CHAPTER 8

MEDICAL NEUROSCIENCE OF PATANJALI YOGA SUTRAS IN CLINICAL PRACTICE AND ITS QUANTITATIVE STUDY

This chapter has two parts:

1.1 The first part describes a clinical mind-body medicine program called PRAYOGA derived from the Patanjali Yoga Sutras based on sound scientific basis of medical neuroscience developed and used by the author in medical clinical practice.

1.2 The second part describes a small quantitative clinical study of the application of the PRAYOGA program in a clinical population for chronic distress.

8.1 PRAYOGA: A Clinical Therapeutic Mind Body Medicine Intervention Program based on the Ashtanga Yoga of Patanjali Yoga Sutras


8.1.1 INTRODUCTION TO PRAYOGA

PRAYOGA is a Preventive Remedial Yoga Program, a mind-body medicine program developed by the researcher based on the Ashtanga Yoga or the eight limbs or parts forming the core practice of traditional yoga incorporating evidence based clinical therapeutic concepts and practices established in contemporary medical science practice. “prayoga” is a Sanskrit term which means ‘practice’ or ‘application’ or ‘undertaking’ or ‘means’ or ‘research’. PRAYOGA is used here as a practical and proactive means to achieve health and wellbeing. PRAYOGA is used as an acronym for the program to highlight two aspects of the program:
(1) “Proactive Ashtanga Yoga” indicates its practical nature, the need to engage and take initiative, be positive and comprising of eight parts.

(2) “Progressive Reconditioning Algorithm to Yield Optimum Gain in Action” describes its science based principle, mechanism and outcome.

Research in medical science and especially in medical neuroscience has shown that to gain optimum health and wellness it is necessary to gradually and progressively recondition the body and mind so as to train ourselves into making balanced choices in our overall action including diet, lifestyle, activities and ways of thinking and being. Due to aberrant conditioning as a result of the fast-paced, disorganised, pressured lifestyle and motives, there is a tendency to narrow choices that give immediate gratification and pleasure or an escape-route. But these choices are usually reactive and not proactive contributing to a vicious cycle of stress and distress.

PRAYOGA is an empowering program that emphasises that it is within our power and capacity to proactively retrain and recondition ourselves by gaining knowledge and understanding, practice health giving habits both physically and mentally to enhance our resilience, self-efficacy and attitude that naturally lead to wellness and wellbeing.

PRAYOGA is a mind-body medicine practice that is a lifestyle modification practice. This is similar to lifestyle programs incorporating aspects of traditional yoga in the West that have also shown to influence genetic mechanisms. They facilitate the “turning-on” of disease preventing genes and “turning-off” of the disease promoting genes. There is also a significant increase in the enzyme telomerase that is responsible for increasing the length of telomeres located at the ends of chromosomes that controls aging and longevity.

The PRAYOGA program is well grounded in the evidence-base of mind-body medicine. It provides the knowledge and skills based on the premise that conscious and mindful awareness, physical and mental efforts and practices can train the mind and so change the brain through positive neuroplasticity...
influencing the psycho-neuro-immuno-endocrine system complex to be activated and sustained through a virtuous cycle of healing.

8.1.2 CURRICULUM OF THE PRAYOGA PROGRAM

Following on the Ashtanga Yoga principles and practice the PRAYOGA program has eight components bearing the names of the eight limbs or parts of Ashtanga Yoga.

1) **Yama: Observances**

Counselling and education is provided in a clinical session focussing on the following aspects:

(i) Physical Hygiene:

