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## MiYoga: A randomized controlled trial of a mindfulness movement program based on hatha yoga principles for children with cerebral palsy - A study protocol

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**Study Protocol**

**Title:** MiYoga: A randomized controlled trial of a mindfulness movement program based on hatha yoga principles for children with cerebral palsy - A study protocol

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## ABSTRACT

**Introduction:** Cerebral Palsy (CP) is the most common childhood physical disability, with life-long impacts for 1.77 in 1000 children<sup>1</sup>. Although CP is primarily a physical disability, children with CP have an increased risk of experiencing cognitive difficulties, particularly attention and executive function deficits.<sup>2-4</sup> Impairment in cognitive abilities can lead to subsequent impairment in independent functioning, education, employment, and interpersonal relationships. This paper reports the protocol of a randomized controlled trial of a novel family-centered lifestyle intervention based on Mindfulness and Hatha Yoga (MiYoga). MiYoga aims to enhance child and parent outcomes for children with CP.

**Methods and analysis:** The aim is to recruit 36 child-parent dyads (children 6-16 years old; bilateral or unilateral CP; GMFCS I-III) who will be randomly assigned to two groups: MiYoga and waitlist control. Mindfulness and Hatha Yoga techniques in the MiYoga program will be facilitated in a group format. Assessments will be administered at baseline, following completion of MiYoga, and at 6-month follow-up (retention). The primary outcome will be the child's sustained attentional ability as measured by the Conner's Continuous Performance Test (CPT). Other outcomes of interest for children with CP consists of attentional control, physical functioning, behavioural and wellbeing. For parents, the outcomes of interest are mindfulness, psychological flexibility and wellbeing. Data will be analyzed using general linear models, specifically analysis of covariance and analysis of variance.

**Ethics and dissemination:** Full ethical approval for this study has been obtained by the Children's Health Queensland Hospital and Health Service Research Ethics Committee (HREC/12/QRCH/120) and The University of Queensland (2012000993). If MiYoga is

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2  
3 proven effective, its dissemination would assist children with CP and complement their on-  
4  
5 going therapy by; improving the ability of the child to pay attention at school and in therapy,  
6  
7 and alleviating environmental stressors for both the child and their parents.  
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9

10 **Trial Registration:** ACTRN12613000729729;

11  
12 <http://www.ANZCTR.org.au/ACTRN12613000729729.aspx>  
13  
14

15 **Date of Trial Registration:** prospectively registered on 2/07/2013 – present (ongoing).  
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17

18 **Findings to Date:** Recruitment is complete. Data is still being collected at present. We aim  
19  
20 to complete data collection by Feb 2017.  
21  
22

23 **Strengths and Limitations of this study:**  
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- 26  
27 • To our knowledge this is the first randomized controlled trial exploring the benefits of  
28  
29 a mindfulness-based movement intervention for children with cerebral palsy.  
30  
31
- 32 • MiYoga is designed to be a lifestyle intervention so that children and parents will be  
33  
34 able to continue practice at home in their everyday lives after the complete of the  
35  
36 program.  
37
- 38 • MiYoga is fun and developmentally appropriate and is adaptable to the needs of the  
39  
40 child and/or parent.  
41
- 42 • All participants will be offered MiYoga before completion of the study for ethical  
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44 reasons.  
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## INTRODUCTION

Cerebral Palsy (CP) is the most common physical disability in childhood with life-long impact for 1.77 in 1000 children.<sup>1</sup> Cerebral palsy is caused by non-progressive damage to the fetal or infant brain that results in motor and postural difficulties.<sup>5</sup> In addition to the physical impairments which are the diagnostic features of CP, children can also experience cognitive and psychological difficulties.<sup>6-8</sup> The motor and cognitive difficulties are often accompanied by disturbances of sensation, communication, perception, behavior problems, and/or by a seizure disorder.<sup>5,7</sup>

Present therapies focus primarily on physical difficulties faced by children with CP<sup>9</sup> despite the fact that children with CP also have an increased risk of experiencing cognitive difficulties. In 2009, the Australia Cerebral Palsy Register reported that 1 in 3 children with CP experience cognitive difficulties.<sup>3</sup> More recent studies reported that 1 in 2 children with CP had an intellectual disability<sup>7</sup> and compared to typically developing children, children with CP have attention and executive function deficits.<sup>2,4</sup> These impairments in attention and executive function may explain why children with CP have increased social and learning problems.

### Attention

Attention is the foundation of most cognitive and neuropsychological functions in our everyday life. It is a cognitive ability that underpins and influences executive function and other cognitive outcomes such as self-control (inhibition), decision-making, goal setting, planning, problem solving, emotional responses and behavior. Three basic concepts about the attention system were suggested.<sup>10</sup> The first is that the attention system: that it is anatomically separate from neural systems for processing incoming sensory stimuli, making decisions, and producing outputs; that it depends on a network of anatomical areas; and that

1  
2  
3 these anatomical areas carry out different functions that can be specified in cognitive terms.

4  
5 They further proposed that the attention system is divided into three networks, each  
6  
7 representing a different set of attentional processes, namely alerting, orienting and executive  
8  
9 attention (or executive control) networks.  
10

11  
12 The alerting network, is a 'bottom-up', stimulus-driven or exogenous attention system (e.g.,  
13  
14 visual, auditory, originating from any position in space). These describe attentional  
15  
16 processing which is driven by the properties of the sensory objects themselves. For example,  
17  
18 a sudden loud noise or motion can attract our attention and we attend to them whether we  
19  
20 want to or not.<sup>11</sup> This network is thought to involve both the parietal and temporal areas of  
21  
22 the brain, as well as the brain stem arousal systems.<sup>10</sup>  
23  
24

25  
26 Orienting and executive networks are both 'top-down' processes, which are together, also  
27  
28 known as goal-driven, endogenous attention, attentional control or executive attention.<sup>10</sup>  
29

30  
31 These two attentional networks focus on our ability to voluntarily select and orient attention  
32  
33 to relevant stimuli or tasks, a process mediated primarily by the frontal cortex and basal  
34  
35 ganglia.<sup>10 12</sup> Orienting can be measured by the speed and accuracy of responses to cues that  
36  
37 indicate where a stimulus may later occur on a computer screen. The executive network  
38  
39 involves mechanisms for monitoring and resolving conflict when two responses are  
40  
41 simultaneously called for by a stimulus among our thoughts, feelings and responses. Within  
42  
43 this executive network, attentional switching and, the ability to disengage from distracting  
44  
45 stimuli and re-engage attention to the relevant task/stimulus, is an important part of executive  
46  
47 attention. Previous studies have confirmed that two networks are related to executive  
48  
49 functions,<sup>10 13</sup> working memory<sup>14</sup> and conflict resolution and inhibition.<sup>15</sup>  
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53  
54 Both orienting and executive networks of attention are critical for the ability to maintain and  
55  
56 focus attention on a given task, referred to as sustained attention. Sustained attention is a  
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1  
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3 core executive function and can be defined as the ability to maintain an alert, goal-directed  
4  
5 focus in the absence of an external stimulation.<sup>16</sup> Difficulty maintaining goal-directed  
6  
7 attention can interfere with non-cognitive aspects of therapy and rehabilitation. For example,  
8  
9 the capacity to self-sustain attention has been shown to predict motor recovery in adults  
10  
11 following a right hemisphere stroke over a 2-year period<sup>17</sup> This finding suggests that it is  
12  
13 imperative to address sustained attention deficits in the development of interventions and  
14  
15 rehabilitation programs.  
16  
17

18  
19 In the three-network model of attention,<sup>10</sup> each network has different implications for  
20  
21 problems in everyday life. Impairments in attention in children, may lead to reading  
22  
23 problems,<sup>18</sup> poorer math achievements<sup>19,20</sup> and poor self-confidence and general cognitive  
24  
25 impairments,<sup>21</sup> poor executive function and executive attention such as working memory  
26  
27 which are usually associated with poorer social skills<sup>22,23</sup> and problem behaviors.<sup>23</sup>  
28  
29 Consequently, in order for all children to learn and benefit from school, therapy, and from  
30  
31 their environment, they must be able to focus and sustain their attention.  
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34

### 35 36 **Cognitive Abilities in Children with CP**

37  
38 Recent studies demonstrated that attention, executive function and other intellectual  
39  
40 capabilities were impaired in children with CP.<sup>2,4,6,7,24</sup> A cross-sectional study evaluated  
41  
42 sustained attention in 10 adolescents with CP through a visual Continuous Performance Test  
43  
44 (CPT).<sup>4</sup> The results indicated that sustained attention and inhibition capabilities were  
45  
46 impacted in CP even after controlling for motor deficits by using eye movements to measure  
47  
48 sustained attention. Another study investigated attention and executive function in children  
49  
50 with unilateral and bilateral spastic CP.<sup>2</sup> Four subtests from the Wechsler Intelligence Scale  
51  
52 for Children (WISC-III), namely, information, similarities, comprehension, and vocabulary  
53  
54 were used to measure general cognitive functioning. They also used three subtests from the  
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3 Test of Everyday Attention for Children (TEA-Ch)<sup>25</sup> to measure selective attention (Sky  
4 Search), sustained attention (Score!) and divided attention (Sky Search Dual Task).

5  
6  
7 Executive functions were assessed by the Contingency Naming Test (CNT) and the teacher  
8 version of the Behavior Rating Inventory of Executive Function (BRIEF). The results  
9  
10 demonstrated that impairments in sustained attention, divided attention, inhibition, switching  
11  
12 and general executive function were present in children with CP.  
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17 Few interventions exist that aim to increase children's ability to sustain their attention on task  
18  
19 or selectively focus their attention on appropriate stimuli. Previous research explored  
20  
21 attention and problem-solving training for children with Attention Deficit Hyperactivity  
22  
23 Disorder (ADHD),<sup>26</sup> children with learning disabilities and co-morbid ADHD.<sup>27</sup> In addition,  
24  
25 some studies investigated efficacy of interventions that may increase attentional abilities in  
26  
27 children with traumatic brain injury<sup>26 28</sup> and for the late effects of treatment for childhood  
28  
29 cancer.<sup>29</sup> There is a paucity of research on interventions to improve attention in children with  
30  
31 CP.  
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33

### 34 35 36 **Mindfulness and Attention**

37  
38  
39 In recent years, several investigators have proposed theoretical explanations of how the  
40  
41 practice of focused attention through Mindfulness (awareness of the present moment) training  
42  
43 can enhance and develop attention regulation.<sup>30-33</sup> Mindfulness practice involves sustaining  
44  
45 attention on a chosen object, such as the breath, an object, or a mantra, and directing attention  
46  
47 to that object while sustaining this focused attention for as long as possible. In order to  
48  
49 sustain this focus, one must monitor the quality of this focus. For example, while focusing on  
50  
51 the rise and fall of the chest with each breath, one might notice their attention has shifted to  
52  
53 something that happened during the day, or what they would like for dinner later. At some  
54  
55 point they would realize their focus has wandered and let go of their distraction and re-attend  
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3 to their breath. Mindfulness is the state of awareness of the thoughts or feelings that arise  
4  
5 when our mind wander. This awareness gives us the opportunity to inhibit the more  
6  
7 dominant response of rumination and switch our attention back to the point of focus.  
8

9  
10 It has been proposed<sup>31</sup> that this type of monitoring of one's attention and focus consists of  
11  
12 three types of attention regulation; (i) monitoring the present-moment (i.e. detect mind  
13  
14 wandering), (ii) attentional switching (i.e. disengage from a distracting object/thought  
15  
16 without further involvement), and (iii) selective attention (i.e. ability to redirect focus  
17  
18 promptly back to target object). Researchers reason that Mindfulness training entails  
19  
20 extended practice of these attentional abilities.<sup>34-36</sup>  
21  
22

23  
24 These proposed theoretical models of the cognitive mechanism of Mindfulness have inspired  
25  
26 experimental research examining the effects of Mindfulness training on attention  
27  
28 performance. The effects of Mindfulness practice on the three attention networks (alerting,  
29  
30 orienting, and conflict monitoring) were examined by Jha and colleagues (2007) using the  
31  
32 Attention Network Test (ANT).<sup>37</sup> Attentional efficiency was assessed before and after an  
33  
34 eight-week Mindfulness-Based Stress Reduction (MBSR) course administered to meditation-  
35  
36 naïve participants, as well as a one-month intensive Mindfulness retreat attended by  
37  
38 experienced meditators, compared to an eight-week no treatment control group. The retreat  
39  
40 group showed better conflict monitoring at baseline than participants in the control and  
41  
42 MBSR groups, suggesting that executive attention improves with long-term exposure to  
43  
44 Mindfulness meditation. The retreat group had improved alerting among the previously  
45  
46 experienced meditators. The authors concluded that Mindfulness training improves voluntary  
47  
48 (top-down; endogenous) attentional control leading to improved orienting and /or conflict  
49  
50 monitoring, and prior experience with concentrative meditation allows for the development of  
51  
52 improved bottom-up, receptive attention involved in alerting. It may be that Mindfulness  
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3 training improves the functioning of each of the attentional subsystems at various points in  
4  
5 the course of Mindfulness training.  
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7

