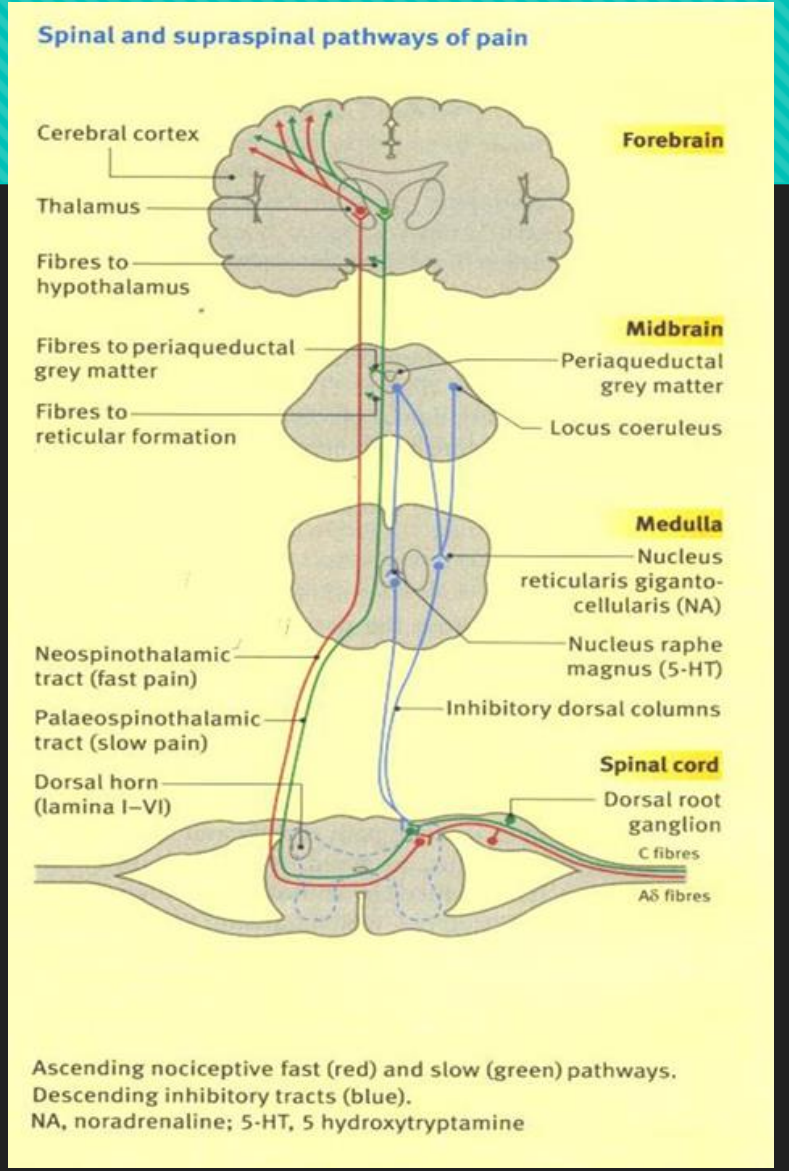
Is mindfulness meditation an appropriate therapy in patients presenting with chronic pain?

Background

- Chronic pain affects between one-third and one-half of the UK adult
  - 10.4% to 14.3% of cases being 'moderate-severely disabling chronic pain'
- The cost back pain alone is likely to be in the region of £5billion per annum
  - Also increasing demand for mental health services
- Increased recognition of limitations of drug therapy in non-cancer chronic pain patients.
- Chronic pain management in the UK shifting towards a holistic approach
  - Chronic pain clinics run by MDTs
  - Referrals to Pain Management Programmes incorporating mindfulness meditation techniques

Mechanisms of chronic pain

- In acute tissue injury, cytokines and other inflammatory mediators activate nociceptors in Aδ and C fibres.
- The thalamus interacts with the cortex (where pain perception occurs), limbic system and brainstem.
  - These areas modulate pain via descending pathways to the dorsal horn, in most cases decreasing the signal
- Peripheral sensitization through 'inflammatory soup' reducing the threshold of nociceptors, increasing their response
- Central sensitization results from prolonged exposure to pain signals
  - Increased excitability of central nerves results in abnormal pain modulation, which can amplify pain signals rather than decreasing them.