- Basic Cleanliness
  To prevent and protect from environmental causes of diseases
- Adequate sun exposure
  Sun is the main source of all energy. It is also essential for Vitamin D that is required for several essential metabolic processes. Vitamin D deficiency has become an epidemic in recent times due to modern lifestyle and neglect and is a contributory cause for several physical and mental disorders.
- Self-massage
  Helps improve the blood circulation and nourishing of the body surface and deeper tissues and muscles and also helps relieve tension and produces relaxation. Massage can be with or without oil.
- Kapalbhati Breathing
  A cleansing breathing technique adapted from the *shatkriya* of Hatha Yoga. It is considered as a ‘brain cleansing’ practice and has been shown to have beneficial effects in several disease conditions.
Diet Optimization counselling:
- Low fat, low salt, low sugar, high fibre, predominantly vegetarian balanced diet
- High coloured fresh fruits and vegetables are rich in antioxidants and have the right balance of vitamins, minerals and other micronutrients for good health. Antioxidants remove free radicals and keep the cells healthy and efficient
- Nuts like walnuts, almonds, groundnuts, flaxseeds are rich in Omega-3 fatty acids which are antioxidants
- Buttermilk is rich in probiotics that improves the gut flora and helps maintain the microbiome balance and its contribution to brain and body health
- Drinking adequate water is essential

Mental Hygiene:
- Relaxation
- Creative activity, music, art, reading/listening to moral stories

Sleep Hygiene:
- Regular time for sleep and waking
- Using bed for sleep so that the brain makes this association
- Dark airy quiet room for sleeping
- Using blanket for warmth
- Evening warm bath or shower
- Refrain from stimulating activities at bed-time: TV, computer, etc.
- Winding-down rituals (bed making, brushing teeth, story reading, etc.)
- Relaxation (breathing exercise, music, aromatherapy, etc.)
- Exposing face to sunlight on waking up (with eyes closed)

2) Niyama: Disciplines
• Reemphasis of cleanliness and hygiene as described above
• Preparing and following Daily Time-Table including week-ends. This helps to be organized. It gives predictability and hence reduces stress.
• Plan of Action: Setting Short-Term and Long-Term Goals. Problems are seen as challenges. Problem solving techniques are taught. Formulation of an ‘Action Plan’ with setting of goals which are realistic and achievable within a reasonable time frame.
• Home-work tasks are assigned for self-study and practice, and reviewed.

3) Asana: Adaptability Practice
   • Conditioning and Preparatory practices: sankalpa
   • Slow Joint Movements: sukshma vyayam
   • Hatha Yoga and Tai Chi sequence: Simple flexibility training with postures and exercises.

4) Pranayama: Breathing Exercise
   • Deep Breathing Technique:
     Slow and deep diaphragmatic breathing enhances the tone of the Vagus nerve regulating the parasympathetic nervous system thus activating the relaxation response. This is a key component that can be practiced in all the six limbs of Ashtanga Yoga starting with Asana.

5) Pratyahara: Sensory Regulation Practice
   • Body Scan Exercise
     Paying attention to sensations by moving the focus in the mind starting from the toes and reaching to top of the head, scanning the whole body to bring greater awareness, control and relaxation.
   • Guided Imagery
     Directing the imagination to produce a state of calmness and control through mental association with pleasant and natural sensations associated with the sensory faculties of vision, hearing, smell, taste and touch.
6) **Dharana: Focused Attention**
   - **Breath-Attention Exercise**
     Focussing attention on the sensation of breathing passively and objectively with a non-judgemental and non-reactive attitude.

7) **Dhyana: Meditation**
   - **Mindfulness Chanting Meditation**
     Based on the technique of Mindfulness Meditation and Transcendental Meditation or Mantra Meditation
   - **Compassion Meditation**
     Meditation involving deliberately cultivating the feeling of loving kindness.

8) **Samadhana: Contemplation and Contentment**
   (modified; cf. samadhi in the Patanjali Yoga Sutra)
   - **Cognitive Restructuring Training**
     This is based on the cognitive therapy model of psychology. This is again based on techniques derived from philosophy: Socratic questioning from Greek philosophical premises of Socrates and also Buddhist thought. This module comprises the following:
     1. Teaching the cognitive model of distress.
     2. Teaching recognition, identification and acknowledging of feelings.
     3. Teaching recognition, identification and acknowledging of automatic thoughts and dysfunctional beliefs
     4. Teaching self-application of principle and practice of the author’s adaptation of cognitive behaviour therapy: Mindfulness Based Cognitive Behaviour Therapy (MBCBT)
        - **Principle:** AUM: Acceptance – Understanding – Management
        - **Practice:** SANTI: Stop – Attend – Notice – Think – Intend

8.1.3 **CONDENSED PATANJALI YOGA SUTRA**

Twenty-five key sutras from the body of Patanjali Yoga Sutras are introduced as part of the PRAYOGA to provide motivation, inspiration,
direction and application for enrichment and transformation. It also helps highlight the insights of the yoga sutras as a psychotherapeutic and spiritual practice.

