

## Treating Chronic Pain With Meditation

Jayatunge, R.M., Wachholtz, A.B.

**Abstract:** This paper discusses clinical application of meditation in chronic pain. Chronic pain is an unpleasant feeling and it disrupts physical and emotional wellbeing. Chronic pain often triggers depression anxiety and addictions. Treating chronic pain could be challenging. Some therapists have proposed meditation as an alternative pain management modality. Meditation is a researched proven effective method to attenuate pain. Meditation uplifts psychosocial wellbeing. In addition meditation helps to decrease the pain-related drug utilization.

Key Words: Chronic Pain, Meditation, Mindfulness, Vipassana Meditation

The term "Meditation" refers to a family of practices that train attention in order to heighten awareness and bring mental processes under greater voluntary control. The ultimate aims of these practices are the development of deep insight into the nature of mental processes, consciousnesses, identity, and reality, and the development of optimal states of psychological well-being and consciousness (Walsh, 1983). Meditation has been extensively practiced in many civilizations for thousands of years as a means of cultivating a state of well-being and for religious purposes (Braboszcz et al., 2010). Western theories of meditation include Jungian, Benson's relaxation response, and transpersonal psychology (Bonadonna, 2003).

Practicing meditation was formerly thought to induce passive relaxation states primarily by producing changes in the autonomic nervous system. However, recent findings from electroencephalogram (EEG) and neuroimaging studies suggest that meditation is associated with active states of consciousness that involve cognitive restructuring, learning, and changes in the structure of the brain itself (Horowitz, 2010). Meditation has become an essential component in complementary and alternative medicine.

Recent researches suggest that meditation, which is a purely mental activity, may also induce brain plasticity (Lutz, Greischar, Rawlings, Ricard, & Davidson, 2004). Davidson and team (2003) suggest that meditation may change brain and immune function in positive ways. Meditation uplifts physical and mental health. In addition meditation helps to attenuate pain.

Meditation has been studied in populations with chronic pain. Meditation helps alter the behavioural response in chronic pain situations (Patil, 2009) as well as altering physiological autonomic responses to pain (Wachholtz & Pargament, 2005, 2008). Meditation can also decrease the use of analgesic medications during pain experiences (Wachholtz, Malone, & Pargament, 2015). Several studies have demonstrated beneficial effects of mindfulness-based interventions for both chronic and acute pain (Salomons & Kucyi, 2011). According to Kabat-Zinn and team (1985) some types of meditations especially mindfulness training has shown benefit for the treatment of pain. Adding up Morone et al (2008) shown that Mindfulness-Based Stress Reduction (MBSR) program significantly improved pain symptoms and overall quality of life.

## **The Impact of Pain on Psychological Well-being**

Pain is a sensory and emotional experience (Rajagopal, 2006). The International Association for Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage or both. Pain is a subjective experience, and no objective tests exist to measure it (American Pain Society, 2009). Pain is a complex phenomenon that combines information from the nervous system with thoughts, emotions and social context (Henry , 2008).

Fishman (2000) provides a more patient focused definition of pain: `It is whatever the patient states it is unless proven otherwise by poor adherence to the agreed upon medical regimen. Pain is considered a major clinical, social, and economic problem in communities around the world (Henschke et al., 2015). Psychosocial and behavioural factors play a significant role in the experience, maintenance, and exacerbation of pain (Turk et al., 2008). Pain causes much suffering and disability and is frequently mistreated or undertreated (Ashburn & Staats, 1999).

Pain can be acute or chronic. Acute pain is defined as ‘pain of recent onset and probable limited duration. It usually has an identifiable temporal and causal relationship to injury or disease (Ready & Edwards, 1992). Acute pain is a universal experience and is biologically protective (Hainline, 2005). The transition from acute to chronic pain appears to occur in discrete pathophysiological and histopathological steps (Voscopoulos & Lema, 2010).

Chronic pain is defined as pain which persists a month beyond the usual course of an acute disease or a reasonable time for an injury to heal, or is associated with a chronic pathological process which causes continuous pain, or pain which recurs at intervals for months or years (Bonica ,1990). Chronic pain is a major public health issue that affects the quality of life and productivity (Burgoyne, 2007). According to Abu-Saad Huijer (2010) chronic pain is considered the most underestimated health care problem impacting quality of life.