## 8 **Yoga**

9  
10 Traditional yoga is a Mindfulness practice that directs attention towards the present  
11  
12 moment.<sup>38</sup> The aim of yoga is to calm and unify the mind, body and breath to promote  
13  
14 positive health, self-awareness and spirituality.<sup>39</sup> Yoga postures, known as *asana* in Sanskrit,  
15  
16 are the third of the eight ‘limbs’, or practices, of yoga according to the traditional texts of the  
17  
18 Yoga Sūtras of Patañjali. *Asana* directly translates to “posture” and was derived from the  
19  
20 Sanskrit root word *as* which means “to be”, “to sit”, “to stay” or “to be established in a  
21  
22 particular posture”.<sup>40</sup> The Yoga Sūtras of Patañjali describes *asana* as having two important  
23  
24 qualities. The first quality is steadiness and alertness, while the second quality of *asana* is the  
25  
26 ability to remain comfortable in a posture.<sup>39</sup> That is, when practicing *asana*, both of these  
27  
28 qualities should be present. The combination of performing *asana* with  
29  
30 pranayama (breathing techniques), comprise the style of yoga commonly referred to as Hatha  
31  
32 Yoga. Hatha Yoga unites the actions of the body, breath and mind by the synchronization of  
33  
34 movement with the breath which in turn directs the practitioner’s attention and awareness to  
35  
36 the present. The unity of body and mind is what makes traditional Hatha Yoga an embodied  
37  
38 mindfulness practice.  
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## 45 **Mindfulness and Yoga for Children**

46  
47 In the pediatric literature, it has been documented that Mindfulness and yoga improves  
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49 memory in school children,<sup>41</sup> cognitive function in children with mental retardation,<sup>42</sup>  
50  
51 planning abilities and executive function in healthy school aged girls,<sup>43</sup> as well as attention,  
52  
53 behavior and emotional control in healthy children and children with Attentional Deficit  
54  
55 Hyperactive Disorder (ADHD).<sup>44</sup> It has also been documented that yoga increases balance,  
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3 motors skills and strength, as well as the quality of life and general well-being in a range of  
4  
5 different participant groups.<sup>45-48</sup>  
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8 Mindfulness-based Stress Reduction (MBSR)<sup>49</sup> programs bring together Mindfulness and  
9  
10 Hatha Yoga techniques. The aim of MBSR is to cultivate greater awareness of the unity of  
11  
12 mind and body, as well as of the ways the unconscious thoughts, feelings, and behaviors can  
13  
14 undermine emotional, physical, and spiritual health. The underlying principles for  
15  
16 Mindfulness training in MBSR program are to (a) be non-judgmental, (b) be patient, (c) see  
17  
18 the world as if for the first time, (f) accept seeing things as they are without trying to change  
19  
20 anything, (g) and let go of attachment to repetitive thoughts, actions or beliefs. The features  
21  
22 of MBSR are group interaction, formal and informal meditation practice, daily homework  
23  
24 and a one day silent retreat.<sup>49</sup> The formal practice includes Mindfulness meditation and  
25  
26 mindful movements in the form of Hatha Yoga. The informal practices include mindful  
27  
28 eating and walking. Although a number of studies explored the effectiveness of MBSR in the  
29  
30 adult population,<sup>50 51</sup> there is a paucity of randomized controlled trials that explore the effects  
31  
32 of a developmentally appropriate MBSR program for children.  
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38 School-age children are interested in yoga as a mind-body therapy for pain and other  
39  
40 ailments.<sup>52</sup> By adapting a Mindfulness-base program for children, with a focus on mindful  
41  
42 movements through Hatha Yoga, it may provide a developmental approach to Mindfulness  
43  
44 training. Yoga has been shown to improve body awareness in adults,<sup>53</sup> and it may teach  
45  
46 children and adolescents about their growing bodies as they become more aware of their  
47  
48 bodies and their movements. As children are also naturally more active, teaching them  
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50 Mindfulness through movements using traditional Hatha Yoga postures along with the some  
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52 Mindfulness exercises to begin with, may be more developmentally appropriate than teaching  
53  
54 them the more traditional seated Mindfulness meditations. This remains to be tested.  
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3 The mindful movement program in this project, MiYoga, combines both cognitive  
4 (mindfulness) and physical (yoga postures) aspects into therapy. It has the potential to assist  
5 children with CP to alleviate any negative effects of environmental stressors by focusing their  
6 attention on the present moment so that they can fully focus on activities at school, in therapy  
7 or when interacting with peers. At the same time, Hatha Yoga may provide additional  
8 physical benefits to complement the on-going therapy for children with CP. MiYoga will  
9 also be delivered to both the child and parent, this enables parents to facilitate and monitor  
10 the MiYoga approach, which is likely to improve translation and implementation of  
11 techniques into everyday life. This project will test the efficacy of a mindful movement  
12 (MiYoga) program administered to children with CP and one of their parents. The MiYoga  
13 program would be an adjunct to children's on-going rehabilitation therapy and would provide  
14 a means of working with the whole family.

### 30 **Aim**

31  
32 The focus of this study is to design and test a novel mindful movement program, MiYoga,  
33 and to investigate its efficacy for enhancing sustained attention in children with CP. Efficacy  
34 will be tested in a randomized controlled trial (N=36) with an intervention group (MiYoga  
35 program + standard care) compared to a wait-list control group receiving standard care alone.  
36 This enables all participating children to receive the intervention, maximizing participant  
37 recruitment and retention and fulfilling ethical obligations to participating children and  
38 families. Outcomes measures will be taken at baseline, immediately post-intervention and at  
39 follow-up 6 months post intervention.

40  
41 Qualitative interviews will also be conducted with each child and parent participant  
42 individually. The aim of these interviews is to collect the participants' perceptions of the  
43 MiYoga program.

## Hypotheses

It is hypothesized that, compared to the waitlist control group the MiYoga group will show improvements in the following child outcomes:

- 1) Sustained attention (Conner's Continuous Performance Test (CPT II)) ;
- 2) Executive function (information processing, attentional control, cognitive flexibility, working memory and behavioral manifestations of executive function in daily life);
- 3) Psychological functioning (Strengths and Difficulties Questionnaire (SDQ));
- 4) Physical capacity including functional strength (Sit-to-stand, Half-kneel to stand and Lateral step up tests), and flexibility (Sit and Reach test);
- 5) Present-moment awareness (Child and Adolescence Mindfulness Measure (CAMM));
- 6) Quality of life (CP-QOL-Child or CP-QOL-Teen)

In addition, it is hypothesized that the MiYoga group will show improvements in the following parent outcomes:

- 7) Mindfulness (Mindfulness Awareness Attention Scale (MAAS));
- 8) Parent psychological wellbeing (Depression Anxiety and Stress Scale (DASS));
- 9) Parent's psychological flexibility (Acceptance and Action Questionnaire ((AAQ-2));
- 10) Parent's personal wellbeing (Personal Wellbeing Index – Adults (PWI-A)); and
- 11) Child-parent relationship (Child-Parent Relationship Scale (CPRS)).

## METHODS AND ANALYSIS

### Ethics

Full ethical approval for this study has been obtained by the Behavioral and Social Sciences Ethical Review Committee of The University of Queensland (2012000993) and Children's Health Queensland Hospital and Health Service Research Ethics Committee (HREC/12/QRCH/120). Protocol modifications and amendments will be submitted to the

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2  
3 ethical committees for approval. This trial has been registered with the Australian New  
4  
5 Zealand Clinical Trials Registry (ACTRN12613000729729). All families will be given  
6  
7 written informed consent to participate and their parents or guardians prior to entering into  
8  
9 the trial.  
10

### 11 12 **Recruitment**

13  
14 Thirty-six children with a diagnosis of CP with spastic motor type, either diplegia (bilateral  
15  
16 CP) or hemiplegia (unilateral CP) motor distribution and one of their parents will be recruited  
17  
18 into the MiYoga study. Children must also have sufficient co-operation and cognitive  
19  
20 understanding to follow simple instructions. The primary parent of eligible children will  
21  
22 participate alongside their child. Children with co-morbid diagnoses to CP are included.  
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25  
26 Children will be excluded if they have (i) received upper-limb or lower-limb surgery in the  
27  
28 previous 6 months; (ii) unstable epilepsy (i.e. frequent seizures not controlled by medication);  
29  
30 (iii) spinal instability or other spinal problems that would prevent them from participating  
31  
32 safely in the MiYoga program; (iv) have a medical condition that would prevent them from  
33  
34 participating safely in the MiYoga program; or (v) parents/guardians who are pregnant as a  
35  
36 safety precaution. Diagnosis of CP must be confirmed by the treating pediatrician or  
37  
38 clinician and in accordance with published recommendations.  
39  
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41  
42 Eligible children living in South East Queensland, Australia, will be recruited through patient  
43  
44 databases of Queensland Cerebral Palsy Rehabilitation Research Centre (QCPRRRC) at the  
45  
46 Royal Children's Hospital and the Queensland Cerebral Palsy Register, and via referrals from  
47  
48 clinicians in the Queensland Pediatric Rehabilitation Service (QPRS). Potential participants  
49  
50 will be invited to participate in the study via letters and follow up phone calls. Flyers and  
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52 posters will displayed in the reception areas of clinics, and clinicians will be informed of the  
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54 study, and encouraged to refer appropriate patients to the program. External advertising will  
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3 include a webpage on The University of Queensland School of Psychology website and a  
4  
5 study flyer or a brief description of the study will also be advertised in some South East  
6  
7 Queensland schools' newsletters and notice boards.  
8

9  
10 Participants will be assessed for eligibility and enrolled in the study by the study coordinator  
11  
12 as they provide informed consent. The study will be explained to parents by a member of the  
13  
14 research team, and signed written consent will be obtained, acknowledging that the children  
15  
16 and parents are aware of all study requirements, consent to take part, give permission for  
17  
18 researchers to access their child's medical records, agree to the video-recording and  
19  
20 photographs of sessions, and understand that they are free to withdraw their consent at any  
21  
22 time. It is anticipated that enrolment will commence in September 2013.  
23  
24

## 25 **Design**

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27  
28 This study will utilize a randomized waitlist controlled trial design to evaluate the efficacy of  
29  
30 the MiYoga program compared to waitlist control (care as usual) for children with CP, aged 6  
31  
32 to 16 years old (see Figure 1 for CONSORT flow chart). After each participating child and  
33  
34 parent completes their baseline assessments they will be randomly allocated to one of two  
35  
36 groups:  
37  
38

- 39 1. Immediate MiYoga Group (Group 1) – Families commence MiYoga program  
40 immediately for 8 weeks.  
41  
42
- 43 2. Waitlist MiYoga Control (Group 2) - Families continue care as usual for 8 weeks and  
44 then are re-assessed before commencing a future MiYoga Program. Care as usual  
45 consists of any therapies (for example, occupational therapy, physiotherapy,  
46  
47 psychologist) usually provided by public or private services and visits to their treating  
48  
49 pediatrician or general practitioner.  
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55 To limit confounding variables during the immediate intervention period (baseline to 8 week  
56  
57 follow up), children scheduled to receive casting, splinting, or intramuscular botulinum toxin  
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3 type A [BoNT-A] injections during the immediate intervention period will not be eligible.  
4  
5 Participants who have received intramuscular BoNT-A prior to beginning the study will have  
6  
7 their baseline assessments postponed until one month after their standard follow up has been  
8  
9 completed. Questionnaires will record the type, frequency and duration of any concurrent  
10  
11 therapies provided by public and private services during the study for all participants.  
12  
13

### 14 **Randomization**

15  
16 Prior to the intervention, participants will be asked to complete baseline assessments and  
17  
18 questionnaires. Once these are completed, participants will be randomly assigned to either  
19  
20 the wait-list group or immediate group and informed of the dates and times of their group.  
21  
22 The randomization sequence will be computer-generated. Treatment allocations will be  
23  
24 recorded pieces of paper, which will be folded and placed inside sealed, numbered, opaque  
25  
26 envelopes by a staff member not involved in the study. A staff member not involved in the  
27  
28 study will also open consecutive envelopes as each participant returns their baseline  
29  
30 questionnaires. After the randomization process is complete, study personnel will be  
31  
32 informed of group allocation and information packs will be sent out to families. Given the  
33  
34 nature of the study, no parties will be blinded to group assignment. The experimental design  
35  
36 and outcome measures are depicted in Figure 1.  
37  
38  
39  
40

### 41 **Figure 1. INSERT FLOWCHART OF MIYOGA STUDY DESIGN**

### 42 **Adverse Events**

43  
44  
45 There are no known health or safety risks associated with participation in the described study  
46  
47 and the risk of adverse events is low. The ethical review process and conduct of the trial is  
48  
49 monitored by the two ethics committees therefore no additional Data Monitoring Committee  
50  
51 is considered necessary.  
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3 Any minor or major events associated with intervention or usual care groups will be  
4  
5 monitored through out the 8-week program duration. The chief investigators KW and RB will  
6  
7 review any adverse events or unintended effect detected.  
8  
9

### 10 **Study Procedure**

11  
12 All participants will attend baseline assessments (T1) before being randomly allocated into  
13  
14 either the immediate MiYoga group or the waitlist control group. Participants in the  
15  
16 immediate group will begin the 8 week MiYoga program within three weeks of their baseline  
17  
18 assessment, while the waitlist group will continue care as usual for the next 8 weeks. When  
19  
20 the immediate group has completed the MiYoga program, all participants from both groups  
21  
22 (immediate and waitlist) will be re-assessed (T2) at. The waitlist group can then commence a  
23  
24 future MiYoga group of their choice. For each participant, data will be collected at Baseline  
25  
26 (T1) and following the immediate MiYoga group's completion of the program at 8 weeks  
27  
28 (T2). The waitlist group will also complete assessments after they have completed the  
29  
30 MiYoga program at 16 weeks (T3). Both groups will complete their follow up assessments  
31  
32 24 weeks after completing the MiYoga program – this will be 32 weeks post-baseline for the  
33  
34 immediate group and 40 weeks post-baseline for the waitlist group (T4). Participants will  
35  
36 complete their assessments within three weeks of the target time-points (in weeks) listed  
37  
38 above.  
39  
40  
41  
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43