1) *atah yoga anushasanam*
   Now begins the discipline of yoga

2) *yogas chitta vrutti nirodaha*
   Yoga is the stopping of the cycle of conditioning of consciousness.

3) *tadaa drastuhu swaroope awasthanam*
   Then we can perceive the true state of being.

4) *abhyaasa vairagyabhyam tan nirodaha*
   Practice and discipline are needed for this stopping.

5) *sa tu dheerghakala nairantrarya satkaara sevito dhrudabhoomihi*
   And this practice becomes firmly grounded by cultivating it skilfully and continuously over a long time.

6) *maitri karunaa mudita upekshaanam sukha dhukha punya apunya vishayaanaam bhaavanatascitta prasadanan*
   Clarity of mind comes by cultivating friendliness towards the happy, compassion towards the suffering, good-will towards the virtuous, and benevolent indifference towards evil.

7) *nirvichaara vaishaaradhye adyatma prasadaha*
   By mastering clarity of mind one’s true purpose becomes clear.

8) *tapah swadhyaaya ishvarapranidhaanaani kriyayogaha*
   Compassionate work, self-study and trust in a higher self is the practice of yoga.

9) *samadhi bhavanartaha klesha tanu karanaarthscha*
Purpose of achieving equanimity is to diminish suffering.

10) *avidhya asmita raga dvesha abhiniveshaha kleshaaha*  
Ignorance, ego, craving, aversion and clinging to material life are the causes of suffering.

11) *yogaanga anushtanaad shuddhikshaye gnaanadeeptira aviveka khyaatehe*  
The practice of the limbs of yoga removes negativities and enlightens one with discriminating wisdom.

12) *yama niyama asana pranaayama pratyahara dharana dhyana samadhiya ashtavangaani*  
External observances, internal disciplines, adaptability practice, breath control, discipline of senses, concentration, meditation, equanimity are the eight limbs of yoga.

13) *ahimsa satya astheya brahmacharya aparigraha Yamaha*  
Non-harming, non-lying, non-coveting, non-lusting and non-craving are the external observances.

14) *shoucha santosha tapaha swadhyaya ishwara pranidhanani niyama*  
Hygiene (physical and mental), contentment, compassionate work, self-study and trust in a higher self are the internal disciplines.

15) *vitarka baadhane prtipaksha bhavanam*  
When obstacles in practice are encountered, the effort must be to cultivate the opposite attitudes.

16) *sthira sukham aasanam*  
Adaptability practice is for establishing stability and ease.

17) *tasminsati shwasa prashwasa gati vicchedana pranayamaha*  
Regulation of inhalation and exhalation leads to breath control.
18) *swavishaya samprayoge chittasya swaroopanukaara ivendriyaanaam pratyahaaraha*

When the thoughts are unlinked from external objects, the senses do likewise, leading to discipline of senses.

19) *deshabandhaschittasya dharanaha*

Binding the thoughts to a specific object is concentration.

20) *tatra pratayaikataanataa dhyaanam*

Extended and singular concentration is meditation.

21) *tadevaartatranirbhasam swaroopashoonyamiva samaadhihi*

When meditation is such that only the essence of the object is clear devoid of form, it is equanimity.

22) *triyamekatra samyamaha*

The three together (concentration, meditation, equanimity) is equanimous contemplation.

23) *satwapurushayoho shudhisamyame kaivalyam*

True equanimous contemplation on one’s true essence leads to true-freedom

24) *tatah kleshakarma nivrittihi*

Thence, there is cessation of the cycle of conditioning of consciousness and so the suffering.

25) *purusharthashoonyaanaam gunaanaam pratiprasavah kaivalyam swaroopa pratishtaa vaa chittishakteriti*

When the personal qualities move towards the true essence, it leads to being one with the true essence and so to true freedom.
PRAYOGA program is not offered as a cure for any disease. It is a system of mind-body practices grounded in science to help reduce distress and suffering. It is a procedure for bringing awareness, clarity and common sense into the present moment of human condition and the great potential of our body and mind for transformation by enhancing our resilience to stress, facing adversities, illness and pain with the wisdom that each of us is endowed with.

