivered either via face-to-face or via tele-modalities? Future studies need to make direct comparisons between face-to-face and tele-interventions, as well as comparisons between different modalities of telehealth (i.e., telephone versus video conferencing versus Internet; see Heapy et al.,⁴² for further discussion). More specific comparisons will help identify mechanisms of action for yoga in chronic pain. For example, prior studies have demonstrated the efficacy of either exercise^{59,60} or mindfulness-based therapies^{61–63} alone for chronic pain. Yoga combines both of these; however, it is currently unclear whether yoga adds something additional that neither of these individually or combined is capable of contributing (see Mathersul and Rosenbaum⁴⁶ for further discussion).

Summary

Chronic pain is a pervasive, intractable condition that urgently requires more effective nonpharmacological interventions. At the same time, accessibility to specialty care interventions is impeded not only by the condition itself (e.g., mobility issues), but the expertise of primary care providers, particularly in remote areas. Telehealth offers a means of overcoming accessibility issues. Yoga is a promising nonpharmacological CIH intervention that is safe and acceptable to individuals with chronic pain and shows promise for efficacy. Although studies demonstrate preliminary efficacy of telehealth psychological interventions for chronic pain, to date, no formal intervention outcomes or RCT data

have been published on tele-yoga for chronic pain. Pilot studies to establish feasibility (safety and acceptability) of tele-yoga are an important first step in this exciting new field.


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References

- Kroenke K. Patients presenting with somatic complaints: epidemiology, psychiatric co-morbidity and management. *Int J Methods Psychiatr Res.* 2003;12:34–43.
- Haskell SG, Heapy A, Reid MC, Papas RK, Kerns RD. The prevalence and age-related characteristics of pain in a sample of women veterans receiving primary care. *J Women's Health.* 2006;15:862–869.
- Kerns RD, Otis J, Rosenberg R, Reid MC. Veterans' reports of pain and associations with ratings of health, health-risk behaviors, affective distress, and use of the healthcare system. *J Rehabil Res Dev.* 2003;40:371–379.
- Haskell SG, Ning Y, Krebs E, et al. The prevalence of painful musculoskeletal conditions in female and male Veterans in 7 years after return from deployment in Operation Enduring Freedom/Operation Iraqi Freedom. *Clin J Pain.* 2012;28:163–167.
- Smith BH, Elliott AM, Alastair Chambers W, Smith WC, Hannaford PC, Penny K. The impact of chronic pain in the community. *Fam Pract.* 2001;18:292–299.
- Gaskin DJ, Richard P. The economic costs of pain in the United States. *J Pain.* 2012;13:715–724.
- Curatolo M, Bogduk N. Pharmacologic pain treatment of musculoskeletal disorders: current perspectives and future prospects. *Clin J Pain.* 2001;17:25–32.
- von Korff M, Kolodny A, Deyo RA, Chou R. Long-term opioid therapy reconsidered. *Ann Intern Med.* 2011;155:325–328.
- Eaton LH, Gordon DB, Wyant S, et al. Development and implementation of a telehealth-enhanced intervention for pain and symptom management. *Contemp Clin Trials.* 2014;38:213–220.
- Ruhm CJ. Drug poisoning deaths in the United States, 1999–2012: a statistical adjustment analysis. *Popul Health Metr.* 2016;14:1–12.
- Warner M, Chen LH, Makuc DM, Anderson RN, Miniño AM. Drug poisoning deaths in the United States, 1980–2008. *NCHS Data Brief.* 2011;81:1–8.
- National Center for Complementary and Integrative Health. 2016 Strategic Plan. *Exploring the Science of Complementary and Integrative Health*; 2016; Bethesda, Maryland, USA: National Institutes of Health.
- Gaudet TW, Shulkin DJ. *Memorandum: Advancing Complementary and Integrative Health in VHA.* www.va.gov/vhapublications. Published 2016. Moors, F. *Liberating Isolation: The Yogasūtra of Patañjali.* India: Media Garuda: Krishnamacharya Healing & Yoga Foundation, 2012.
- Williams AC, Eccleston C, Morley S. Psychological therapies for the management of chronic pain (excluding headache) in adults. *Cochrane Database Syst Rev.* 2012;11:CD007407.
- Knoerl R, Lavoie Smith EM, Weisberg J. Chronic pain and cognitive behavioral therapy: an integrative review. *West J Nurs Res.* 2014;38:596–628.
- Richmond RL, Carmody TP. Dropout from treatment for chronic low-back pain. *Prof Psychol Res Pract.* 1999;30:51–55.
- Koffel E, Vitiello MV, McCurry SM, Rybarczyk B, Keefe FJ, von Korff M. Predictors of adherence to psychological treatment for insomnia and pain: analysis from a randomized trial. *Clin J Pain.* 2018;34(4):375–382.
- Vlaeyen JWS, Morley S. Cognitive-behavioral treatments for chronic pain: what works for whom? *Clin J Pain.* 2005;21:1–8.
- Ehde DM, Dillworth TM, Turner JA. Cognitive-behavioral therapy for individuals with chronic pain: efficacy, innovations, and directions for research. *Am Psychol.* 2014;69:153–166.
- Institute of Medicine. *Telemedicine: A Guide to Assessing Telecommunications for Health Care.* Washington, DC: The National Academies Press, 1996.
- Institute of Medicine. *The Role of Telehealth in an Evolving Health Care Environment: Workshop Summary.* Washington, DC: The National Academies Press, 2012.
- Liss HJ, Glueckauf RL, Ecklund-Johnson EP. Research on telehealth and chronic medical conditions: critical review, key issues, and future directions. *Rehabil Psychol.* 2002;47:8–30.
- McGeary DD, McGeary CA, Gatchel RJ, Allison S, Hersh A. Assessment of research quality of telehealth trials in pain management: a meta-analysis. *Pain Pract.* 2013;13:422–431.
- Veterans Health Administration. Clinic based telehealth operations manual: clinical video telehealth store-and-forward telehealth. www.telehealth.va.gov. Published 2012.
- Chou R, Huffman LH. Nonpharmacologic therapies for acute and chronic low back pain: a review of the evidence for an American Pain Society/American College of Physicians clinical practice guideline. *Ann Intern Med.* 2007;147:492–504.
- Hume RE. *The Thirteen Principal Upanishads: Translated from the Sanskrit With an Outline of the Philosophy of the Upanishads and an Annotated Bibliography.* London, England: Oxford University Press, 1921.