44 Catherine Mak (CM), the principal researcher, a registered psychologist and a qualified yoga  
45  
46 teacher will conduct all the assessments and MiYoga sessions. A physiotherapist from the  
47  
48 QCPRRC will perform the physical screen assessment for each child at baseline. In addition,  
49  
50 they will be present at the initial assessment to provide professional advice to the child, the  
51  
52 parent/guardian and to the psychologist/yoga teacher regarding the child's ability to perform  
53  
54 various yoga postures and the adaptations that may be necessary. Either a physiotherapist or  
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3 the principal researcher (CM) will conduct the physical assessments. Participants are  
4 encouraged to complete their online questionnaires in person during their assessment session,  
5 if they prefer they may also complete them online from home (via Qualitrics Insight  
6 Platform). Registered clinical and developmental psychologist Dr Koa Whittingham (KW)  
7 will provide regular supervision. In addition, study coordinator will be able to consult with  
8 Professor Roslyn Boyd (RB), a registered physiotherapist, if there are any physical concerns.  
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### 20 **MiYoga Intervention**

21  
22 Following randomization (immediate MiYoga group) or the Time 2 neuropsychological and  
23 physical assessments (waitlist control group), participants and their parents will complete the  
24 MiYoga program. All MiYoga sessions will be delivered in a group format where possible.  
25 Child-parent dyads in the waitlist control group will also receive the same intervention after a  
26 delay. In two-parent families, one of the parents will be invited to attend all sessions, and the  
27 same parent must complete all the questionnaire measures.  
28  
29  
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36

37 The MiYoga program is an 8-week program that consists of six 90-minute sessions over the  
38 initial six weeks then two phone or Skype consultations over the last 2 weeks of the program.  
39 Over these 8 weeks, children and their parent or guardian are asked to partake in a minimum  
40 of 20 minutes daily at home practices. To assist with participants' home practice, a MiYoga  
41 DVD and a MiYoga poster developed by the principal researcher will be provided at the first  
42 MiYoga session. The MiYoga DVD is based on the Mindfulness exercises and *asana*  
43 delivered in the group sessions. The MiYoga poster is also made up of the *asana* delivered in  
44 the group sessions. In addition, it includes child specific modifications identified from the  
45 initial assessment session. Each MiYoga poster will contain general instructions as well as  
46 general and specific modifications for how parents may assist their child. Where possible a  
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3 photo of the child performing the postures with their modifications will also be included.  
4

5 Researchers will assess the child's abilities in each of the yoga postures and provide  
6  
7 modifications for the child as required in each posture. These modifications will be  
8  
9 documented and put into the respective child's poster for them to take home and practice.  
10

11 This will ensure that participants will not attempt any new exercises or poses at home without  
12  
13 assistance and guidance from a therapist (see Appendix A for a MiYoga program summary).  
14

15  
16  
17 MiYoga is a program based on Mindfulness and Hatha Yoga techniques. There are formal  
18  
19 and informal Mindfulness activities. The formal Mindfulness activities consist of mindful  
20  
21 movements in the form of Hatha Yoga and short Mindfulness meditations. The informal  
22  
23 activities present Mindfulness techniques as game-like explorations, based on exploring our  
24  
25 internal and external worlds with the five senses as well as consciously reflecting on thoughts  
26  
27 and feelings. These activities and games were developed based on literature on mindfulness  
28  
29 and yoga for both children and adults.<sup>39 40 49 54-64</sup>  
30  
31

32  
33 For example, children may have to guess what they are eating while blind folded. This game  
34  
35 will involve the child to consciously notice the food with all their senses, such as by feeling  
36  
37 the texture of the food in their hands and mouth, smelling and tasting it, and possibly even  
38  
39 hearing the sounds the food makes when chewing it (and subsequently noticing crunchy,  
40  
41 chewy or soft foods). Children may have to identify an object by exploring it only with their  
42  
43 hands (sense of touch) and then describe how the object feels in their hands to another person  
44  
45 without naming the object. This game encourages the child to use their sense of touch to  
46  
47 explore their environment and increase their awareness of how the sense of touch provides  
48  
49 them with information about their surroundings. Such activities are both interesting for the  
50  
51 participants, but are also mindful practices that stimulate a state of awareness.  
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3 The Hatha Yoga techniques or postures in this study were based on Viniyoga principles<sup>39</sup>  
4  
5 and they were tailored for children with cerebral palsy. The synchronization of breath and  
6  
7 movement is a key element as it helps to focus the mind on the present (i.e. moving through  
8  
9 yoga postures with the breath) providing a mindful movement practice. To make  
10  
11 synchronizing breath and movement more natural and fun for children, participants were  
12  
13 invited to make sounds along with the instructor, such as “Ahh...”, in the asana sequences to  
14  
15 assist with their exhalation. The aim of a mindful movement practice for these children and  
16  
17 adolescence is to enhance their attentional abilities, while the yoga postures selected for the  
18  
19 program aims to help them build strength and increase flexibility (see Appendix B for a table  
20  
21 and illustrations of the MiYoga postures for children with cerebral palsy). The yoga postures  
22  
23 will be modified as required for each participant. Some of the modifications consists of using  
24  
25 supports such a wall, chair, bolster or blocks to ensure correct posture, adequate support and  
26  
27 comfort, or to accommodate muscle shortness or postural difficulties. For example, some  
28  
29 children sat on a block to keep their pelvis level and to accommodate their shorter hamstring  
30  
31 muscles and leading to posture pelvic tilt within long sitting. These physical modifications  
32  
33 are individualized to each child’s need based on the baseline physical screen by a  
34  
35 Physiotherapist. The physical adaptations may not be the same for all children with CP while  
36  
37 some children did not require any physical modifications. For this reason Appendix B  
38  
39 mainly consists of illustrations of the non-adapted postures with some illustrations of possible  
40  
41 modifications. In addition to the physical modifications, verbal prompts were used to guide  
42  
43 the children into the postures, for examples “going as far as it is comfortable for you, this  
44  
45 may be coming forward to thighs or your knees” or “notice the sensation in the back of your  
46  
47 legs as you fold forward, you may like to explore how it feels for you to keep your knees  
48  
49 straight as you come forward” and a verbal prompt for children to sit with good alignment  
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3 (avoid W-sitting) may be “as we sit back onto our heels be mindful that your knees and big  
4  
5 toes are together”.

6  
7  
8 Each session will be 90 minutes with guided instruction throughout each component of  
9  
10 Mindfulness practice. During Hatha Yoga postures, instructions will be provided on safe  
11  
12 ways to get in and out of the positions, pose modification, and use of props to suit needs and  
13  
14 limitations of each child. For instance the supine twist can be performed on a chair rather  
15  
16 than on the ground. Blankets, cushions, bolsters, straps, and other props may be used to  
17  
18 maintain body alignment, structural support, and comfort (see Appendix B’s possible  
19  
20 modification column for more details). Emphasis will be placed on building length along the  
21  
22 spine while maintaining neutrality of spinal position, keeping awareness of the breath, and  
23  
24 using breath and sensations within the body to anchor attention to the present moment.  
25  
26  
27

### 28 29 **Locations**

30  
31 It is expected that groups and assessments will be conducted in Brisbane, and various  
32  
33 locations in South East Queensland. Locations in Brisbane will include The University of  
34  
35 Queensland, St Lucia and Herston campuses, and the Centre for Children’s Health Research  
36  
37 in South Brisbane. If participants are located outside of Brisbane then suitable locations will  
38  
39 be organized with the participating families in those areas.  
40  
41

### 42 43 **Participation and Data Management**

44  
45 To maximize participation and retention, email reminders will be sent to participants three  
46  
47 days prior to their scheduled appointments, and SMS text message reminders will be sent to  
48  
49 participants the day prior to their appointments and their weekly MiYoga sessions. In order  
50  
51 to further promote recruitment, participation and retention, the study offers a waitlist control  
52  
53 group so that all participants have an opportunity to take part in the MiYoga program. It is  
54  
55 also possible to extend the period of recruitment and the delivery MiYoga groups should  
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3 recruitment be more challenging than anticipated. The number of participants recruited and  
4  
5 participant retention will be recorded throughout the trial period.  
6  
7

8 Treatment dose will be calculated based on participants' attendance at the weekly MiYoga  
9  
10 sessions as well as the amount of home practice completed by participants between sessions.  
11

12 The therapist will record participant attendance after each weekly MiYoga session, and  
13  
14 parent participants will record the amount of home practice they completed each week in  
15  
16 their MiYoga diary. The MiYoga diaries will be collected weekly and monitored by the  
17  
18 therapist. Strategies to facilitate and support engagement in the program will be discussed  
19  
20 with the participant and their parents throughout the duration of the MiYoga program in the  
21  
22 group sessions as well as via individual phone calls.  
23  
24

25 Paper copy data will be de-identified and physically stored in a locked file cabinet at the  
26  
27 QCPRRC. These physical documents may be scanned (after de-identification) and password  
28  
29 protected in a computer file on a secure server. Computer files will be de-identified and  
30  
31 password protected on a secure server.  
32  
33

34 Video files of the MiYoga sessions will be used to monitor therapy fidelity and assess for  
35  
36 therapist integrity and consistency across groups. These video files will be managed and  
37  
38 kept on a secure online database run through QCPRRC and back up files may be kept on a  
39  
40 external harddrive or CD in a locked cabinet.  
41  
42  
43

44 Study updates and general outcomes will be sent to participants in a newsletter format. A  
45  
46 summary report of the overall study findings will also be sent to participants at the conclusion  
47  
48 of the project. Feedback on the specific formal assessments will be provided when requested  
49  
50 by the participant or parent.  
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#### 54 **Participant Characteristic Measures**

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3 The following questionnaires and assessments will be completed at baseline, prior to the  
4  
5 intervention, to gather information about the sample of children with CP and their parents:  
6

7  
8 *Gross Motor Function Classification System (GMFCS)*

9  
10 The GMFCS classifies, across 5 levels, a child's ability to carry out self-initiated sitting and  
11 walking movements.<sup>65</sup> A correlation between the GMFCS and the Gross Motor Function  
12 Measure (GMFM) of  $r=0.91$  suggests construct validity has been obtained.<sup>66</sup> GMFCS also  
13  
14 has good inter observer reliability between professionals as well as between professionals and  
15  
16 parents in children with CP.<sup>67</sup>  
17  
18  
19

20  
21 *Brief Health Questionnaire (BHQ)*

22  
23 The Brief Health Questionnaire (BHQ) was developed to screen for existing medical  
24 conditions that may prevent the child or the parent to participant in MiYoga, with separate  
25 questionnaires for children and parents. (see Appendix C).  
26  
27  
28

29  
30 *Physical screening clinical examination*

31  
32 A physiotherapist will conduct this examination to determine if the participating child has  
33 any physical conditions that might preclude them from exercise (see Appendix D).  
34  
35

36  
37 *Wechsler Intelligence Scale for Children–Fourth Edition Short Form (WISC-IV;*  
38  
39 *Wechsler, 2003)*

40  
41 Intellectual functioning will be assessed using the Wechsler Intelligence Scale for  
42 Children fourth edition short form (WISC-IV).<sup>68</sup> The WISC-IV comprises seven subtests that  
43 generate the four indices of verbal comprehension (VCI), perceptual reasoning (PRI),  
44 working memory (WM), and processing speed (PSI). From these overall short form index  
45 scores a full scale intelligence quotient (FSIQ) score can be calculated. In the WISC-IV short  
46  
47 form the VCI index is made up of the Vocabulary and Similarities subtests. The Vocabulary  
48 subtest assesses knowledge of word meanings and will require participants to name pictures  
49 or provide spoken definitions of words (e.g., “what is a bicycle?”). The Similarities subtest  
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3 assesses verbal abstraction and reasoning and will require participants to describe how two  
4 words are similar (e.g., “how are anger and joy alike”). The Block Design and Matrix  
5 Reasoning subtests make up the PRI index in the WISC-IV short form. Block design will  
6 require participants to construct abstract visual designs with a set of red-and-white 3D blocks  
7 within a specified time period. Matrix Reasoning, will require participants to use their non-  
8 verbal abstract reasoning and problem solving skills in order to select the correct picture from  
9 an array of five options that fits into the missing space of a visual design. The WMI index is  
10 made up of the Digit Span subtest in which participants will be required to repeat a number of  
11 verbally presented digits in forward and reverse order. Finally, the PRI index is made up of  
12 the Coding and Symbol Search subtests, each of which has a two-minute time limit and  
13 therefore require participants to work as quickly as possible without making mistakes. For  
14 the Coding subtest, participants will need to match abstract symbols with a number key while  
15 for Symbol Search, participants will be required to detect the presence of one or more  
16 symbols in a sequence of five.<sup>68</sup>

17  
18 Scaled scores will be derived from index scores in accordance with normative data based on  
19 the child’s age and gender (mean=100, standard deviation [SD]=15).<sup>69 70</sup> All index scores of  
20 the WISV-IV SF have shown moderate to high levels of internal consistency ( $\alpha=0.87-0.96$ )  
21 and are equivalent to those documented for the full WISV-IV, with the exception of the WMI  
22 which is marginally lower than its full length equivalent.