Many chronic pain patients become preoccupied with their pain and gradually lose interest in social activities, or they may use their pain to avoid anxiety-producing situations (Ruoff & Beery ,1985). Alba-Delgado and team (2013) hypothesized that chronic pain leads to concomitant noradrenergic impairment and mood disorders. Depression can influence pain and vice versa (Bravo et al., 2014). Morasco et al (2013) state that people with chronic pain and comorbid posttraumatic stress disorder (PTSD) report more severe pain and poorer quality of life than those with chronic pain alone.

Chronic pain and substance abuse go hand in hand (Wachholtz, Gonzalez, Boyer, Rosenbaum, & Ziedonis, 2011). Opioid abuse creates hyperalgesia which can also trigger opioid cravings leading to a dangerous cycle (Wachholtz, Foster, & Cheatle, 2015; Wachholtz & Gonzalez, 2014; Wachholtz, Ziedonis, & Gonzalez, 2011) Chronic pain and substance abuse are independently recognized as complex problems growing in both scope and severity. Each has its own unique difficulties that contribute to poor outcomes and partial response to treatment. (Clark & Treisman, 2011). Moreover chronic pain imposes a heavy burden on patients and caregivers, on the health care system and on the economy (Henry,2008).

## **Neuroscience of Pain and Meditation**

Pain is undertreated in all parts of the world (Heit, 2001). Pain is increasingly recognized, managed and treated as a disease (Siddall & Cousins, 2004). Pain is a subjective experience, and its severity can be influenced by many factors including previous experience of pain, cultural background, coping mechanisms, fear, anxiety and depression. The patient's perception of pain therefore, is different from nociception (Mowat & Johnson, 2013). The process of pain management starts with adequate assessment of the pain to differentiate the multiple components that comprise the pain experience- psychological, biological, social, and spiritual (Wachholtz & Makowski, 2012). Once the pain components are adequately assessed, then a multi-disciplinary pain management strategy can be developed to address pain. Generally pain management includes some form of pharmacologic methods and ideal pain management strategies also include psychological, behavioral, or complementary/alternative medicine treatments. No single therapeutic approach manages all types of pain for all types of patients under all clinical circumstances (Cole, 2002).

Often the pain management is done through medications. Medications used for the relief of pain, especially opioids, have the potential to exacerbate or reactivate preexisting addictive disorders. In some cases, their use can be associated with the development of de novo addictive disease (Ziegler, 2005). Therefore alternative pain management modality such as mediation would help to decrease the pain-related drug utilization.

The cognitive modulation of pain is influenced by a number of factors ranging from attention, beliefs, conditioning, expectations, mood, and the regulation of emotional responses to noxious sensory events (Zeidan et al., 2012). Meditation interventions have been found to attenuate pain symptoms in both experimental and clinical settings (Teixeira 2008 ; Zeidan et al., 2010).

The primary somatosensory cortex is the area of the brain directly involved in pain processing. Zeidan and colleagues (2011) believe that meditation-induced reductions in pain intensity are associated with increased activity in the anterior cingulate cortex and anterior insula, areas involved in the cognitive regulation of nociceptive processing. In addition they considered reductions in pain unpleasantness also were associated with thalamic deactivation, which may reflect a limbic gating mechanism involved in modifying interactions between afferent input and executive-order brain areas.

Nakata and team (2014 ) hypothesized that meditation reduces pain-related neural activity in the ACC, insula, secondary somatosensory cortex, and thalamus. According to Grant and colleagues (2010) state that extensive mental training can result in thickening of cortical regions associated with pain processing, including midcingulate cortex (MCC) and primary and secondary somatosensory cortices.

## **Mindfulness Meditation**

Mindfulness can be considered as a universal human ability embodied to foster clear thinking and open-heartedness (Trousselard et al., 2014). Mindfulness has been described as a “non-elaborative, nonjudgmental awareness” of present moment experience (Kabat-Zinn, 1990).

Mindfulness meditation seems to improve moment-to-moment awareness, acceptance and non-reactivity to thoughts, sensations, and emotions (Bishop et al., 2004). Mindfulness has been theoretically and empirically associated with psychological well-being (Keng, 2011).