The curriculum of the PRAYOGA program can be completed in four sessions, each session lasting one hour of more. The sessions are offered on an out-patient clinic basis. The sessions have been conducted flexibly on four separate days at weekly intervals or less as per the convenience of the patient. Audio visual aids are used in the form of multimedia presentations and practical demonstrations of techniques. Assignments are provided and then discussed in the sessions.

The PRAYOGA program is an integrated holistic therapeutic intervention and follows a full assessment of the physical and mental status. On-going assessments are done at each contact before commencement of the session and at follow-ups. Follow-up sessions are used to reinforce and consolidate the principles and practice. There are no reported adverse effects of the program.

The following section (8.2) presents a small clinical study of the application of the PRAYOGA program demonstrating its effectiveness in a routine clinical setting.
8.2 A Brief Clinical Study of PRAYOGA in Chronic Distress due to Chronic Pain


8.2.1 INTRODUCTION

Pain is a protective mechanism that is necessary for survival. Pain is a reaction or a response to damage or threat to the integrity of the organism. It activates the healing process to restore integrity. Pain can therefore be considered as a normal phenomenon. Chronic or persistent pain is abnormal pain. Pain persists for a long time much beyond the time by which healing is expected to be complete. Chronic pain produces chronic distress. Distress is a neuropsychological phenomenon with brain mechanisms underlying the suffering.

Chronic pain is established in the peripheral and central neuronal circuits due to negative neuroplasticity. Due to abnormal over-sensitization and deconditioning of the neuropsychological mechanism, a vicious cycle gets established perpetuating the distress. Due to an abnormality, pain signals are generated spontaneously from over-sensitized regions and circuitry in the brain which are not controlled by inhibitory mechanisms and balances in the brain.

Distress is prolonged due to effect on the limbic system modulated stress and emotional response. Apart from bodily symptoms of fatigue, tension, heaviness, tightness, tingling, low energy levels and decreasing activities, etc. psychological symptoms also occur like excessive anxiety, worry, depression, mental tension, disturbed sleep, disturbance of appetite, irritability, poor concentration, decreased motivation, etc. These together contribute to the chronic distress.

Management of chronic pain and associated chronic distress requires a combined physical and psychological approach. Normal ways of managing this
pain or ineffective. The patient has to understand the nature of the distress and develop ways of self-management which can reduce distress and optimize social and occupational functioning. The clinician can empower the patient through education and teaching of techniques derived from Mind Body Medicine (MBM).

PRAYOGA is a mind-body medicine program and an acronym for ‘Proactive Ashtanga Yoga’ and ‘Progressive Reconditioning Algorithm to Yield Optimum Gain in Action’.

The PRAYOGA program as described above, was offered to patients attending a neuropsychiatric clinic conducted by the author. The PRAYOGA is a further modification and refinement of the Mind Body Medicine Program that the author was offering to his patients based on Cognitive Behaviour Therapy (CBT) and Mindfulness, called Mindfulness Based Cognitive Behaviour Therapy (MBCBT) described elsewhere.

After the initial assessment of the patient in the first contact, and baseline recording of the subjective distress, the concept of PRAYOGA was discussed with the patient along with education about chronic pain and concept of distress. Subsequent sessions included education and skills training based on the PRAYOGA paradigm.

The PRAYOGA program consisted of three to four sessions, each session lasting for about an hour or longer. Follow-up sessions were to assess progress, record subjective distress and reinforce the continued application and practice of the knowledge and skills.

8.2.2 OBJECTIVE AND PURPOSE

The objective of this study was to highlight the clinical outcome of using the PRAYOGA program developed by the author in an out-patient clinic setting for the treatment of chronic distress resulting from chronic pain conditions. The purpose was to demonstrate the effectiveness of an evidence-based Mind Body
Medicine intervention based on the Ashtanga Yoga principles derived from Patanjali Yoga Sutras, developed by the author.