## 23 24 25 **Primary Outcome Measures**

### 26 27 *Attention*

28  
29 The Conner’s Continuous Performance Test (CPT II) will be used to measure sustained  
30 attention performance.<sup>71</sup> It is a standardized 14-minute computer administered test in which  
31 participants are asked to observe letters displayed on a computer screen and click at the  
32 appearance of each letter, except for that of the letter ‘X’. The stimuli appear at random



1  
2  
3 intervals (1, 2 or 4 seconds) and the duration of each stimulus is 250 milliseconds. This test  
4  
5 measures the time to process information (e.g. Reaction Time (RT)) and errors such as false  
6  
7 negatives or false positives. The test is divided into six equal blocks of 20 trials.  
8  
9

10 Twelve indices from the Conners' CPT will be analyzed. These indices are: (i) Number of  
11  
12 omissions: the number of letters, other than X, not detected; (ii) False positives/  
13  
14 Commissions: the number of responses to the letter X; (iii) Hit Reaction time (RT); (iv)  
15  
16 Standard error (SE) and (v) Variability of RT: indicates consistency of RTs between blocks;  
17  
18 (vi) Detectability: RT distribution of target vs. non-target (X); (vii) Perseverations: responses  
19  
20 with a RT too short (5100 ms) indicating anticipatory responding or responses to a previous  
21  
22 stimuli (suggesting very slow responses/inattentiveness); (viii) Response style: indicates an  
23  
24 over-cautious vs. a highly impulsive response; (ix) Hit RT block change: a high score implies  
25  
26 that, as the test progresses, RTs are longer; (x) Hit SE block change: a high score implies that  
27  
28 as the test progresses, RT variation increases; (xi) Hit RT Inter-Stimulus Intervals (ISI)  
29  
30 change: a high score implies that, as the stimulus interval increased, the RTs became longer;  
31  
32 and (xii) Hit SE ISI change: a high score implies that RT variation increased as the stimulus  
33  
34 interval increased. Some of these indices make up different variables, namely, sustained  
35  
36 attention, inattention and vigilance.  
37  
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42 The primary variable of interest in this study is sustained attention. This is observed through  
43  
44 the participant's responding pattern on the CPT's Hit RT block change, commissions block  
45  
46 change and omissions block change indices. A decrease in sustained attention performance is  
47  
48 captured by significant slowing in participant's HitRT, and significant increase in errors  
49  
50 (ommissions and commissions) as the task progresses. Participant's performance across  
51  
52 blocks 1 and 2 will be compared to their performance across blocks 5 and 6 of the same  
53  
54 administration.  
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3 The indices that measure participant's inattention are poor detectability, a high number of  
4 omission and commission errors, a slow Hit RT, and high variability in RT (HitRT SE).

5  
6  
7 While the indices that measure participant's vigilance (participant's performance at different  
8 stimulus frequency or inter-stimulus intervals), is captured by performance on the Hit RT ISI  
9 change.  
10  
11  
12

### 13 14 15 **Secondary Outcome Measures**

#### 16 17 *Executive functioning*

18  
19 A neuropsychological test battery will be used to evaluate executive attention and other  
20 executive function abilities that consists of selective attention, attentional control, cognitive  
21 flexibility, and working memory. This neuropsychological test battery is comprised of  
22 subtests from the Wechsler Intelligence Scale for Children Fourth Edition (WISC-IV),<sup>68</sup> and  
23 the Delis-Kaplan Executive Function System (D-KEFS).<sup>72</sup> A parent-rated questionnaire, the  
24 Behavior Rating Inventory of Executive Function (BRIEF),<sup>73</sup> will be used as a measure of  
25 day-to-day behavioral manifestations of executive functioning.  
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36 *Digit Span (from the WISC-IV).* The WISC-IV Digit Span subtest is a verbal memory  
37 task requiring participants to repeat a number of digits in the forward and backwards order. It  
38 is a measure of a child's working memory and their ability to temporarily store information.  
39 Digit Span Forward requires the child to repeat a series of numbers given verbally by the  
40 examiner, increasing one digit per item from two digits to a maximal of nine digits. Digit  
41 Span Backward requires the child to repeat given number series in the reverse order (e.g., if  
42 the examiner said "5 – 7 – 4" the child should say "4 – 7 – 5"). A score of one will be given  
43 to each string correctly answered and a total score will be generated (Digit Span Backward  
44 range = 0 – 16). Raw scores can be converted into scaled scores (M = 10, SD = 3). Digit  
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3 Span Backward has a good internal consistency ( $\alpha = .80$ )<sup>70</sup> and a high test-retest reliability ( $r$   
4  
5 = .74).<sup>70</sup>  
6  
7

8 *Symbol Search (from the WISC-IV).* The WISC-IV Symbol Search subtest will be  
9  
10 used as a measure of selective attention. Participants will be required to visually scan a group  
11  
12 of symbols and indicate whether a target symbol is present in the group of symbols by  
13  
14 placing a line through the word 'yes' or 'no' for every item on this subtest. Participant score  
15  
16 are calculated by taking away the total number of incorrectly identified symbols from the  
17  
18 total number of correctly identified symbols. Symbol search has adequate internal  
19  
20 consistency ( $\alpha = 0.79$ ) and a high level of test-retest reliability ( $r = 0.80$ ).<sup>70</sup>  
21  
22  
23

24 *Color-Word Interference Test (from the D-KEFS).* The inhibition condition (cond 3)  
25  
26 of the Color-Word Interference Test will be used to measure attentional control, while the  
27  
28 inhibition/switching condition (cond 4) will be used to measure attentional control and  
29  
30 cognitive flexibility. In the inhibition condition (cond 3), children will be required to name  
31  
32 the ink color that color words are printed in. The total number of errors and the time it takes  
33  
34 to complete the task will be used as outcome measures of attentional control, with the longer  
35  
36 times and more errors indicating poorer attentional control. In the inhibition/switching  
37  
38 condition (cond 4) children will be required to switch between naming the color of the ink  
39  
40 that the word is printed in (like in cond 3) and reading the word (if it is presented in a box).  
41  
42 The total time it takes to complete the task will be used as outcome measures of cognitive  
43  
44 flexibility, while the total number of errors will be used as outcome measures of attentional  
45  
46 control. The Color-Word Interference Test has excellent test-retest reliability ( $r = 0.90$ ).<sup>72</sup>  
47  
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49  
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51 *Trail Making Test (D-KEFS).* The number-letter switching condition (cond 4) from  
52  
53 the Trail Making Test will be used to measure attentional control and cognitive flexibility. In  
54  
55 condition 4 of the Trail Making Test, children will be required to switching back and forth  
56  
57 between connecting numbers in numerical order and letters in alphabetical order, for  
58  
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1  
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3 example, 1 to A to 2 to B to 3 to C and so on all the way to P. The number of errors and the  
4  
5 time it takes to complete the task will be recorded and the more error and the longer it takes  
6  
7 to complete the task indicates greater difficulty with attention control and cognitive  
8  
9 flexibility. Moderate test-retest reliability for number-letter switching condition ( $r=0.20-$   
10  
11  $0.55$ )<sup>74-75</sup> has been documented.

12  
13  
14  
15 *Brief Rating Inventory of Executive Function (BRIEF)*. The BRIEF is a parent-rated  
16  
17 questionnaire for assessing day-to-day behavioral manifestations of executive function.  
18  
19 Parents will be required to rate 86 items (e.g., “gets stuck on one topic or activity”) on a  
20  
21 three-point Likert scale, from 1 (*never*) to 3 (*often*). The provided normative data in the  
22  
23 manual will allow raw scores to be converted into *T* scores (M = 50, SD = 10). Eight  
24  
25 subscales are combined to form the Behavioral Regulation Index (BRI; Initiate, Working  
26  
27 Memory, Plan/Organize, Organization of Materials, and Monitor subscales) and the  
28  
29 Metacognition Index (MCI; Inhibit, Emotional Control, and Shift subscales). Together these  
30  
31 form the overall Global Executive Composite (GEC). *T* scores of 65 or more (1.5 SD above  
32  
33 the mean) indicate elevated levels on the corresponding subscales and indices. Higher *T*  
34  
35 scores indicate greater executive dysfunction. In this study, the GEC will be used as primary  
36  
37 measures of executive function in everyday life. The BRIEF has been shown to be a valid  
38  
39 measure of executive functioning and has good internal consistency ( $\alpha = 0.80 - 0.98$ ) and  
40  
41 high test-retest reliability on the GEC ( $r=0.86$ ).<sup>73</sup>

#### 42 43 44 45 46 47 *Mindfulness*

48  
49 Child and Adolescent Mindfulness Measure (CAMM)<sup>76</sup> assesses present-moment awareness  
50  
51 and nonjudgmental, non-avoidant responses to thoughts and feelings. In this 10-item  
52  
53 questionnaire, children are asked to indicate how each item reflects their experience using a  
54  
55 5-point scale ranging from 0 (Never true) to 4 (Always true). A total acceptance-Mindfulness  
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3 score will be generated by reverse scoring negatively worded items and summing the item  
4  
5 total, yielding a possible range in scores from 0-100. The higher scores indicate higher levels  
6  
7 of acceptance and Mindfulness. This test has been shown to have good internal consistency  
8  
9 ( $\alpha = 0.81$ ).<sup>76</sup>  
10

### 11 12 *Behavioral*

13  
14  
15 Strengths and Difficulties Questionnaire (SDQ)<sup>77 78</sup> is a 25-item parent-report questionnaire  
16  
17 designed to assess their child's behavior and adjustment. The items are divided into 5 scales  
18  
19 to assess the frequency within the last six months of emotional symptoms, conduct problems,  
20  
21 inattention/hyperactivity, peer problems and prosocial behavior. These items are rated on  
22  
23 three-point scale, from zero (*not true*) to two (*certainly true*), allowing for a total score for  
24  
25 each scale (0-10) to be calculated, along with an overall difficulties score that takes into  
26  
27 account overlapping elements of each score (0-40). Higher scores indicate more distress on  
28  
29 all scales except prosocial behavior. In this study, the SDQ total score will be used as  
30  
31 primary measures of children's behavior. SDQ total score has been shown to have a  
32  
33 moderate to high level of internal consistency ( $\alpha = 0.73-0.82$ )<sup>79 80</sup> and a moderate to high test-  
34  
35 retest reliability ( $r=0.77 - 0.85$ ).<sup>78 80</sup>  
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### 40 **Physical Outcome Measures**

#### 41 42 *Flexibility*

43  
44  
45 Lower back and hamstring muscle flexibility will be assessed by the Sit and Reach test (reach  
46  
47 distance). Participants sit on the floor with both legs extended as straight as possible in front,  
48  
49 heels placed on the floor, and feet flat against a wall so that the ankle is dorsiflexed to  
50  
51 approximately 90 degrees. Participants are instructed to stretch their arms straight in front  
52  
53 with hands overlapping (middle fingers overlapping too) and slowly bend forward at the hip  
54  
55 joint reaching as far as possible towards their toes. The maximum reach must be held for 2  
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seconds, and the distance between the tips of the middle fingers to the wall at the top of the toes is recorded.

### *Lower Limb Functional Strength*

The following functional exercises will be used to assess strength.

*Lateral step-up.* Lateral step-up records the number of steps up on to a step from the floor that the child can perform during 30 seconds.<sup>81</sup> The test will be performed on a 10cm high step for all children, with a complete up and down step being one full cycle. The child stands parallel to the step with the leg being tested on the step and the non-testing leg on the floor. They are asked to extend their test leg (on the step) straight and lift their non-test leg off the ground and onto the step and then lower the non-test leg back down to the floor until the foot touches the ground.<sup>82</sup> This is then repeated for the other leg. Reliability for this test is strong (ICC=0.94) and mean repetitions for the lateral step up were 13.2 (SD=10.5; standard error of measurement (SEM)=2.4 reps; CV=17.8%) for the left side, and 12.6 (SD=10.4; SEM=2.6 reps; CV=22.7%) for the right side.<sup>81</sup>

*Sit-to-stand.* The Sit-to-stand functional strength test records the number of sit-stand-sit repetitions that the child can perform within 30 seconds.<sup>81</sup> The test will be performed on a chair where the child's knees and hips are at 90° flexion, upper legs parallel to the floor and feet flat on the floor. The child will be asked to stand up straight so that their hips and knees are extended and then sit back down. Reliability for this test was strong (intra class correlation (ICC) =0.91) and the mean number of repetitions was 14.4 (SD=5.0; SEM=2.6 reps; CV=22.7%).<sup>81</sup>

*Half-kneel to stand.* Half-kneel to stand records the number of repetitions from half kneel to stand the child can perform within 30 seconds.<sup>81</sup> The child is positioned on a mat, with one leg kneeling on the floor while the other leg is in front with the knee at 90° flexion

1  
2  
3 and foot flat on the floor. From this half-kneeling position the child is asked to assume a  
4 standing position. Repetitions are counted each time the participant achieves a standing  
5 position where both legs and hips are extended as much as possible. This is then repeated  
6 with the other leg in front. Reliability for this test was strong (ICC=0.93 to 0.96) and mean  
7 repetitions was 7.5 reps (SD=5.5; SEM=1.1 reps; CV=28.6%) for the left side and 6.0  
8 (SD=5.3; SEM=1.4 reps; CV=39.9%) for the right side.<sup>81</sup>

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*Submaximal motor capacity test.* The 6-minute walk test (6MWT) is a submaximal  
clinical exercise test which measures the distance the child can walk in six minutes.<sup>83</sup> The  
child will be asked to walk as many laps as they can without running for 6 minutes along a  
straight, flat a corridor, between two markers set 10m apart. The 6MWT will be conducted  
with standardized verbal encouragement and the child will be advised on the time remaining  
every minute and the number of laps they have completed as it happens. The 6MWT has  
been demonstrated to be reliable in independently ambulant adolescents with CP and the test-  
retest is excellent (ICC=0.98).<sup>83</sup>

### *Mobility*

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The MobQues28 questionnaire measures mobility limitations a child with CP experiences in  
everyday life as rate by their parents.<sup>84 85</sup> The MobQues28 is score on a 5 point scale from 0-  
4, with 0 being *Impossible without help*; 1 being *Very difficult*; 2 being *Somewhat difficult*; 3  
being *Slightly difficult*; and 4 being *Not difficult at all*. Item scores (range 0–4) are added  
together and then divided by the maximum possible score and multiplied by 100 to obtain  
total scores on a scale of 0 to 100 (lower scores indicate severe limitations in mobility):  
MobQues28=( $\sum$  item / 112)·100. Construct validity was demonstrated as MobQues28 scores  
decreased with increasing GMFCS level (p<0.001) and in a sub group of 162 children,  
MobQues28 score was positively correlated to GMFM-66 (r=0.67, p<0.001).<sup>85</sup> The