Chronic pain and mental health

- In many patients, investigations suggest a peripheral pathology causing their chronic pain is absent. This is indicative that the pathology lies within the aspects of the central nervous system involved in pain processing.
- There are many identified functional chronic pain conditions, including fibromyalgia, irritable bowel syndrome and chronic tension headache.
- It is hypothesised that excessive activity of the limbic system disrupts normal pain processing and results in abnormal amplification of pain signals.
- Anxiety and depression are common comorbidities in patients presenting with chronic pain.
- Perception of pain via cognitive modulation may also be negatively affected by social factors.
- Pain can also impact on sleep, which may feed into the cycle mentioned above to further exacerbate cognitive stress and altering modulation of pain.

Limitations of drug therapy in chronic pain

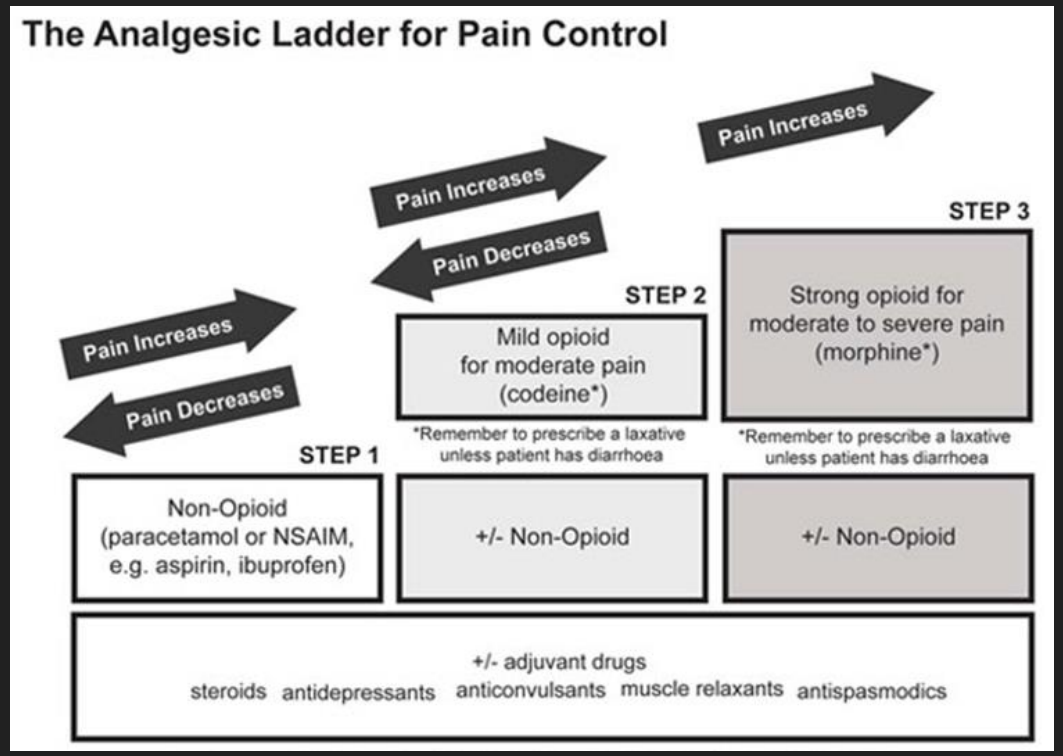


Figure 1. The WHO analgesic ladder for pain control using pharmaceutical interventions. Image from: 'Essential Pain Management Lite'.

- In 1986, the World Health Organization (WHO) developed the analgesic stepladder for palliative cancer care (Figure 1.).
- This model was revolutionary in reversing the stigmatisation of opioid use, and ultimately resulted in less suffering during end of life treatment.
- However, the use of the WHO analgesic ladder in non-cancer chronic pain, where there is no predictable trajectory, is frequently ineffective as pain often becomes unresponsive to opioids.
- Between 1999 and 2010 the US saw a fourfold inflation in prescribing with a proportionate increase in opioid deaths and admission for misuse.
- Does not address many of the factors influencing pain, particularly psychosocial.

What is mindfulness meditation?

"Mindfulness means paying attention in a particular way;
On purpose, in the present moment, and nonjudgmentally."