27. Moors F. *Liberating Isolation: The Yogasūtra of Patañjali*. India: Media Garuda: Krishnamacharya Healing & Yoga Foundation, 2012.
28. Farmer MA, Baliki MN, Apkarian AV. A dynamic network perspective of chronic pain. *Neurosci Lett*. 2012;520:197–203.
29. Menezes CB, Dalpiaz NR, Kiesow LG, Sperb W, Hertzberg J, Oliveira AA. Yoga and emotion regulation: a review of primary psychological outcomes and their physiological correlates. *Psychol Neurosci*. 2015; 8(1):82–101.
30. Clarke TC, Black LI, Stussman BJ, Barnes PM, Nahin RL. Trends in the use of complementary health approaches among adults: United States, 2002–2012. *Natl Health Stat Report*. 2015;79:1–16.
31. Clarke TC, Nahin RL, Barnes PM, Stussman BJ. Use of complementary health approaches for musculoskeletal pain disorders among adults: United States, 2012. *Natl Health Stat Report*. 2016;98:1–12.
32. Bonura KB, Tenenbaum G. Effects of yoga on psychological health in older adults. *J Phys Act Health*. 2014; 11(7):1334–1341.
33. Lindahl E, Tilton K, Eickholt N, Ferguson-Stegall L. Yoga reduces perceived stress and exhaustion levels in healthy elderly individuals. *Complement Ther Clin Pract*. 2016;24:50–56.
34. Posadzki P, Ernst E, Terry R, Lee MS. Is yoga effective for pain? A systematic review of randomized clinical trials. *Complement Ther Med*. 2011;19:281–287.
35. Büssing A, Ostermann T, Lütke R, Michalsen A. Effects of yoga interventions on pain and pain-associated disability: a meta-analysis. *J Pain*. 2012;13:1–9.
36. Langhorst J, Klose P, Dobos GJ, Bernardy K, Häuser W. Efficacy and safety of meditative movement therapies in fibromyalgia syndrome: a systematic review and meta-analysis of randomized controlled trials. *Rheumatol Int*. 2013; 33:193–207.
37. Frank JW, Carey EP, Fagan KM, et al. Evaluation of a telementoring intervention for pain management in the Veterans Health Administration. *Pain Med (United States)*. 2015;16:1090–1100.
38. Katzman JG, Comerici G, Boyle JF, et al. Innovative telementoring for pain management: project ECHO pain. *J Contin Educ Health Prof*. 2014;34:68–75.
39. Kroenke K, Krebs EE, Wu J, et al. Telecare collaborative management of chronic pain in primary care: a randomized clinical trial. *J Am Med Assoc*. 2014;312:240–248.
40. Kohut SA, Stinson JN, Ruskin D, et al. iPeer2Peer program: a pilot feasibility study in adolescents with chronic pain. *Pain*. 2016;157:1146–1155.
41. Bennell KL, Nelligan R, Dobson F, et al. Effectiveness of an internet-delivered exercise and pain-coping skills training intervention for persons with chronic knee pain. *Ann Intern Med*. 2017;166:453–462.
42. Heapy AA, Higgins DM, Cervone D, Wandner L, Fenton BT, Kerns RD. A systematic review of technology-assisted self-management interventions for chronic pain: looking across treatment modalities. *Clin J Pain*. 2015;31:470–492.
43. Fisher E, Law E, Palermo TM, Eccleston C. Psychological therapies (remotely delivered) for the management of chronic and recurrent pain in children and adolescents. *Cochrane Database Syst Rev*. 2015;3:CD011118.
44. Selman L, McDermott K, Donesky DA, Citron T, Howie-Esquivel J. Appropriateness and acceptability of a Tele-Yoga intervention for people with heart failure and chronic obstructive pulmonary disease: qualitative findings from a controlled pilot study. *BMC Complement Altern Med*. 2015;15:21.
45. Schulz-Heik RJ, Meyer H, Mahoney L, et al. Results from a clinical yoga program for veterans: yoga via telehealth provides comparable satisfaction and health improvements to in-person yoga. *BMC Complement Altern Med*. 2017; 17(1):198.
46. Mathersul DC, Rosenbaum S. The roles of exercise and yoga in ameliorating depression as a risk factor for cognitive decline. *Evid Based Complement Alternat Med*. 2016; 2016:1–9.
47. Ertelt TW, Crosby RD, Marino JM, Mitchell JE, Lancaster K, Crow SJ. Therapeutic factors affecting the cognitive behavioral treatment of bulimia nervosa via telemedicine versus face-to-face delivery. *Int J Eat Disord*. 2011;44:687–691.
48. Morland LA, Mackintosh MA, Greene CJ, et al. Cognitive processing therapy for posttraumatic stress disorder delivered to rural veterans via telemental health: a randomized noninferiority clinical trial. *J Clin Psychiatry*. 2014;75:470–476.
49. Richardson L, Reid C, Dziurawiec S. “Going the extra mile”: Satisfaction and alliance findings from an evaluation of videoconferencing telepsychology in rural Western Australia. *Aust Psychol*. 2015;50:252–258.
50. Sucala M, Schnur JB, Constantino MJ, Miller SJ, Brackman EH, Montgomery GH. The therapeutic relationship in E-therapy for mental health: a systematic review. *J Med Internet Res*. 2012;14(4):e110.
51. Moffet H, Tousignant M, Nadeau S, et al. In-home tele-rehabilitation compared with face-to-face rehabilitation after total knee arthroplasty: a noninferiority randomized controlled trial. *J Bone Joint Surg*. 2015;97:1129–1141.
52. Dal Bello-Haas VPM, O’Connell ME, Morgan DG, Crossley M. Lessons learned: feasibility and acceptability of a telehealth-delivered exercise intervention for rural-dwelling individuals with dementia and their caregivers. *Rural Remote Health*. 2014;14:1–11.
53. Tousignant M, Corriveau H, Kairy D, et al. Tai Chi-based exercise program provided via telerehabilitation compared to home visits in a post-stroke population who have returned home without intensive rehabilitation: study protocol for a randomized, non-inferiority clinical trial. *Trials*. 2014;15:42.
54. Dowd H, Hogan MJ, McGuire BE, Davis MC, Sarma KM, Fish RA, ... Zautra AJ. Comparison of an online mindfulness-based cognitive therapy intervention with online pain management psychoeducation: A randomized controlled study. *Clin J Pain*. 2015;31:517–527.
55. Currie M, Philip LJ, Roberts A. Attitudes towards the use and acceptance of eHealth technologies: a case study of older adults living with chronic pain and implications for rural healthcare. *BMC Health Serv Res*. 2015;15:162.
56. Baumeister H, Seiffert H, Lin J, Nowoczin L, Lüking M, Ebert D. Impact of an acceptance facilitating intervention