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3 MobQues28 has been demonstrated to be reliable with high the interrater reliability  
4  
5 (ICC=0.87), standard error of measurement (SEM) was 8.9. The intrarater reliability was  
6  
7 higher (ICC=0.96-0.97; SEM=4.4-4.9).<sup>84</sup>  
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### 10 *Quality of Life*

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13 *CP QOL-Child.* The CP QOL-Child is a condition-specific quality of life measure for  
14  
15 children with cerebral palsy.<sup>86</sup> Two versions of the CP QOL-Child will be used in this study;  
16  
17 the CPQOL-Child parent report version will be used for all participants under 12 years of  
18  
19 age, and the CPQOL-Child self-report version will be used for children 9-12 years of age.  
20  
21 The parent-report measure of child quality of life is a 66-item questionnaire and the child  
22  
23 self-report version is a 53-item questionnaire. Results of factor analysis demonstrated that  
24  
25 the CPQOL measures 7 broad domains of quality of life: social wellbeing and acceptance,  
26  
27 functioning, participation, physical health, emotional wellbeing, access to services, pain,  
28  
29 impact of disability and family health. In this study, the GEC will be used as primary  
30  
31 measures of executive function in everyday life. The CPQOL-Child has a high internal  
32  
33 consistency ( $\alpha=0.74-0.92$  for parent report and  $\alpha=0.80-0.90$  for child self-report), good test-  
34  
35 retest reliability (ICC=0.76-0.89) and it is moderately correlated with generic QOL and health  
36  
37 measures ( $r=0.30-0.51$ ).<sup>87 88</sup>  
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43 *CP QOL-Teen.* The CP QOL-Teen is a condition specific quality of life measure for  
44  
45 adolescents with cerebral palsy. Two versions of this CP-QOL will also be use: the CPQOL-  
46  
47 Teen parent report version will be completed by parents of participants aged 13-18 and the  
48  
49 CP-QOL-Teen self-report version will be completed by participates 13-18 years of age.<sup>89</sup>  
50  
51 This measure has strong internal consistency ( $\alpha=0.81-0.95$  for the primary parent report, and  
52  
53  $\alpha=0.84-0.96$  for the adolescent self-report), good test re-test reliability for primary parents  
54  
55 (ICC=0.72-0.92) and adolescents (ICC=0.84-0.87). All domains of the CPQOL-Teen parent  
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3 report ( $r=0.40-0.46$ ) and adolescent report ( $r=0.58-0.68$ ) were correlated with a generic QOL  
4  
5 instruments.<sup>90</sup>  
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7

### 8 *Pain*

9  
10 The Baker-Wong Faces™ Pain Rating Scale will be used to assess the child's pain level.<sup>91</sup>  
11  
12 Children will be asked to match which of the six hand-drawn faces show their pain level,  
13  
14 with faces ranging from smiling ('no hurt') to crying ('hurts worst'), with the scale scored  
15  
16 from 0 to 5. It has been documented that Baker-Wong Faces™ Pain Rating Scale has an  
17  
18 excellent test-retest reliability over 15 minutes, 8 hours and immediately post-procedure in  
19  
20 children 3–18 years old ( $r = 0.90 - 0.84$ ).<sup>92 93</sup> There are also strong positive correlations  
21  
22 between the Wong–Baker FACES Pain Scale and other well-established self-report measures  
23  
24 ( $r = 0.74 - 0.78$ ) (e.g., Pieces of Hurt tool, Faces Pain Scale, and a visual analogue scale).<sup>92 94-</sup>  
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### 32 **Parent Outcome Measures**

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35 The following tests will be used to assess the psychological well-being of parents of children  
36  
37 with CP. These assessments will be completed at baseline, pre-intervention, post-  
38  
39 intervention, and at a 6-month follow-up.  
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#### 42 *Mindfulness Attention Awareness Scale (MASS)*

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44  
45 The Mindfulness Attention Awareness Scale (MASS) will be used to measure each parents'  
46  
47 tendency to be mindful of moment-to-moment experiences.<sup>97</sup> The MAAS is a 15 item  
48  
49 instrument focusing on the presence or absence of attention and awareness of their present  
50  
51 immediate environment. Participants are asked to indicate how frequently they have the  
52  
53 experience described in each of the 15 statements using a 6-point Likert scale from 1 (almost  
54  
55 always) to 6 (almost never). For example, one statement is "It seems I am 'running on  
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3 automatic', without much awareness of what I'm doing", while another is "I snack without  
4 being aware that I am eating". The total score is used as outcome measure, with higher  
5 scores reflecting more Mindfulness. This scale has been shown to relate to various aspects of  
6 well-being and to how effectively people deal with stressful life events.<sup>97</sup> The MAAS also  
7 has good internal consistency, with alphas ranging of .82 in student sample.<sup>97</sup>  
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#### 14 15 *Acceptance and Action Questionnaire (AAQ-II)*

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17  
18 The Acceptance and Action Questionnaire (AAQ) assesses the construct referred to as,  
19 variously, acceptance, experiential avoidance, and psychological inflexibility.<sup>98</sup> This 7 item  
20 questionnaire has been documented to have a satisfactory structure, reliability, and validity  
21 with a mean alpha coefficient of 0.84 (0.78–0.88), and the 3- and 12-month test–retest  
22 reliability is 0.81 and 0.79, respectively.<sup>98</sup>  
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#### 29 30 *Depression Anxiety Stress Scale (DASS)*

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33 The Depression Anxiety Stress Scale (DASS) is a 42-item questionnaire that assesses the  
34 presence of psychological symptoms in adults.<sup>99</sup> In this study, a total score will be  
35 computed, range 0–126, higher scores indicate suboptimal states. The measure has shown  
36 high internal consistency for depression ( $\alpha = 0.91$ ), anxiety ( $\alpha = 0.84$ ) and stress ( $\alpha = 0.90$ )  
37 scales. The DASS also has good discriminate and concurrent validity.<sup>99 100</sup>  
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#### 45 46 *Personal Wellbeing Index – Adult (PWI-A)*

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48 The Personal Wellbeing Index – Adult (PWI-A) is an eight item questionnaire that assesses  
49 the ones' level of satisfaction with life as a whole.<sup>101</sup> Each item corresponds to a quality of  
50 life domain, such as: standard of living, health, achieving in life, relationships, safety,  
51 community-connectedness, future security, and spirituality/religion.  
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#### 57 58 *Child–Parent Relationship Scale (CPRS)*

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3 The Child–Parent Relationship Scale (CPRS)<sup>104</sup> is a 15-item questionnaire that use a 5-point  
4 rated scale and it is completed by the parent to assess the quality of the parent–child  
5 relationship.<sup>102 103</sup> The CPRS is an adaptation of the Student–Teacher Relationship Scale  
6 (STRS) , which has been used extensively in studies of relationship quality in the US  
7 (National Institute of Child Health and Development Early Child Care Research Network,  
8 n.d.).<sup>104</sup> In this study, the overall conflict score and closeness score will be used as  
9 measures of parent-child relationship quality.  
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### 19 **MiYoga Session Measures**

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21  
22 The following tests were developed to measure the mechanism of change due to the MiYoga  
23 intervention. Both child and parent participants will complete these measures either before  
24 and after or just after each MiYoga session.  
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27  
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#### 29 *Mindfulness*

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31  
32 MiYoga Session Mindfulness Measure is a 5-item scale adapted from the CAMM. It  
33 measures children and parent’s Mindfulness in the MiYoga session they have just completed.  
34 Each child and parent will complete this Mindfulness scale at the end of each MiYoga  
35 session (see Appendix E).  
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#### 42 *Mood*

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45 The Mood Scale is a short scale used to measure participants’ mood or how they are feeling  
46 before and after each MiYoga session. It is a 1 to 5 scale with 5 being very good and 1 being  
47 very bad where 5 matched with a happy face, 3 is matched with a neutral face and 1 is  
48 matched with a sad face (see Appendix F).  
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#### 55 *Session feedback*

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2  
3 At the end of each MiYoga session, children and parents will each be asked to complete a  
4  
5 Session Feedback Scale. This is a short four item questionnaire asking the participants about  
6  
7 the session in regards to comfort, enjoyment, body awareness and overall satisfaction. Each  
8  
9 of these questions is also on a 0 to 10 scale, with 10 being high (or very good) and 0 being  
10  
11 low (or very bad; see Appendix G).  
12

### 13 14 15 **Qualitative Interviews**

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17  
18 A short interview will be conducted with individual participants post-MiYoga program at the  
19  
20 end of the program by a registered psychologist or a probationary psychologist under  
21  
22 supervision. The interviewer will be unrelated to the MiYoga study to avoid bias and to  
23  
24 encourage participants to express their view and opinions about the program freely. The aim  
25  
26 of these interviews is to gather qualitative information such as what the participants liked or  
27  
28 disliked about the program and what worked and what did not work for them. This  
29  
30 qualitative information will help with program refinement and translation. For example, it  
31  
32 will provide information on how Mindfulness and yoga can be integrated into participants'  
33  
34 everyday life (see Appendix H for qualitative interview script and questions).  
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### 38 39 **STATISTICAL ANALYSIS**

#### 40 41 **Sample Size**

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44 It has been documented that the reaction time of children with CP was two standard  
45  
46 deviations below healthy controls on the Continuous Performance Test (CPT)<sup>4</sup>. The present  
47  
48 study is interested in detecting a difference of one standard deviation between the immediate  
49  
50 treatment and control group at Time 2 (post-intervention) to determine the clinical  
51  
52 significance of the MiYoga program compared to waitlist control. Based on Lehr's equation  
53  
54 with alpha set at 0.05 and power set at 0.80, to detect a difference of one standard deviation  
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3 between groups, a sample size of 16 participants per group would be needed<sup>105</sup>. If a  
4  
5 retention rate of 90% is assumed, a total of 36 children will need to be recruited.  
6  
7

### 8 **RCT data analysis**

9  
10 Analysis will follow standard principles for RCTs, using two-group comparisons on all  
11  
12 participants on an intention-to-treat basis. Any missing data in the event of withdrawal or  
13  
14 loss to follow up, a participant's assessment from the last available time-point will be carried  
15  
16 forward. External and internal validity of results will be checked using baseline and general  
17  
18 descriptive information available for all eligible families; comparing the characteristics of  
19  
20 families who completed the study with those who enrolled in the study but did not complete,  
21  
22 and those who did not enroll. The primary comparison immediately post intervention (T2)  
23  
24 will be scores from the Continuous Performance Test.  
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28  
29 Analysis will follow standard methods for randomized controlled trials using comparisons  
30  
31 between the two groups (MiYoga and wait-list control). The experimental unit will be the  
32  
33 child and their participating parent. Attrition analysis will be conducted. Data will be  
34  
35 analysed using Statistical Package for the Social Sciences (SPSS). The hypotheses relating to  
36  
37 intervention efficacy will be tested using general linear models, specifically via analysis of  
38  
39 covariance (ANCOVA). In addition, predictors of treatment outcome will be explored using  
40  
41 regression analyses. Non-parametric methods will be used for simple comparisons in cases  
42  
43 where continuous data exhibit substantial skewness not overcome by transformation.  
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### 48 **Qualitative data analysis**

49  
50 The qualitative interviews will be audio recorded and transcribed verbatim. Transcripts will  
51  
52 be read and coded by two study investigators. Coding will involve identifying themes or  
53  
54 patterns, such as ideas, concepts, terminology or phrases. Once these themes are identified,  
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3 the investigators will discuss the appropriateness of their themes and develop a coding  
4  
5 framework based on their themes until consensus is achieved. The researchers will then re-  
6  
7 read the transcripts and organize the themes into categories and sub categories based on the  
8  
9 coding framework they have developed.  
10

## 11 12 **ETHICS AND DISSEMINATION**

13  
14  
15 Full ethical approval for this study has been obtained by the Behavioral and Social Sciences  
16  
17 Ethical Review Committee of The University of Queensland (2012000993) and Children's  
18  
19 Health Queensland Hospital and Health Service Research Ethics Committee  
20  
21 (HREC/12/QRCH/120). Protocol modifications and amendments will be submitted to the  
22  
23 ethical committees for approval. This trial has been registered with the Australian New  
24  
25 Zealand Clinical Trials Registry (ACTRN12613000729729). All families will be given  
26  
27 written informed consent to participate and their parents or guardians prior to entering into  
28  
29 the trial. If found to be effective, MiYoga has the potential to be disseminated as a lifestyle  
30  
31 intervention for families. The study results will be disseminated through publication in  
32  
33 scientific journals, presentation at relevant conferences and directly to the families who  
34  
35 participated in the study. The dissemination would assist children with CP and complement  
36  
37 their on-going therapy by; improving the ability of the child to pay attention at school and in  
38  
39 therapy, and alleviating environmental stressors for both the child and their parents.  
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## 44 45 **DISCUSSION**

46  
47 This proposed study presents the background and design for a randomized waitlist controlled  
48  
49 trial investigating the efficacy of an 8 week Mindfulness and Yoga program to for children  
50  
51 and adolescence with an CP and one of their parents. To our knowledge this study is the first  
52  
53 to investigate the effects of a family centred Mindfulness-based yoga program for children  
54  
55 and adolescence with CP. Furthermore, we will be evaluating children's cognitive, physical,  
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3 behavior and emotional outcomes as well as parents' psychological well-being. The  
4  
5 qualitative information, such as what the participants liked or disliked about the program, will  
6  
7 help provide information on how Mindfulness and yoga can be integrated effectively into  
8  
9 participants' everyday lives. It is anticipated that the results of this study will be  
10  
11 disseminated through peer reviewed journals and national and international academic  
12  
13 conferences.  
14