- Prof. Jon Kabat-Zinn, University of Massachusetts Medical Centre

Efficacy of mindfulness meditation in pain management

- In a study investigating the effects of an 8-week mindfulness programme on chronic back pain, participants were randomized to an 8-week mindfulness-based meditation program or to a wait-list control group. The study found that chronic pain acceptance questionnaire scores significantly improved in the meditation group, while the control group worsened during the 8 weeks.

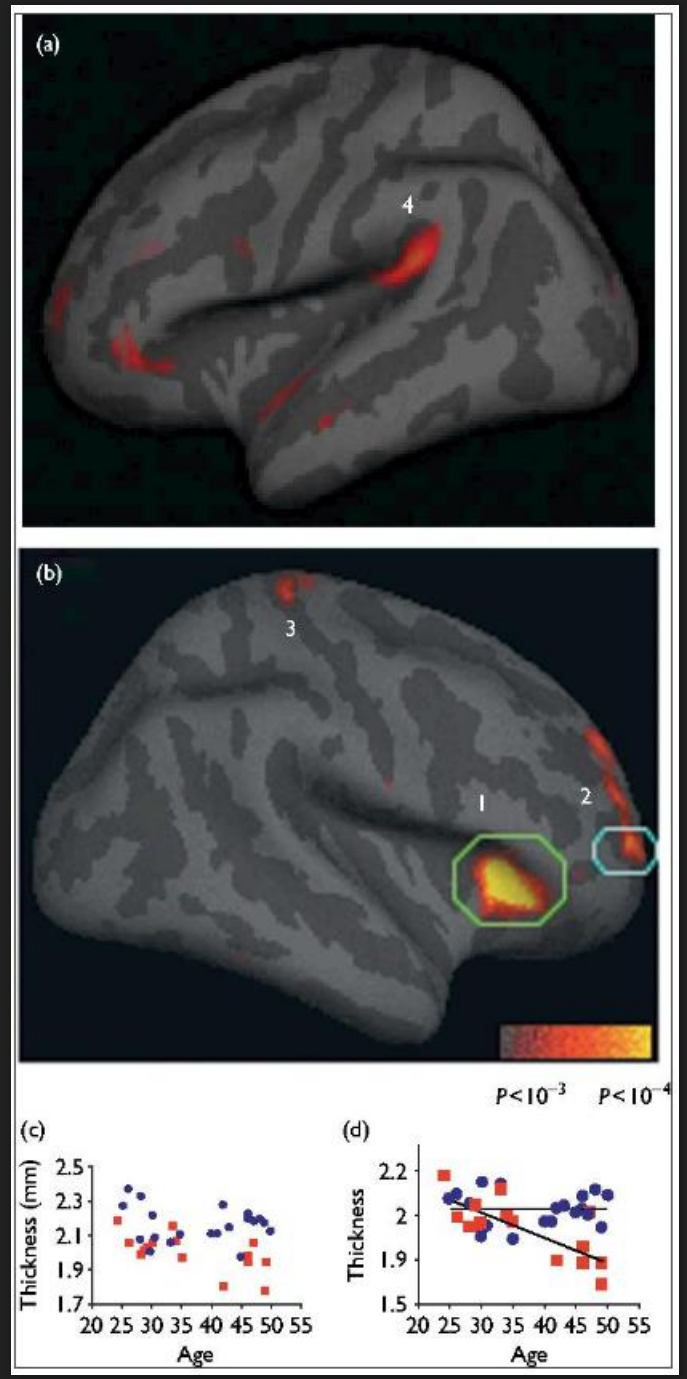
- A study by Jon Kabat-Zinn and colleagues investigated the longitudinal effects of mindfulness meditation on chronic pain management. The study found that in the majority of patients the initial benefits of mindfulness meditation in management of their chronic pain was maintained at this point. The conclusion by the authors is that mindfulness meditation is effective in the long-term management of chronic pain.

- A systematic review and meta-analysis of 11 studies in the effects of mindfulness meditation on chronic pain conditions including fibromyalgia, rheumatoid arthritis, chronic musculoskeletal pain, failed back surgery syndrome, and mixed aetiology. Meta-analysis found that mindfulness-based interventions may have positive effects on perceived pain control), but there was no significant evidence of benefit in pain intensity or depression.