Mindfulness, the most scientifically investigated form of meditation, has been the subject of a huge growth of interest in clinical and scientific circles in recent years (Hassed, 2008). Barker (2014) views mindfulness as a popular and paradigmatic alternative healing practice within the context of contemporary medicalization trends.

As elucidated by Grossman and team (2004) mindfulness meditation has been found to improve a wide spectrum of cognitive and health outcomes. They further state that mindfulness related health benefits are associated with enhancements in cognitive control, emotion regulation, positive mood, and acceptance, each of which have been associated with pain modulation. Mindfulness meditation is the observation of bodily sensations, including pain (Sun, Kuo & Chiu 2002). Mindfulness meditation was introduced as a clinical intervention for conditions such as chronic pain and anxiety (Kabat-Zinn et al., 1992).

Mindfulness meditation has been shown to decrease the anticipation of and reactivity to pain by cultivating a sense of acceptance and nonjudgmental awareness (Brown & Jones, 2010). A standardized mindfulness program (MBSR) contributes positively to pain management and can exert clinically relevant effects on several important dimensions in patients with long-lasting chronic pain (la Cour & Petersen, 2014).

### **Vipassana Meditation**

The concept of mindfulness is based on Vipassana, a Buddhist meditation technique (Delgado-Pastor et al., 2013). Vipassana (‘Insight’) meditation includes paying close attention to the inner experiences (conceptual, emotional, tactile, and visceral) associated with the current state of the body, primarily in order to better develop a non-discursive awareness centered in the present moment (Goenka, 2000). Vipassanā can be cultivated by the practice that includes contemplation, introspection and observation of bodily sensations, analytic meditation and observations on life experiences like death and decomposition (Pandita , 2004).

Vipassana meditative practice involves the adoption of a mindful and receptive mental awareness, with attentional absorption on present-moment sensations in the body and meta-cognitive reframing of ongoing experience as impersonal phenomena to be observed but not reacted to (Gunaratana ,2002 ; Cahn et al., 2010).

Delgado-Pastor and colleagues (2013) report that Vipassana meditators showed increased attentional engagement after meditation and increased autonomic regulation during meditation. Pain diminution in Vipassana mediation could be due to autonomic regulation.

Moreover Cahn and Polich (2009) suggest that that meditation state can decrease the amplitude of neurophysiologic processes that subserve attentional engagement elicited by unexpected and distracting stimuli and therefore consistent with the aim of Vipassana meditation to reduce cognitive and emotional reactivity, the state effect of reduced P3a amplitude to distracting stimuli reflects decreased automated reactivity and evaluative processing of task irrelevant attention-demanding stimuli.

### **Loving-kindness Meditation (LKM)**

Loving-kindness meditation is a practice designed to enhance feelings of kindness and compassion for self and others. Loving-kindness meditation involves repetition of phrases of positive intention for self and others (Kearney, 2013). The literature suggests that Loving-kindness meditation is associated with an increase in positive affect and a decrease in negative affect (Hofmann, Grossman & Hinton, 2011). Shahr and team (2014) of the view that Loving-kindness meditation may be efficacious in alleviating self-criticism, increasing self-compassion and improving depressive symptoms among self-critical individuals.

Lutz and colleagues (2008) state that compassion cultivates the desire to relieve pain and suffering for the self and others, while loving-kindness loads the mind with universal, nonreferential compassion towards oneself and other beings (Lee et al., 2012). Neuroimaging studies suggest that Loving-kindness meditation may enhance activation of brain areas that are involved in emotional processing and empathy (Hofmann et al., 2011).

Chapin and colleagues (2014) are of the view that the emergence of anger as an important predictor of chronic pain. Therefore compassion cultivation has been shown to influence emotional processing and reduce negativity bias in the contexts of emotional and physical discomfort, thus suggesting it may be beneficial as a dual treatment for pain and anger. Loving-kindness meditation is a potential healing method in chronic pain. Loving-kindness program can be beneficial in reducing pain, anger, and psychological distress in patients with persistent low back pain (Carson et al., 2005). Tonelli and Wachholtz (2014) report that 20-minute guided meditation session based on "loving kindness" approach participants reported a 33% decrease in pain and a 43% decrease in emotional tension.