15  
16  
17 Current models of rehabilitation for children with CP solely focus on physical rehabilitation.  
18  
19 MiYoga provides a holistic approach while the Mindfulness and yoga techniques can be  
20  
21 integrated easily into the child and their families' everyday life. If MiYoga is found to be  
22  
23 effective, multi-disciplinary teams will have an evidence-based mode of therapy to offer that  
24  
25 is an engaging lifestyle intervention, incorporates cognitive rehabilitation, and tools to teach  
26  
27 families valuable skills for the rest of their lives.  
28  
29

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32  
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34  
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36  
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38  
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40  
41 also supported by Merchant Charitable Foundation through Children's Health Queensland.  
42  
43  
44

### 45 46 **Contributions**

47  
48 CM is the chief investigator (CI) and together with KW and RB designed and established this  
49  
50 research study. CM was responsible for ethics applications and reporting. CM was  
51  
52 responsible for recruitment. CM was responsible for data collection and implementation of  
53  
54 the training program. CM will take lead roles on preparation for publications on the clinical  
55  
56 outcomes of the study. KW, RB and RC will contribute to the preparation of publications  
57  
58  
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3 within their respective fields of expertise. CM will take on a lead role of the statistical  
4  
5 analysis for the study. CM drafted the final version of this manuscript. All authors critically  
6  
7 reviewed and approved the final version. All data from this study will be submitted to peer  
8  
9 review journals. CM will use the data from this study to contribute to her PhD thesis.  
10

### 11 12 **Competing Interests**

13  
14  
15 MiYoga was developed by first author. There are no other competing interests to declare.  
16

### 17 18 **Ethics approval and consent to participate**

19  
20  
21 Full ethical approval for this study has been obtained by the Behavioral and Social Sciences  
22  
23 Ethical Review Committee of The University of Queensland (2012000993) and Children's  
24  
25 Health Queensland Hospital and Health Service Research Ethics Committee  
26  
27 (HREC/12/QRCH/120). All families will be given written informed consent to participate  
28  
29 and their parents or guardians prior to entering into the trial.  
30

### 31 32 **Consent for Publication**

33  
34  
35 Consent to publish was obtained from both the individual and from the parent of the child  
36  
37 whose photographs are presented in this manuscript.  
38

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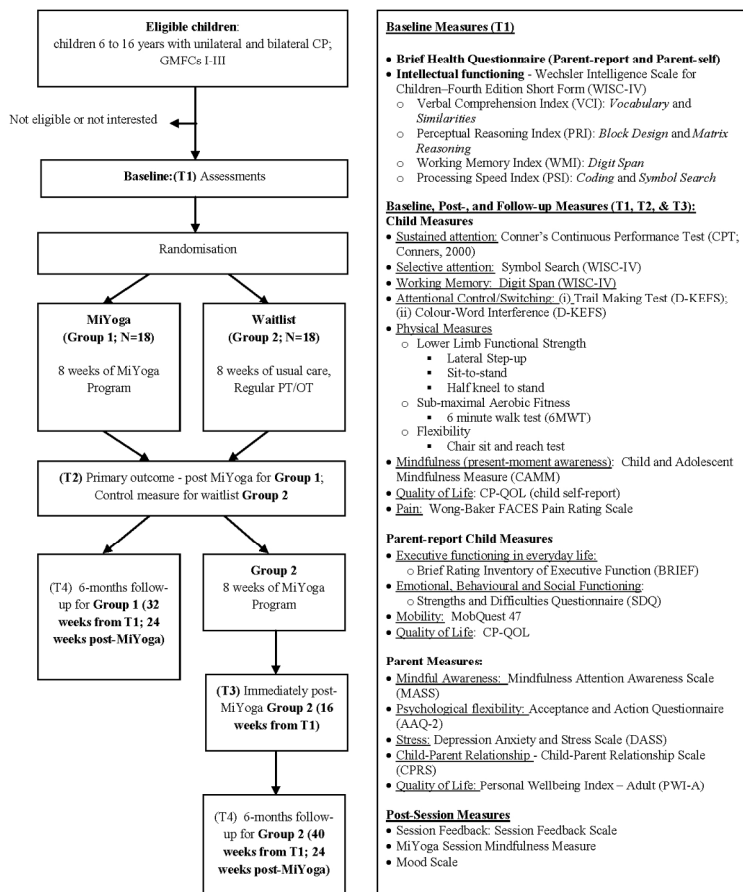


Figure 1. Flow chart of MiYoga study design

210x297mm (200 x 200 DPI)

Appendix A  
MiYoga Program Summary

Week	Theme	Welcome	Introduction to Mindfulness	Hatha Yoga	End of Session
<b>1</b>	Explore our everyday life with awareness in the present moment  Focus of session is on being mindful while performing yoga postures; and to teach participants their individualised modifications	Getting to know you – pass the ball around in a circle.  Explain the that over the next 6 weeks we are be training to be explorers of our feelings, our thoughts and things in our everyday life  <ul style="list-style-type: none"> <li>• Housekeeping</li> <li>• Give out MiYoga packs</li> <li>• Set group rules</li> </ul>	Introduction to mindfulness and mindful movements ie. raise arms with awareness and discuss if they feel any different.	Go through yoga postures.  Therapist will teach participant their modifications to each posture and teach participants how to safely go in and out of each posture.  <b><u>Mindfulness relaxation</u></b>  Progressive muscle relaxation exercise	Discussion - what they experienced through their exploration today and time for any questions.  Remind them of their homework 20 minutes of practice a day along with poster and CD and to record their daily practices in their diary.  Complete end of session questionnaires.
Week	Theme	Review and Mindfulness Explorations	Hatha Yoga	Mindfulness relaxation	End of Session
<b>2</b>	Senses: Feel/Touch	Review last session and briefly discuss home practice in the last week.  Introduction to Feel/Touch  Exploration exercises <ol style="list-style-type: none"> <li>1) Feel and describe object with hands</li> <li>2) Whose hands are they?</li> <li>3) Mirror Me</li> </ol>	Practise yoga postures.  Therapist will monitor participant's progress and continue to modify the poses as the child progresses in each posture.	Body Scan	Discuss what they experienced during the body scan and from the session.  Remind them of their homework 20 minutes of practice a day along with poster and CD and to record their daily practices in their diary.  Complete end of session questionnaires.

Week	Theme	Review and Mindfulness Explorations	Hatha Yoga	Mindfulness relaxation	End of Session
3	Hearing	Review last session and briefly discuss home practice in the last week.  Exploration exercises What do you hear? Sound exercises - clasp hands over ears, what do you notice? Make sounds with our breath – practice the ocean breath, pranayama (yogic breathing exercises)	Practise yoga postures.  Incorporate ocean breath into the postures by linking movement with inhalation and exhalation.  Therapist will monitor participant's progress and continue to modify the poses as the child progresses in each posture.	Mindfulness of sound – Tibetan bowl	Discuss what they experienced/heard during the mindfulness exercise and from the session today.  Remind them of their homework 20 minutes of practice a day along with poster and CD and to record their daily practices in their diary.  Complete end of session questionnaires.
Week	Theme	Review and Mindfulness Explorations	Hatha Yoga	Mindfulness relaxation	End of Session
4	Seeing	Review last session and briefly discuss home practice in the last week.  Introduction to Seeing  Exploration exercises What colour eyes do your friends have? What did you see? Mindfulness of the hand	Sound exercises  Pranayama exercises  Incorporate sound into the postures by linking sounds with exhalation.  Therapist will monitor participant's progress and continue to modify the poses as the child progresses in each posture.	Short body scan and short imagery script	Discuss what they experienced from the session today.  Remind them of their homework 20 minutes of practice a day along with poster and CD and to record their daily practices in their diary.  Complete end of session questionnaires.

Week	Theme	Review and Mindfulness Explorations	Hatha Yoga	Mindfulness relaxation	End of Session
5	Taste & smell	Review last session and briefly discuss home practice in the last week.  Introduction to taste and smell  Exploration exercises 1) What are you eating? 2) Mindful eating 3) Mindful drinking	Eye movements  Sound exercises  Pranayama exercises  Practise yoga postures  Therapist will monitor participant's progress and continue to modify the poses as the child progresses in each posture.	Body Scan or Progressive muscle relaxation or Mindfulness of breath or Mindfulness of sound	Discuss their experienced from the session today.  Remind them of their homework 20 minutes of practice a day along with poster and CD and to record their daily practices in their diary.  Complete end of session questionnaires.
Week	Theme	Review and Mindfulness Explorations	Hatha Yoga	Mindfulness relaxation	End of Session
6	Thoughts & feelings	Review last session and briefly discuss home practice in the last week.  Introduction to feelings – can be pleasant and unpleasant but like senses it is helpful. Exploration exercises 1) Explore thoughts and feelings through listening to short stories and/or music 2) Discussion of thoughts and feelings that arise in our lives. 3) Bubbles of thoughts and feelings exercise	Eye movements  Sound exercises  Pranayama exercises  Practise yoga postures  Therapist will monitor participant's progress and continue to modify the poses as the child progresses in each posture.	Short body scan and finding a comfortable place	Discuss thoughts and feelings about the session.  Remind them of their homework 20 minutes of practice a day along with poster and CD and to record their daily practices in their diary.  Organise times for phone/skype consultations  Complete end of session questionnaires.




Week 7	Theme	Review	Q & A and problem solve obstacles to practice	Planning and Setting Goals
<b>Phone consultation</b>	Maintaining MiYoga practice	Review and briefly discuss home practice in the last week  Was daily practice maintained? What were barriers to practice? What helped/encourage practice?  Any other questions regarding mindfulness or their practice?	Address participants questions  Problem solve ways to overcome barriers to practice – be as specific as possible  Revisit – reasons for practice - Benefits of yoga and mindfulness	Goals and plans in regards to practice for the next week - be as specific as possible
Week 8	Theme	Review	Q & A and problem solve obstacles to practice	Planning and Setting Goals
<b>Phone consultation</b>	Maintaining MiYoga practice	Review and briefly discuss home practice in the last week  Was daily practice maintained? What were barriers to practice? What helped/encourage practice?  Any other questions regarding mindfulness or their practice?	Address participants questions  Problem solve ways to overcome barriers to practice – be as specific as possible  Revisit – reasons for practice - Benefits of yoga and mindfulness	Goals and plans to continue practice - be as specific as possible  Discuss maintaining practice over time



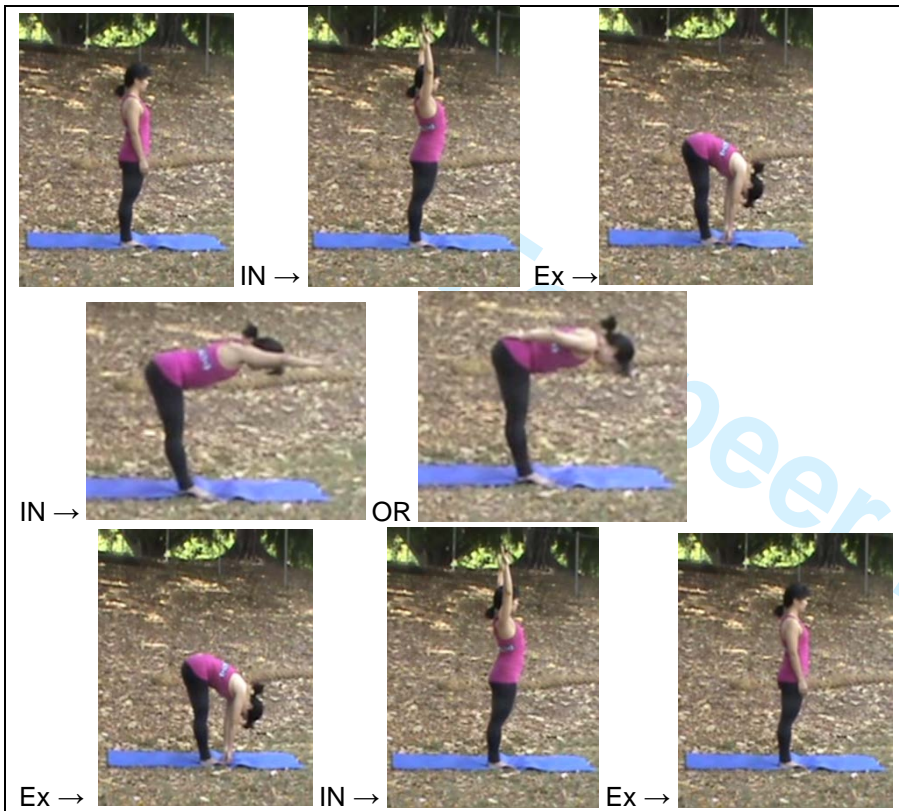
Appendix B

Table 1

MiYoga Postures

Illustration of Posture	Posture	Physical Benefits	Possible Modifications
 <p>Inhale (IN) → Exhale (Ex) →</p> <p>IN → Ex → IN → Ex →</p>	<p><b>Warm-Up</b></p>	<p><b>Strengthens:</b></p> <ul style="list-style-type: none"> <li>• legs</li> <li>• arms</li> <li>• torso</li> </ul> <p><b>Lengthens:</b></p> <ul style="list-style-type: none"> <li>• back of the body</li> <li>• back of the legs</li> </ul> <p>Induces balance</p>	<p>If required, have support (e.g. table/chair/wall) in front or to the required side.</p>  <p>This posture can also be performed in a chair or wheelchair</p>  <p>Provide prompts for children to keep their knees straight in forward bend (if standing) and only to go as far as they are comfortable when bending forward. Encourage children to bear weight evenly on both left and right sides.</p>

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**Half Forward Bend**

**Strengthens:**

- legs
- arms
- torso

**Lengthens:**

- back of the body
- back of the legs




Induces balance

If required, have support (e.g. table/chair/wall) in front or to the required side.