Cortical regions thicker in meditators than in controls.

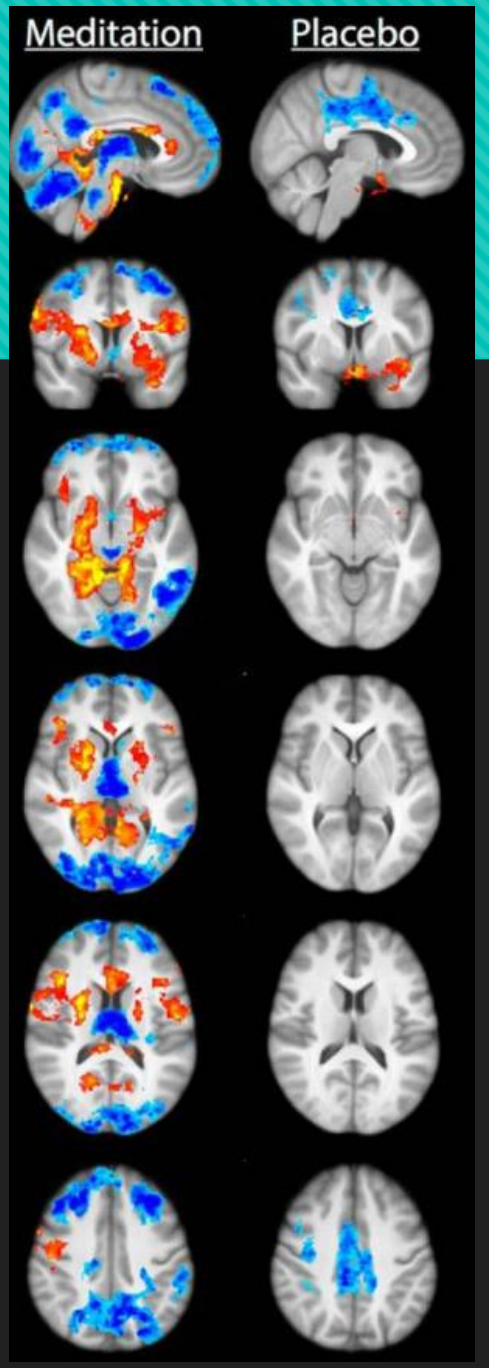
a + b: Statistical map depicting between-group differences in thickness at each point on the cortical surface overlaid on the inflated average brain. Numbered regions: (1) insula, (2) Brodmann area (BA), (3) somatosensory cortex, (4) auditory cortex.

c + d: Scatter plot of mean cortical thickness of each participant in the subregion above threshold within each circled region of (c) insula and (d) BA, plotted versus age. Meditation participants: blue circles; control participants: red squares.



- MRI compared brain structure in meditators and non-meditators found that specific regions of the cortex, such as the prefrontal cortex and right anterior insula, were thicker in meditators than the non-meditator group.
- The researchers hypothesise meditation may be associated with structural changes in areas of the brain that are important for sensory, cognitive and emotional processing
- This remodelling may reduce cognitive stress in response to emotional input, reversing the pain amplification cycle and resulting in a reduction in the perception of pain

Mindfulness Meditation-Based Pain Relief Employs Different Neural Mechanisms Than Placebo and Sham Mindfulness Meditation-Induced Analgesia



- fMRI study randomised patients into 3 groups: mindfulness meditation, sham meditation and placebo conditioning
- The mindfulness meditation group showed increased activity in areas associated with cognitive modulation of pain (including the subgenual anterior cingulate and anterior insular cortex)
- Analgesia in placebo conditioning group was associated with deactivation of the secondary somatosensory cortex (sensory processing regions).
- Significantly higher pain reduction in the mindfulness-meditation group than the sham-meditation group

Case studies in pain management using mindfulness meditation

- Individual case studies suggest that mindfulness practice is ineffective in some patients who don't have confidence in their diagnosis or the analgesic properties of the intervention.
  - Highlights common misunderstanding amongst the general population about chronic pain, particularly in patients without a peripheral pathology
- The decision to practice mindfulness meditation and/or reduce ineffective drug therapy as a means of pain management is a behavioural change.
  - The Transtheoretical model is a useful tool in assessing the suitability of mindfulness for individual patients
- Communicating the mechanisms of chronic pain, particularly how pain can arise in the absence of peripheral pathology, is essential in promoting awareness and reassurance in patients.
  - Education on the evidence supporting mindfulness-based therapies encourages contemplation and adherence to mindfulness-based pain management programmes, and ultimately more positive patient outcomes.