### **Vedananupassana Meditation**

Vedananupassana meditation (Contemplation on Feelings) is one of the four types of Vipassana meditations. Vedananupassana consists of minutely observing feelings such as aversion and desire as well as pleasant and unpleasant ones. As described by Nyanaponika, (1962) when there are painful impulses the person dwells practicing feeling-contemplation on feelings internally, or externally, or both internally and externally.

Although pain is essential or survival pain is an 'unpleasant sensory and emotional experience. Pain signals often drive the individual into a behavioral response. The very attempt that the patient makes to detach and banish pain keeps pain more adhered. A growing body of research

supports the notion that pain-related fear may contribute to the development of chronic pain and pain-related disability (Zale et al., 2014).

The strength and unpleasantness of pain is neither simply nor directly related to the nature and extent of tissue damage (McGrath, 1994). Psychological factors are closely associated with pain. Situational and emotional factors intensely affect pain perceptions. By concentrating and accepting painful impulses the patient learns to manage his painful symptoms more effectively.

Vedananupassana mediation helps to transform pain by contemplating painful sensations. It edifies patients to be mindful of painful feelings and become tolerable to them. Acceptance of the painful impulses helps to reduce pain and it boosts psychological flexibility. A study done by Viane and colleagues (2004) found that acceptance was related to less attention to pain. As reported by McCracken and Velleman (2010) psychological flexibility may reduce the impact of chronic pain in patients with low to moderately complex problems outside of specialty care. In addition McCracken & -O'Brien (2010) suggest that, when people with chronic pain are willing to have undesirable psychological experiences without attempting to control them, they may function better and suffer less.

Mindfulness of the body and mindfulness of the pain help to see the true nature of pain and pain related suffering. While concentrating on pain the person realize that the sensation of pain is created by the mind. Being mindfulness of the painful sensations it helps to see different elements of pain and soothes the mind's perception of pain. Furthermore Vedananupassana mediation is associated with greater pain tolerance. Revealing personal experiences Frezza (2008) narrates that focusing on chronic pain helped to manage painfully sensations more effectively.

### **Case Discussion**

- 1) Mr. LXX 36 year old combatant diagnosed with Somatoform Disorder assisted with Anapanasati Mediation or mindfulness of breathing for a period of twelve weeks. He was trained to perform meditation by an instructor from the Vipassana Meditation Center in Colombo. He was instructed to relax his body then close his eyes and to concentrate on his breathing rhythm. Gradually he was able to increase his attention span. Mr. LXX underwent three meditation sessions (each 120 min) per week. At the end of the 12<sup>th</sup> week Mr. LXX reported significant improvement with regard to his pain. As the patient indicated his painful symptoms reduced and sleep improved over time.
- 2) Mr. JXX 48 year old male suffered from chronic backache for nearly five years assisted to perform Vedananupassana meditation (Contemplation on Feelings). He concentrated on his painful impulses while accepting his chronic pain condition. As he performed the mediation he found that painful impulses were not frustrating as he perceived. He could mindfully sense the back pain and engage in his day-to-day activities. Following the intervention by Vedananupassana meditation Mr. JXX's functionality improved up to a considerable level.

- 3) Mrs. SXX was diagnosed with Fibromyalgia and prescribed opiates to treat her pain. Gradually her pain increased and she started self medicating with high opiate doses. Mrs. SXX's somatic pain and opiate usage led to a major addiction condition. She was feeling depressed and could not perform her duties effectively. She underwent Mindfulness mediation program under a trainer and after six months Mrs. SXX was able to reduce her opiate addiction and agreed to seek alternative treatments. With the mindfulness program she was able to manage her pain more effectively. In addition her negative symptoms such as anger, self loathing, and despair reduced significantly. Hence her functionality improved and Mrs. SXX was able to manage her pain and addiction fruitfully.

## **Conclusion**

Chronic pain is a major public health problem and it has negative consequences on quality of life and individual's functionality. To treat pain related symptoms, mediation has been identified as a safe and cost-effective non-pharmacological method. In addition mediation helps to maintain holistic health and wellness. Clinical trials show that mediation is helpful for reducing chronic pain. Moreover a number of neurological researches specify that meditation inhibits or relieves pain perception up to a significant degree and reduces pain-related neural activity. Meditation is a safe as well as inexpensive, non-invasive method. Therefore mediation can be recommended as a self-regulation method for chronic pain.