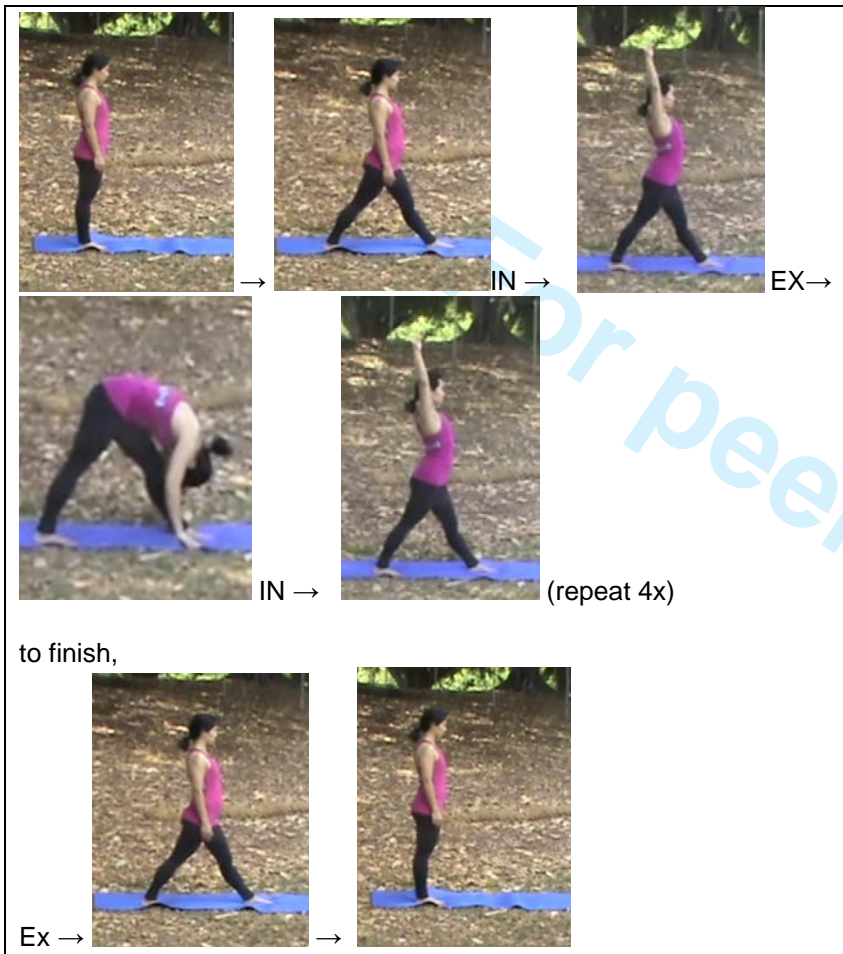


Provide prompts for children to keep their knees straight in forward bend (if standing) and only to go as far as they are comfortable when bending forward. Encourage children to bear weight evenly on both left and right sides.

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 <p>Warrior sequence</p> <p>Strengthens:</p> <ul style="list-style-type: none"> <li>• quadricep muscles</li> <li>• arms</li> <li>• torso</li> </ul> <p>Lengthens:</p> <ul style="list-style-type: none"> <li>• hip flexor muscles</li> <li>• calve muscles</li> </ul> <p>If required, have support (e.g. table/chair/wall) in front or to the required side.</p>   <p>Provide prompts for children to keep both of their feet pointing forward if possible and aim to have the back heel on the ground. Encourage children to bear weight evenly on both left and right sides.</p>			
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**One sided forward bend**

**Strengthens:**

- legs
- arms
- torso

**Lengthens:**

- hip flexor muscles
- calve muscles

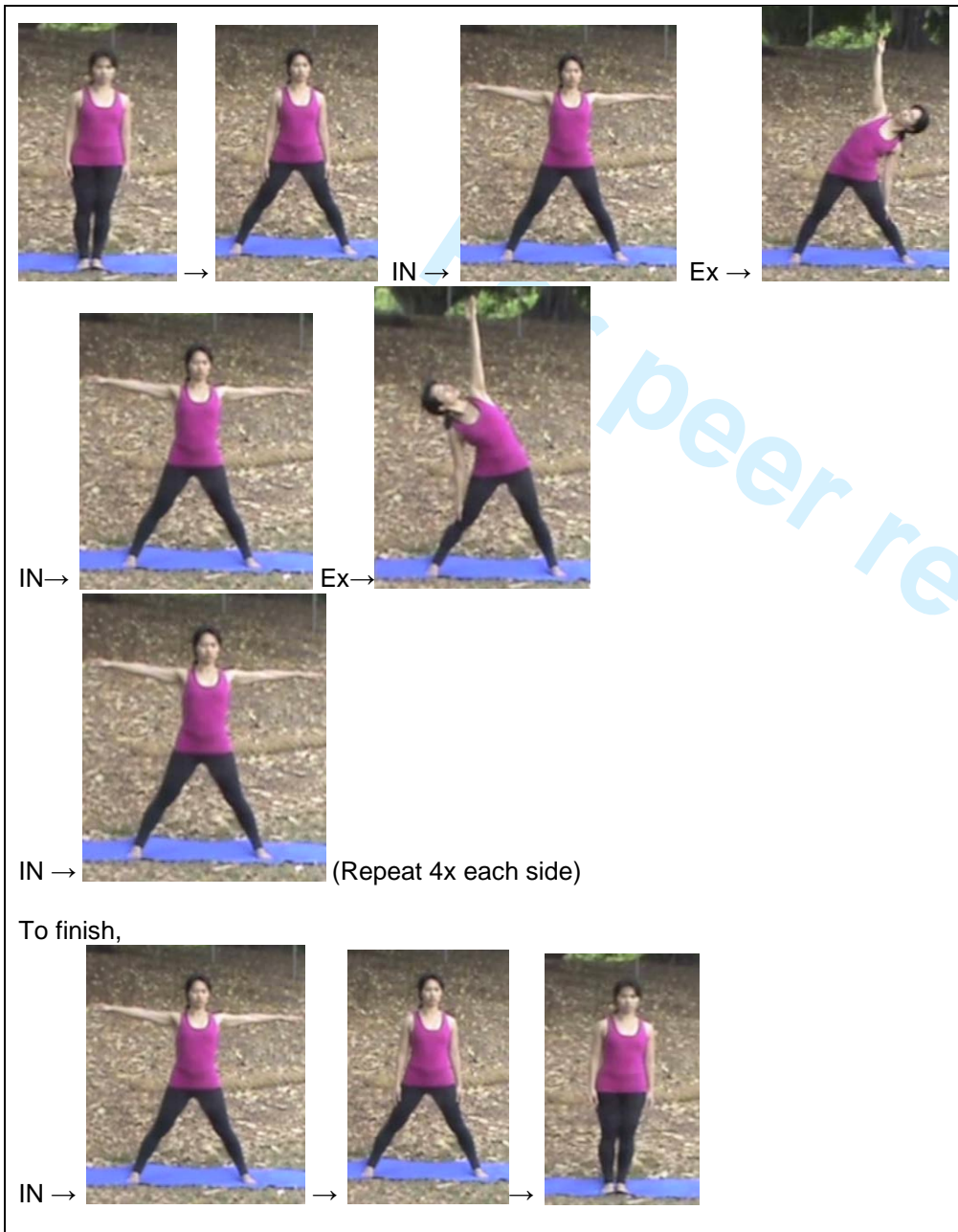
Induces Balance

If required, have support (e.g. table/chair/wall) in front or to the required side.



Provide prompts for children to keep both of their feet pointing forward if possible and aim to have the back heel on the ground. Ask the children to explore with having the front knee as straight as it is comfortable for them. Encourage children to bear weight evenly on both left and right sides.

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**Triangle**

**Strengthens:**

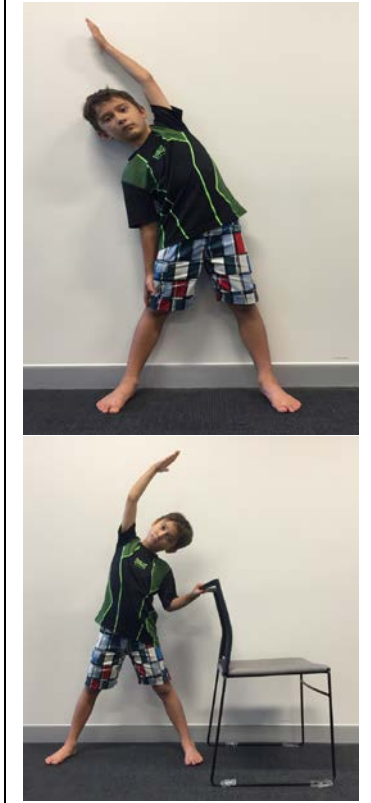
- legs
- arms
- torso

**Lengthens:**

- muscles along the side of the body

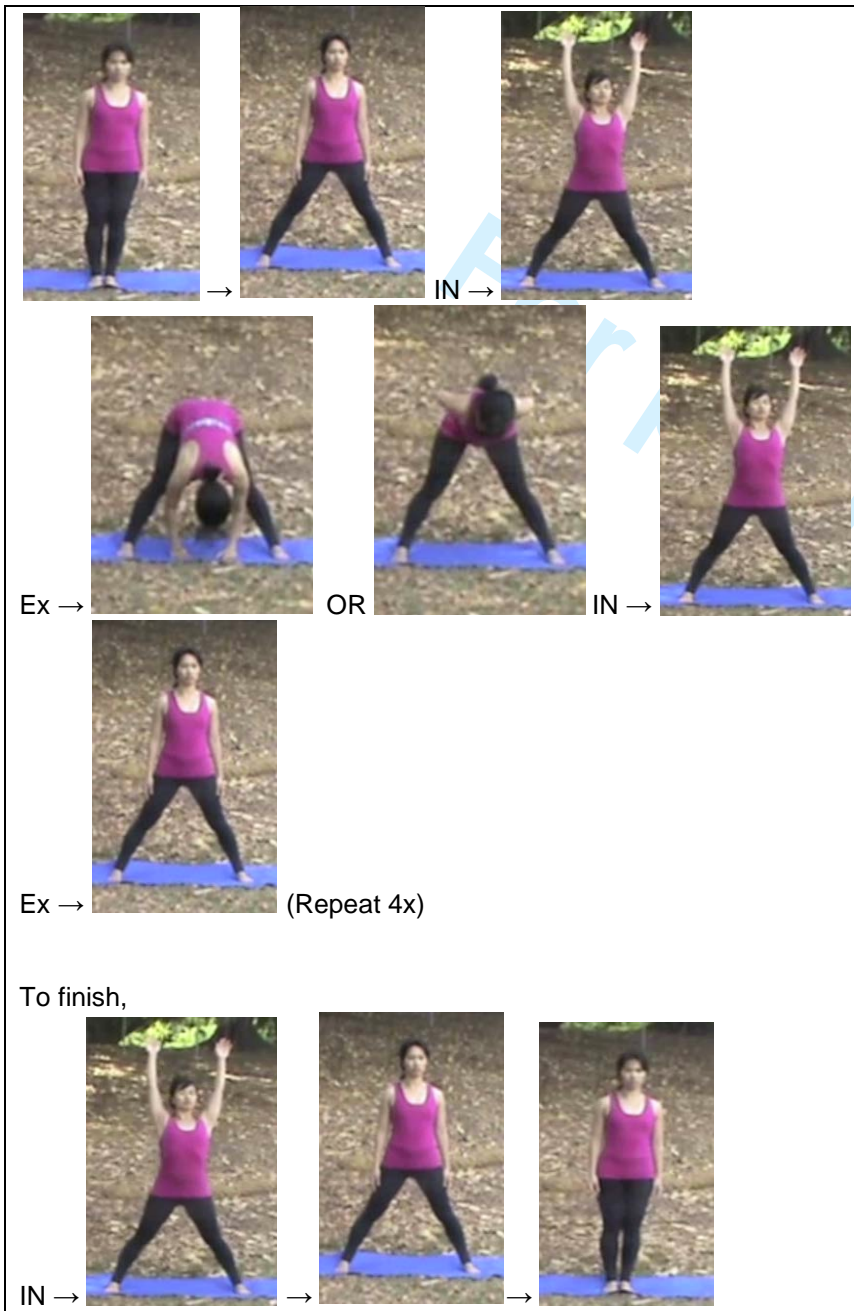
Induces Balance  
Increases hip flexibility

If required, this pose can be down with back gently against a wall and/or have support (e.g. table/chair) on either side.



Provide prompts for children to keep their knees straight in forward bend and only to go as far as they are comfortable when bending forward. Encourage children to bear weight evenly on both left and right sides.

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**Feet apart Forward Bend**

**Strengthens:**

- legs
- arms
- torso

**Lengthens:**

- muscles of the inner thighs and hamstrings

Induces Balance  
Increases hip flexibility

If required, have support (e.g. table/chair/wall/blocks) in front.



Provide prompts for children to have the feet pointing forward and to keep their knees straight in forward bend and only to go as far as they are comfortable when bending forward. Encourage children to bear weight evenly on both left and right sides.

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**Downward Dog**

- Strengthens:**
- legs
  - arms
  - upper body
  - torso

- Lengthens:**
- muscles in back of the body and legs

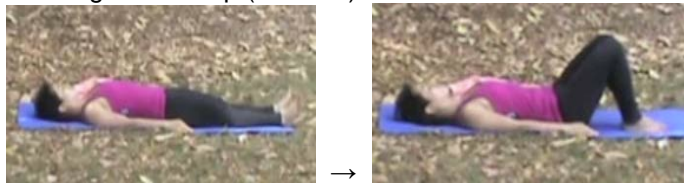
Provide prompts for children to keep their heels and big toes together in the kneeling postures. Encourage children to bear weight evenly on both left and right sides.

Downward dog pose can also be performed separately.