8.2.3 DESIGN AND METHOD

This very brief study was an open clinical observational study with mixed semi-quantitative and qualitative aspects.

8.2.3.1 Subject Characteristics:

The sample was a convenience sample of twenty patients attending a private out-patient clinic. They were referred by other medical professionals as they were deemed to have a strong psychological component in their presentation of chronic pain.

All were suffering from chronic pain and also had prominent symptoms for a diagnosis of a psychiatric condition. Twelve of the patients were professionals working in the Information Technology industry, two were graduate students, three were post-graduate students, and two were home makers and one was a retired engineer and writer.

Among the patients, nine were female and eleven male. The age range was between 20 years and 60 years. The duration of the chronic pain ranged between about 2 years to about 10 years. The diagnosis was a chronic pain condition in the musculoskeletal system. All had additional symptoms to consider a working psychiatric diagnosis (diagnosis was clinical and no psychiatric classificatory system like DSM-5 or ICD-10 was used for diagnosis).

<table>
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<tr>
<th>No.</th>
<th>Patient Initials</th>
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<th>Diagnosis</th>
<th>Duration of the condition</th>
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<td>M</td>
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<td>Fibromyalgia + Chronic Stress</td>
<td>2 years</td>
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<td>ST</td>
<td>F</td>
<td>25</td>
<td>Headache + Dysthymia</td>
<td>2 years</td>
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<tr>
<td>03.</td>
<td>GS</td>
<td>F</td>
<td>20</td>
<td>Fibromyalgia + Chronic Stress</td>
<td>2 years</td>
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8.2.3.2 Measurement:

The subjects were asked to rate their subjective distress resulting from their condition using a simple visual scale created by the author for routine clinical use based on the Faces Pain Scale. (Figure 22)

![DISTRESS SCALE]

Figure 22: Subjective Distress Scale

The patients rated their subjective distress on the scale and the baseline ratings were the scores before the commencement of the PRAYOGA program on the first assessment. Subjective distress was recorded again after four weeks, after 12 weeks and at the end of 24 weeks follow-up respectively. Follow-up assessment was either face to face or via telephone or e-mail. Table 3 shows...
the scores at baseline and on subsequent follow-ups at the end of week 4, week 12 and week 24 respectively.

<table>
<thead>
<tr>
<th>No.</th>
<th>Patient Initials</th>
<th>PRAYOGA sessions attended</th>
<th>Distress Scale Scores</th>
<th>Baseline</th>
<th>4 Weeks Follow-up</th>
<th>12 Weeks Follow-up</th>
<th>24 Weeks Follow-up</th>
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Table 3: Patients’ Ratings on the Subjective Distress Scale

8.2.4 ANALYSIS AND RESULTS

The twenty patients were available for follow-up either through face to face consultation, telephone or e-mail. Feedback was taken, and the ratings of subjective distress were recorded. They were also provided counselling to reinforce the concept of self-management of their condition. Some patients continued to receive intermittent physiotherapy. Some continued to take pain
medications for a while but had discontinued the medications by six months. None of them were prescribed any psychiatric medication.

Of the three patients who had hypothyroidism and had been prescribed thyroid supplement, two patients had reduced the dose to the minimum (Levothyroxine 25 micrograms/day) and one had been advised to discontinue the medication. The positive aspects reported by the patients were: being better informed about their condition, being in control of their pain, being better able to manage stress, greater awareness, better concentration, able to pace themselves, reduced tension, improvements in mood, thinking and decision making.

Quantitative data analysis was done using the SPSS statistical package (developed by IBM, USA). The changes in the means of the ratings on the subjective distress scale indicates significant improvements over time. These are highly significant. The One-Way Analysis of Variance (ANOVA) for correlated samples shows a p value < 0.0001. The Tukey Honest Significant Difference (HSD) test which compares all possible pairs of means also show significance with p values < 0.01. (Figure 23, Tables 4,5 and 6)

Mean of Subjective Distress Ratings:

At First Visit (Baseline): 7.9
At 04 Weeks: 5.5
At 12 Weeks: 4.2
At 24 Weeks: 2.7
Figure 23: Change in the Mean Subjective Distress Scores over time