## **References**

- Abu-Saad Huijjer, H. (2010). Chronic pain: a review. *J Med Liban.* 58(1):21-7.
- Alba-Delgado, C., Llorca-Torralba, M., Horrillo, I., Ortega, J.E., Mico, J.A., Sánchez-Blázquez, P., Meana, J.J., Berrocoso, E. (2013). Chronic pain leads to concomitant noradrenergic impairment and mood disorders *Biol Psychiatry.* 1;73(1):54-62.
- American Pain Society (2009). Principles of analgesic use in the treatment of acute pain and cancer pain, (6th ed.) Glenview, IL: American Pain Society.
- Ashburn, M.A., Staats, P.S. (1999). Management of chronic pain. *Lancet.* 353:1865–9. 8.
- Barker, K.K. (2014). Mindfulness meditation: do-it-yourself medicalization of every moment. *Soc Sci Med.* 2014 Apr;106:168-76.
- Bishop, S.R., Lau, M., Shapiro, S., Carlson, L., Anderson, N.D., Carmody, J., Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice.* 11:230–241.
- Bonadonna, R. (2003). Meditation's impact on chronic illness. *Holist Nurs Pract.* 17(6):309-19.
- Bonica, J.J. (1990) *The Management of Pain* 2 edn. Philadelphia: Lea & Febiger.

Braboszcz, C., Hahusseau, S., Delorme, A. (2010) Meditation and Neuroscience: from basic research to clinical practice. In “Integrative Clinical Psychology, Psychiatry and Behavioral Medicine: Perspectives, Practices and Research”. Editor: R. Carlstedt. Springer Publishing.

Bravo, L., Torres-Sanchez, S. , Alba-Delgado, C., Mico, J.A. , Berrocoso, E. (2014).Pain exacerbates chronic mild stress-induced changes in noradrenergic transmission in rats. *Eur Neuropsychopharmacol.* 24(6):996-1003.

Brown, C. A.,Jones, A. K. P. (2010). Meditation experience predicts less negative appraisal of pain: Electrophysiological evidence for the involvement of anticipatory neural responses. *Pain,* 150(3), 428-438.

Burgoyne, D.S.(2007).Prevalence and economic implications of chronic pain.*Manag Care.* 16(2 Suppl 3):2-4.

Cahn, B.R., Polich, J.(2009).Meditation (Vipassana) and the P3a event-related brain potential.*Int J Psychophysiol.* 72(1):51-60.

Carson, J. W., Keefe, F. J., Lynch, T. R., Carson, K. M., Goli, V. ., Fras, A. M., Thorp, S. R. (2005). Loving-kindness meditation for chronic low back pain: Results from a pilot trial. *Journal of Holistic Nursing* 23:287–304.

Cahn, B. R., Delorme, A., Polich, J. (2010). Occipital gamma activation during Vipassana meditation. *Cognitive Process,* 11, 39-56.

Chapin, H. L., Darnall, B. D., Seppala, E. M., Doty, J. R., Hah, J. M., & Mackey, S. C. (2014). Pilot study of a compassion meditation intervention in chronic pain. *Journal of Compassionate Health Care,* 1(1), 1-12.

Clark, M.R., Treisman, G.J. (2011).Chronic Pain and Addiction. *Adv Psychosom Med. Basel, Karger.*vol 30, pp 1–7.

Cole, B. E. (2002). Pain management: Classifying, understanding, and treating pain. *Hospital Physician,* 38(6), 23—30.

Davidson, R.J, Kabat-Zinn J., Schumacher, J., Rosenkranz, M., Muller, D., Santorelli, S.F., Urbanowski, F., Harrington, A., Bonus, K., Sheridan, J.F. (2003).Alterations in brain and immune function produced by mindfulness meditation. *Psychosom Med.* 65(4):564-70.

Delgado-Pastor, L.C., Perakakis, P., Subramanya, .P, Telles, S., Vila, J.(2013).Mindfulness (Vipassana) meditation: effects on P3b event-related potential and heart rate variability. *Int J Psychophysiol.* 90(2):207-14.