- on patients' acceptance of internet-based pain interventions: a randomized controlled trial. *Clin J Pain*. 2015;31:528–535.
57. Greene CJ, Morland LA, Durkalski VL, Frueh BC. Noninferiority and equivalence designs: Issues and implications for mental health research. *J Trauma Stress*. 2008;21:433–439.
58. World Health Organization. *WHO Normative Guidelines on Pain Management: Report of a Delphi Study to Determine the Need for Guidelines and to Identify the Number and Topics of Guidelines That Should be Developed by WHO*. Geneva, Switzerland: WHO, 2007.
59. McBeth J, Prescott G, Scotland G, et al. Cognitive behavior therapy, exercise, or both for treating chronic widespread pain. *Arch Intern Med*. 2012;172:48–57.
60. Meneses-Echávez JF, González-Jiménez E, Ramírez-Vélez R. Effects of supervised multimodal exercise interventions on cancer-related fatigue: systematic review and meta-analysis of randomized controlled trials. *BioMed Res Int*. 2015;2015:328636.
61. Cherkin DC, Sherman KJ, Balderson BH, et al. Effect of mindfulness-based stress reduction vs. cognitive behavioral therapy or usual care on back pain and functional limitations in adults with chronic low back pain: a randomized clinical trial. *J Am Med Assoc*. 2016;315:1240–1249.
62. Chiesa A, Serretti A. Mindfulness-based interventions for chronic pain: a systematic review of the evidence. *J Altern Complement Med*. 2011;17:83–93.
63. Davis MC, Zautra AJ, Wolf LD, Tennen H, & Yeung. Mindfulness and cognitive-behavioral interventions for chronic pain: differential effects on daily pain reactivity and stress reactivity. *J Consult Clin Psychol*. 2015;83:24–35.