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<td>ΣX</td>
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<td>Std.Err.</td>
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Table 4: Data Summary for Calculation of One-Way ANOVA

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<th>Df (degree of freedom)</th>
<th>MS (Mean Square)</th>
<th>F (F-Statistic)</th>
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<td>79</td>
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Table 5: One-Way ANOVA for Correlated Samples
Tukey HSD Test

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<th>Significance</th>
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<td>P &lt; .01</td>
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<tr>
<td>M1 vs M3</td>
<td>0.84</td>
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<td>M1 vs M4</td>
<td></td>
<td>P &lt; .01</td>
</tr>
<tr>
<td>M2 vs M3</td>
<td></td>
<td>P &lt; .01</td>
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<tr>
<td>M2 vs M4</td>
<td></td>
<td>P &lt; .01</td>
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<tr>
<td>M3 vs M4</td>
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<td>P &lt; .01</td>
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M1 = Baseline Mean, M2 = Week 4 Mean, M3 = Week 12 Mean, M4 = Week 24 Mean

Table 6: Tukey Honest Significant Difference (HSD) Test

8.2.5 DISCUSSION

Pain is a normal physiological phenomenon serving the useful purpose of protection. When the pain is abnormal as a result of negative or aberrant neuroplasticity, it is pathological and brings about over-sensitization and deconditioning of the mind-body system leading to prolonged distress. The PRAYOGA program brings greater awareness into one’s mind-body system. It trains the individual to recondition his/her mind-body system reducing the oversensitivity. This allows the patient suffering from prolonged distress to get a deeper understanding of the self and the pain mechanisms. They learn techniques of self-management. There is a paradigm shift in their understanding of their condition. Thus they become mindful and feel more in control of the pain and so also their lives leading to wellbeing and better quality of life.

The program clarifies and emphasises that patients are provided realistic hope in that they may not be able to get rid of the pain entirely but they can definitely weaken its effect and control over the body-mind. The changes achieved are long lasting. Some patients may require booster or refresher sessions to remind, refresh and reorient the patient but by and large once they have the insight and are empowered they are able to self-manage.
8.2.6 LIMITATIONS

This is a very small clinically based informal study. The sample size is very small. It lacks the rigor of a double blind randomized controlled study which is the gold standard of clinical studies. It would have also been useful to have formally assessed the general assessment functioning (GAF) and the quality of life (QoL) through standardized scales which were not done in this study.

Distress is a human emotional and a mental concept and hence very subjective. Feelings can fluctuate considerably. Subjective self-reports may not be very accurate and may be biased. Mind does not follow linear dynamics as in physics and therefore any attempt to measure any phenomenon of consciousness is only arbitrary.

8.2.7 RECOMMENDATIONS

It would be helpful to do further studies involving larger sample sizes. Ideally a double blind randomized controlled trial would make the evidence more robust.

Longer term cohort studies could be undertaken to look at the longer term benefits and also to see if the health gains are sustained over a long period.

Public health studies could be undertaken to test the program as a preventive medicine intervention. The studies can be extended to specific chronic non-communicable disease conditions and chronic mental disorders.

From a clinical point of view, the program can be considered effective and a valuable addition to the tools of mind body medicine for the therapeutic management of chronic distress due to physical and associated mental conditions as a result of chronic pain.

8.2.8 CONCLUSION
There is a gradual change in the current approaches to management of chronic pain in particular and medical disorders in general. The biological model though can be very useful especially in acute situations has proved to be inadequate. The transformative care approach to healthcare takes a broad based bio-psycho-socio-spiritual model. Better outcomes are achieved using a multidisciplinary approach with the coming together of different expertise and also traditions. This requires a change in the mind-set of patients and professionals.

This is a brief clinical report to highlight the possibilities and potentials of mind-body medicine informed program based on knowledge and wisdom of the ancient and traditional practice of yoga as expounded in the Yoga Sutras of Patanjali. The PRAYOGA program is a novel adaptation of the tenets of the Ashtanga Yoga of Patanjali which forms the core of the practice of yoga into evidence-based and practical mind-body medicine intervention for suffering in the form of subjective distress due to chronic pain conditions.