Fishman, S.M., Wilse,y B., Yang, J., Reisfield, G.M., Bandman, T.B.,Borsook, D.(2000). Adherence monitoring and drug surveillance in chronic opioid therapy. *J Pain Sympt Mgmt*.20: 293±307

Frezza, E.(2008).Focusing and chronic pain. Retrieved from [https://www.focusing.org/folio/Vol21No12008/27\\_FocusingAndChronTRIB.pdf](https://www.focusing.org/folio/Vol21No12008/27_FocusingAndChronTRIB.pdf)

Goenka, S.N. (2000). *The Discourse Summaries*. Onalaska, WA, USA: Vipassana Research Publications. 144 p.

Grant, J.A., Courtemanche, J., Duerden, E.G., Duncan, G.H., Rainville, P. (2010) Cortical thickness and pain sensitivity in Zen meditators. *Emotion* 10:43–53.

Grossman,P., Niemann,L., Schmidt,S., Walach,H. (2004). Mindfulness-based stress reduction and health benefits. A meta-analysis, *Journal of Psychosomatic Research* . 35–43.

Gunaratana, H.(2002). *Mindfulness in plain English*. Boston, MA: Wisdom Publications.

Hainline, B. (2005). *Chronic Pain: Physiological, Diagnostic, and Management Considerations* .*Psychiatr Clin N Am* 28 (:713–735).

Hassed , C. (2008). The health benefits of mindfulness. Retrieved from [http://www.49.com.au/wp-content/uploads/The-health-benefits-of-meditation-and-being-mindful\\_v21-2.pdf](http://www.49.com.au/wp-content/uploads/The-health-benefits-of-meditation-and-being-mindful_v21-2.pdf)

Heit, H.A.(2001). The truth about pain management: the difference between a pain patient and an addicted patient. *European Journal of Pain*. (Suppl. A): 27±29.

Henschke, N. , Kamper, S.J ., Mahe,r C.G. (2015).The Epidemiology and Economic Consequences of Pain.*Mayo Clin Proc*. 90(1):139-147.

Henry, J.L. (2008). Pathophysiology of Chronic Pain.Retrieved from [http://fhs.mcmaster.ca/paininstitute/documents/pathophysiology\\_of\\_chronic\\_pain.pdf](http://fhs.mcmaster.ca/paininstitute/documents/pathophysiology_of_chronic_pain.pdf)

Henry,J.L.(2008). The need for knowledge translation in chronic pain. *Pain Res Manag*. 13(6): 465–476.

Hofmann ,S.G., Grossman, P., Hinton, D.E.(2011).Loving-kindness and compassion meditation: potential for psychological interventions. *Clin Psychol Rev*. 31(7):1126-32.

Horowitz, S. (2010). Health benefits of meditation: What the newest research shows. *Alternative and Complementary Therapies*, 16(4), 223-228.

IASP Sub-committee on Taxonomy. Pain terms: a list with definitions and notes on usage. *Pain* 1980; 8: 249-52.

IASP Task Force on Taxonomy. (1994). Part III: Pain Terms, A Current List with Definitions and Notes on Usage. In H. Merskey & N. Bogduk (Eds.), *Classification of Chronic Pain* (Second Edition ed., pp. 209-214). Seattle: IASP Press.

Kabat-Zinn J., Lipworth, L., Burney, R (1985) The clinical use of mindfulness meditation for the self-regulation of chronic pain. *J Behav Med* 8(2):163–190.

Kabat-Zinn,J. (1990). *Full Catastrophe Living*, Delta Publishing, New York, NY.

Kabat-Zinn J, Massion, A.O., Kristeller, J., Peterson, L.G., Fletcher, K.E., Pbert, L., Lenderking, W.R., Santorelli, S.F. (1992). *Am J Psychiatry* ; 149(7):936-43.

Kakigi, R. , Nakata, H., Inui, K., Hiroe, N., Nagata, O., Honda, M., Tanaka, S., Sadato, N., Kawakami, M.(2005). Intracerebral pain processing in a Yoga Master who claims not to feel pain during meditation.*Eur J Pain.* 9(5):581-9.

Kearney, D. J., Malte, C. A., McManus, C., Martinez, M. E., Felleman, B., & Simpson, T. L. (2013). Loving-kindness meditation for posttraumatic stress disorder: A pilot study. *Journal of Traumatic Stress*, 26, 1–9.