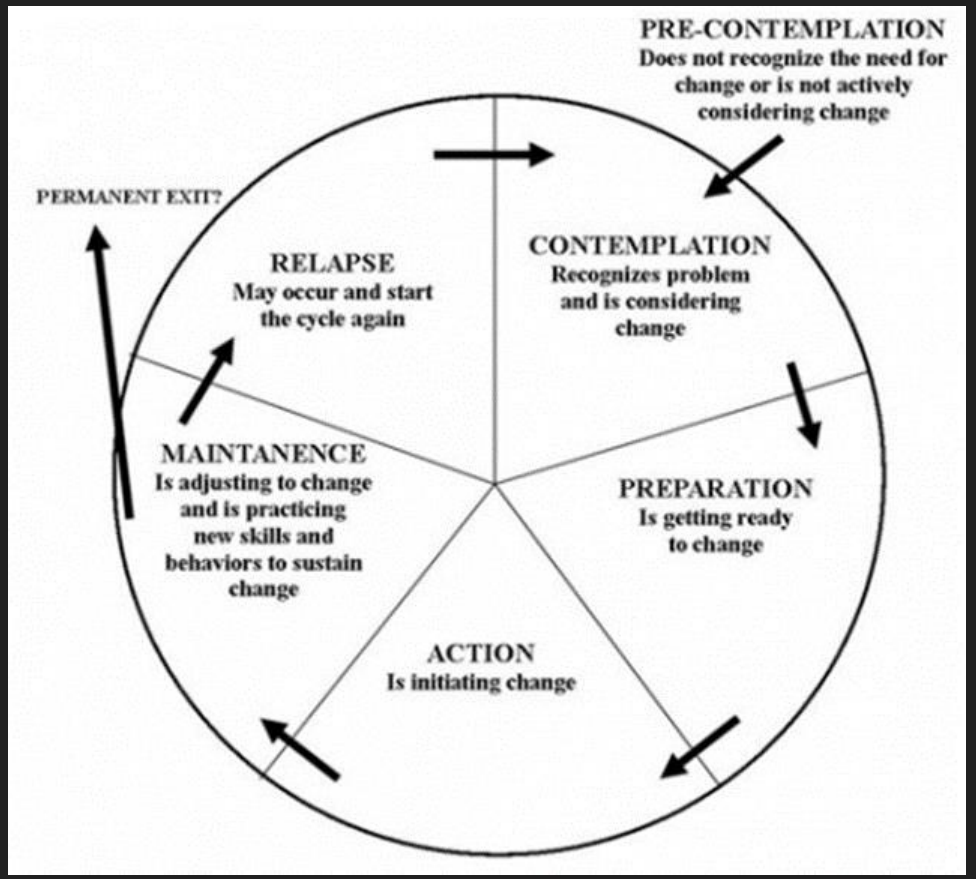


Figure 2. Cycle of behavioural change, outlining the different stages of behaviour modification, adapted from Proschka and DiCelmente's Transtheoretical model

Is mindfulness meditation an appropriate therapy in patients presenting with chronic pain?

- Psychosocial factors, remodelling of pain pathways and neural hypersensitivity have all been implicated in the pathophysiology of chronic pain.
- Many trials have found strong links between mindfulness meditation and a reduction in patient's pain.
- Neuroimaging studies suggest that mindfulness meditation results in remodelling, increasing activity in cognitive pain modulation pathways.
- Individual cases highlight that patient acceptance of a diagnosis and the causes of pain influence uptake and adherence to mindfulness-based pain management programmes.
- Systematic review and meta-analysis of existing studies are limited by the varying definitions and guises of mindful practice, as well as inconsistent methodology.

Is mindfulness meditation an appropriate therapy in patients presenting with chronic pain?

There is evidence to support that mindfulness meditation is an appropriate approach to chronic pain management, however patients must be assessed on a case-by-case basis for suitability in order to maximise patient outcomes.