Keng, S.L.,Smoski,M.J., Robins,C.J.(2011). Effects of Mindfulness on Psychological Health: A Review of Empirical Studies. *Clin Psychol Rev.*31(6): 1041–1056.

la Cour, P. , Petersen, M.(2014).Effects of Mindfulness Meditation on Chronic Pain: A Randomized Controlled Trial. *Pain Med.* doi: 10.1111/pme.12605.

Lee, T. M., Leung, M. K., Hou, W. K., Tang, J. C., Yin, J., So, K. F., & Chan, C. C. (2012). Distinct neural activity associated with focused-attention meditation and loving-kindness meditation. *PLoS One*, 7(8), e40054.

Lutz, A., Greischar, L. L., Rawlings, N. B., Ricard, M., & Davidson, R. J. (2004). Long-term meditators self-induce high-amplitude gamma synchrony during mental practice. *Proceedings of the National Academy of Sciences*, 101(46), 16369–16373.

Lutz A, Brefczynski-Lewis J, Johnstone T, Davidson RJ (2008) Regulation of the neural circuitry of emotion by compassion meditation: Effects of meditative expertise. *PLoS ONE* 3: e1897.

McGrath, P.A. (1994).Psychological aspects of pain perception.*Arch Oral Biol.*39 Suppl:55S-62S.

McCracken, L.M. , Zhao-O'Brien, J.(2010). General psychological acceptance and chronic pain: there is more to accept than the pain itself.*Eur J Pain.* 14(2):170-5.

McCracken, L.M. , Velleman, S.C.(2010).Psychological flexibility in adults with chronic pain: a study of acceptance, mindfulness, and values-based action in primary care.Pain. ;148(1):141-7.

Morasco, B.J., Lovejoy, T.I., Lu, M., Turk, D.C., Lewis, L. (2013) The relationship between PTSD and chronic pain: mediating role of coping strategies and depression. Pain 154: 609–616.

Morone, N.E., Greco, C.M., Weiner, D.K. (2008).Mindfulness meditation for the treatment of chronic low back pain in older adults: a randomized controlled pilot study, Pain 134 . 310–319.

Mowat, I ., Johnson,D. (2013). Acute Pain Management Part 2 – Assessment and Management. Retrieved from <http://www.aagbi.org/sites/default/files/295%20Acute%20Pain%20Management>

Nakata ,H , Sakamoto, K , Kakigi, R. (2014). Meditation reduces pain-related neural activity in the anterior cingulate cortex, insula, secondary somatosensory cortex, and thalamus.Front Psychol. 16;5:1489.

Pandita, S.U. (2004). How to Practice Vipassana Insight Meditation. Retrieved from <http://www.lionsroar.com/how-to-practice-vipassana-insight-meditation/>

Patil,G.P.(2009).Effectiveness of mindfulness meditation (Vipassana) in the management of chronic low back pain.Indian Journal of Anaesthesia. 53 (2):158-163.

Rajagopal, M.R. (2006). Pain Basic Considerations. Indian J. Anaesth. 50(5) : 331-334.

Ruoff, G.E., Beery, G.B.(1985). Chronic pain. Characteristics, assessment, and treatment plans.Postgrad Med. 15;78(4):91-7.

Shahar, B. , Szsepsenwol, O., Zilcha-Mano, S., Haim, N., Zamir, O., Levi-Yeshuvi, S., Levit-Binnun, N.(2014). A Wait-List Randomized Controlled Trial of Loving-Kindness Meditation Programme for Self-Criticism. Clin Psychol Psychother.doi: 10.1002/cpp.1893.

Siddall, P.J., Cousins, M.J. (2004).Persistent pain as a disease entity: Implications for clinical management. Anesth Analg. 99:510–20.

Salomons, T.V., Kucyi, A.(2011).Does Meditation Reduce Pain through a Unique Neural Mechanism.The Journal of Neuroscience. • 31(36):12705–12707.

Sun, T.F., Kuo, C.C., Chiu, N.M.(2002).Mindfulness meditation in the control of severe headache. Chang Gung Med J. 2002 Aug;25(8):538-41.

Teixeira, M.E. (2008).Meditation as an intervention for chronic pain: An integrative review. Holist Nurs Pract 22:225-334.

Tonelli, M.E., Wachholtz, A.B .(2014).Meditation-based treatment yielding immediate relief for meditation-naïve migraineurs. Pain Manag Nurs. 15(1):36-40.

Trousselard, M., Steiler, D., Claverie, D., Canini, F. (2014). The history of Mindfulness put to the test of current scientific data: unresolved questions. *Encephale*. 40(6):474-80

Turk, D.C., Swanson, K.S., Tunks, E.R. (2008). Psychological approaches in the treatment of chronic pain patients--When pills, scalpels, and needles are not enough. *Canadian Journal of Psychiatry*.53:213-223.

Viane, I., Crombez, G., Eccleston, C., Devulder, J., De Corte, W. (2004). Acceptance of the unpleasant reality of chronic pain: effects upon attention to pain and engagement with daily activities. *Pain*.112(3):282-8.

Voscopoulos, C., Lema, M. (2010). When does acute pain become chronic? *Br J Anaesth. Suppl* 1:i69-85.

Walsh, R. (1983). Meditation practice and research. *Journal of Humanistic Psychology* 3:: 18-50.

Wachholtz, A., Foster, S., & Cheatle, M. (2015). Psychophysiology of pain and opioid use: Implications for managing pain in patients with an opioid use disorder. *Drug and Alcohol Dependence*, 146, 1-6.

Wachholtz, A., & Gonzalez, G. (2014). Co-morbid pain and opioid addiction: Long term effect of opioid maintenance on acute pain. *Drug and Alcohol Dependence*, 145, 143-149.

Wachholtz, A., Gonzalez, G., Boyer, E., Rosenbaum, C., & Ziedonis, D. (2011). The intersection of chronic pain treatment and opioid analgesic misuse: A review of the causes, treatments, and policy strategies *Substance Abuse and Rehabilitation Review*, 2, 145-162.

Wachholtz, A., & Makowski, S. (2012). Pain versus Suffering at the End of Life. In R. Moore (Ed.), *Handbook of Pain and Palliative Care: Biobehavioral Approaches for the Life Course*. NY: Springer.

Wachholtz, A., Malone, C., & Pargament, K. (2015). Effect of different meditation types on migraine headache medication use. *Behavioral Medicine*.

Wachholtz, A., & Pargament, K. (2005). Is Spirituality a Critical Ingredient of Meditation? Comparing the Effects of Spiritual Meditation, Secular Meditation, and Relaxation on Spiritual, Psychological, Cardiac, and Pain Outcomes. *Journal of Behavioral Medicine*, 28(4), 369-384.

Wachholtz, A., & Pargament, K. (2008). Migraines and meditation: does spirituality matter? *Journal of Behavioral Medicine*, 31(4), 351-366. Wachholtz, A., Ziedonis, D., & Gonzalez, G. (2011). Co-Morbid Pain & Opioid Addiction: Psycho-social and Pharmacological Treatments. *Substance Use & Misuse*.

Zale, E.L., Lange, K.L., Fields, S.A., Ditre, J.W. (2014). The relation between pain-related fear and disability: A meta-analysis. *J Pain*.14(10): 1019–1030.

Zeidan, F., Gordon, N.S., Merchant, J. & Goolkasian, P. (2010). The Effects of Brief Mindfulness Meditation Training on Experimentally Induced Pain, *The Journal of Pain*,11, 199-209.

Zeidan, F., Martucci, K.T., Kraft, R.A., Gordon, N.S., McHaffie, J.G., Coghill, R.C. (2011). Brain mechanisms supporting the modulation of pain by mindfulness meditation. *J Neurosci.* 6;31(14):5540-8.

Zeidan, F., Grant, J.A., Brown, C.A., McHaffie, J.G., Coghill, R.C. (2012). Mindfulness meditation-related pain relief: evidence for unique brain mechanisms in the regulation of pain. *Neurosci Lett.* 29;520(2):165-73.

Ziegler, P.P. (2005). *Addiction and the Treatment of Pain*. DOI: 10.1080/10826080500294841

### **About the Authors**

- 1) Ruwan M. Jayatunge M.D. Former District Coordinator / Focal Point of Mental Health in the Ministry of Health Government of Sri Lanka.
- 2) Amy B. Wachholtz, PhD, MDiv, MS, ABPP, FACHP is an Assistant Professor of Psychiatry at the University of Massachusetts Medical School, and the Health Psychologist on the Psychosomatic Medicine Consult Service at UMass Memorial Medical Center.