Downward dog can be performed from standing or seating in a chair by placing both hands against a wall or on a table/chair in front with the aim to flex hips, with back straight and shoulder blades back and down (retracted).



Bent legs with strap (or towel)



Place rolled towel/strap under Left foot (Repeat from here)



EX →



IN →



EX →



IN →



EX →

IN Stay



Ex →



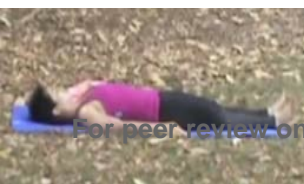
(Repeat)

To Finish: Release towel/strap from under foot

EX →



→



Repeat on other leg

Supine Leg lift

Strengthens:

- arms
- torso

Lengthens:

- muscles in back of the legs

Provides full range of motion from the hip to the toes.

Increase circulation and release any tightness in the hips, knees, and ankles.

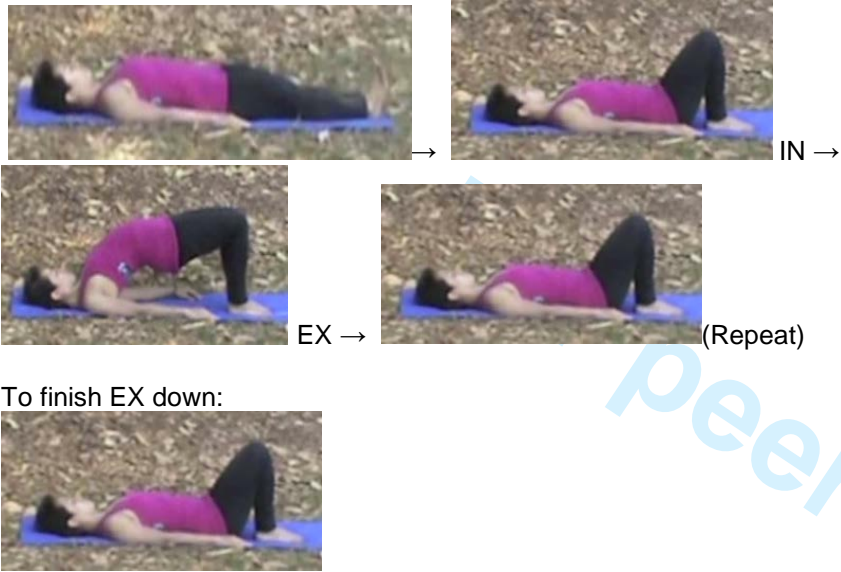


A rolled towel or belt is required for this sequence.

If possible keep the resting leg straight along the floor instead of bent. Feet of resting leg can be placed flat on a wall so that the ankle is at approximately 90degree dorsiflexion and prompt children to push their feet into the wall while they are lifting the other leg. This will help them keep the resting leg active and straight.





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<p>(Repeat from here)</p>  <p>IN →</p> <p>EX →</p> <p>(Repeat)</p> <p>To finish EX down:</p> 	<p><b>Bridge</b></p>	<p><b>Strengthens:</b></p> <ul style="list-style-type: none"> <li>• core back muscles</li> <li>• gluteal muscles</li> </ul> <p><b>Lengthens:</b></p> <ul style="list-style-type: none"> <li>• hip flexor muscles</li> <li>• quadriceps muscles</li> </ul>	<p>Children can hold the block between their knees while moving the hips up and down will help them engage their core muscles.</p> 
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peer review only

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(Repeat from here)

IN → EX →

IN → EX →

(One round; Repeat 4x)

To finish:

**Supine Spinal Twist**

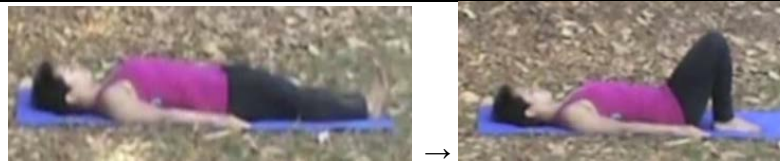
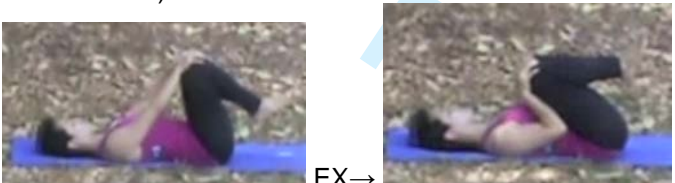

**Lengthens and relaxes:**

- back and spine

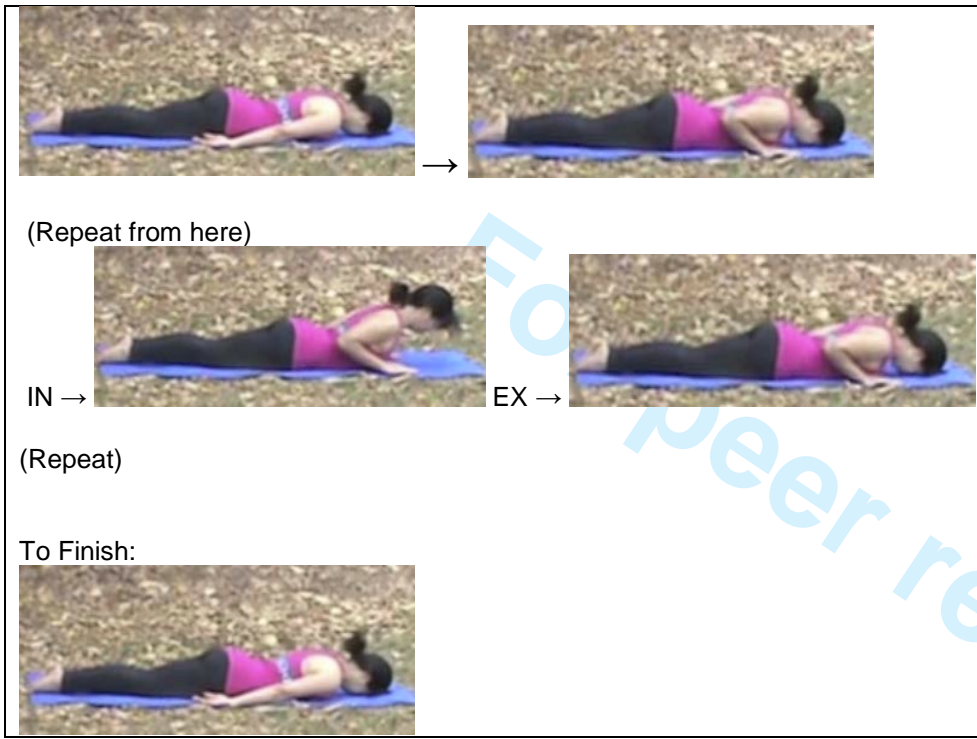
It is also possible to place rolled up blankets or a bolster on the floor in line with the knees (a few inches from the hip) on both sides to prevent any discomfort from rotating too far.

This spinal twist can also be performed from standing or seating in chair. If standing place feet hip width apart, place hand across the body to the opposite waist and twist body (without moving feet). If seating in a chair place feet flat on the floor or on blocks. With back straight, place hand on opposite knee and twist body pass the knee the hand is on.

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 <p>(Repeat from here)</p>  <p>(repeat)</p> <p>To finish:</p> 	<p><b>Apanasana</b></p>	<p><b>Lengthens and relaxes:</b></p> <ul style="list-style-type: none"> <li>back and spine</li> </ul>	<p>Verbal prompts to invite children to experiment with some hip movements, such as rocking slightly from side to side, or move knees and hips in small circles or simply staying still and observing sensations in their bodies while in this pose.</p>
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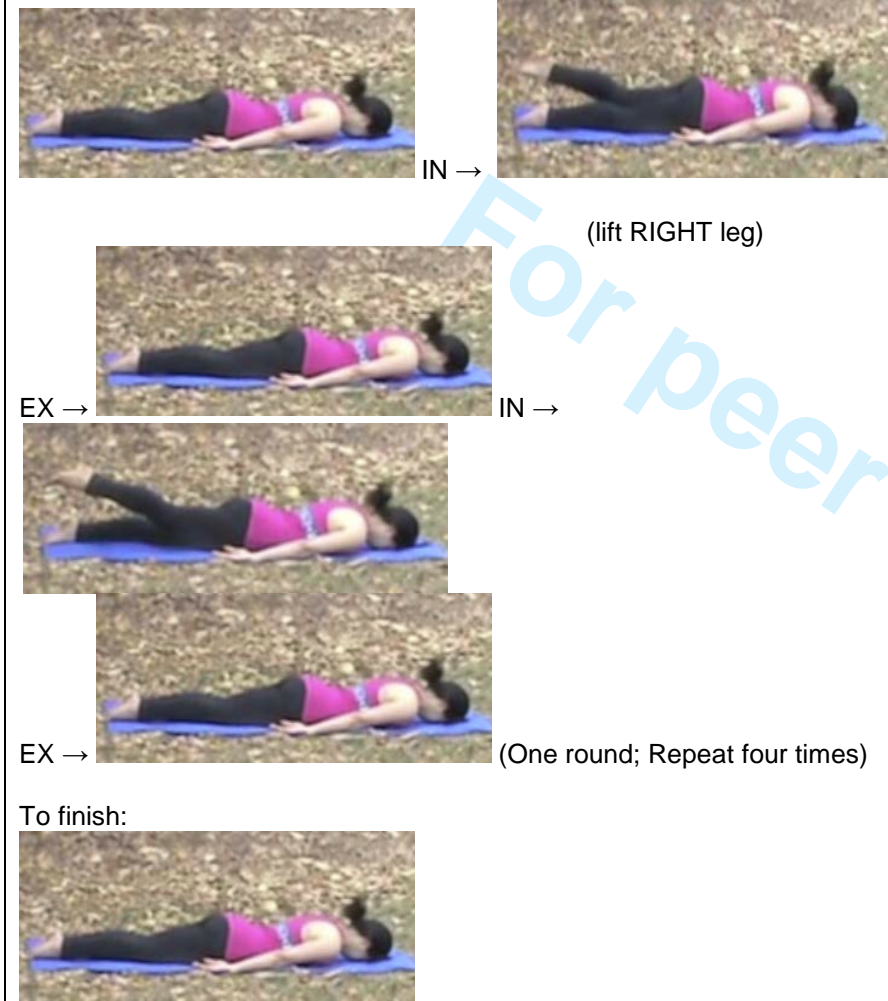



**Cobra**

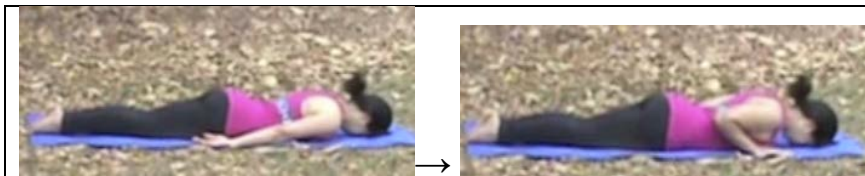
- Strengthens:**
- torso
  - back muscles
  - neck muscles
- Lengthens:**
- muscles in the front of the body

A blanket can be place under hips and lower ribs for comfort.

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<p>(Repeat from here)</p>  <p>IN →</p> <p>(lift RIGHT leg)</p> <p>EX →</p> <p>IN →</p> <p>EX →</p> <p>(One round; Repeat four times)</p> <p>To finish:</p> 	<p><b>Prone with legs</b></p>	<p><b>Strengthens:</b></p> <ul style="list-style-type: none"> <li>• torso</li> <li>• back muscles</li> <li>• gluteal muscles</li> </ul> <p><b>Lengthens:</b></p> <ul style="list-style-type: none"> <li>• muscles in the front of the body</li> </ul>	<p>A folded blanket can be used to help support the lifted leg if placed under the front of thighs (of the lifted leg).</p>
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(Repeat from here)



(Repeat)

To Finish:



**Lotus 2**

**Strengthens:**

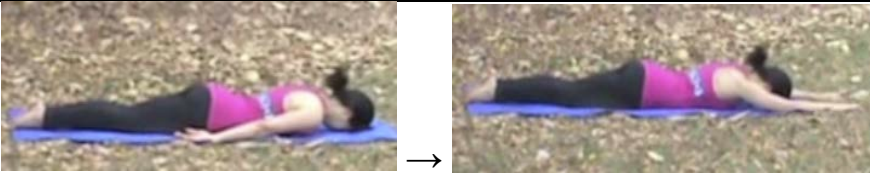
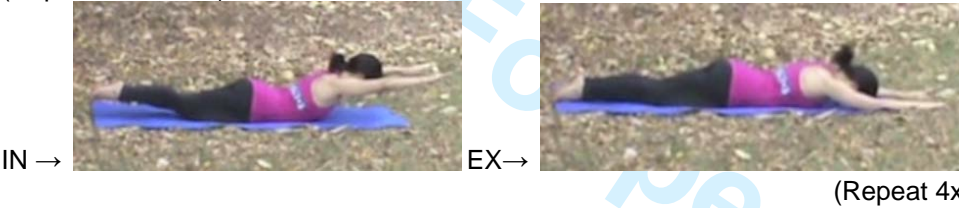
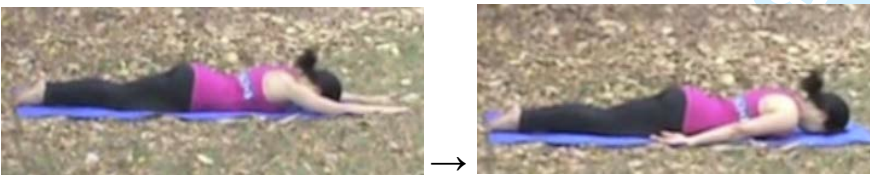
- torso
- back muscles
- neck muscles
- gluteal muscles

**Lengthens:**

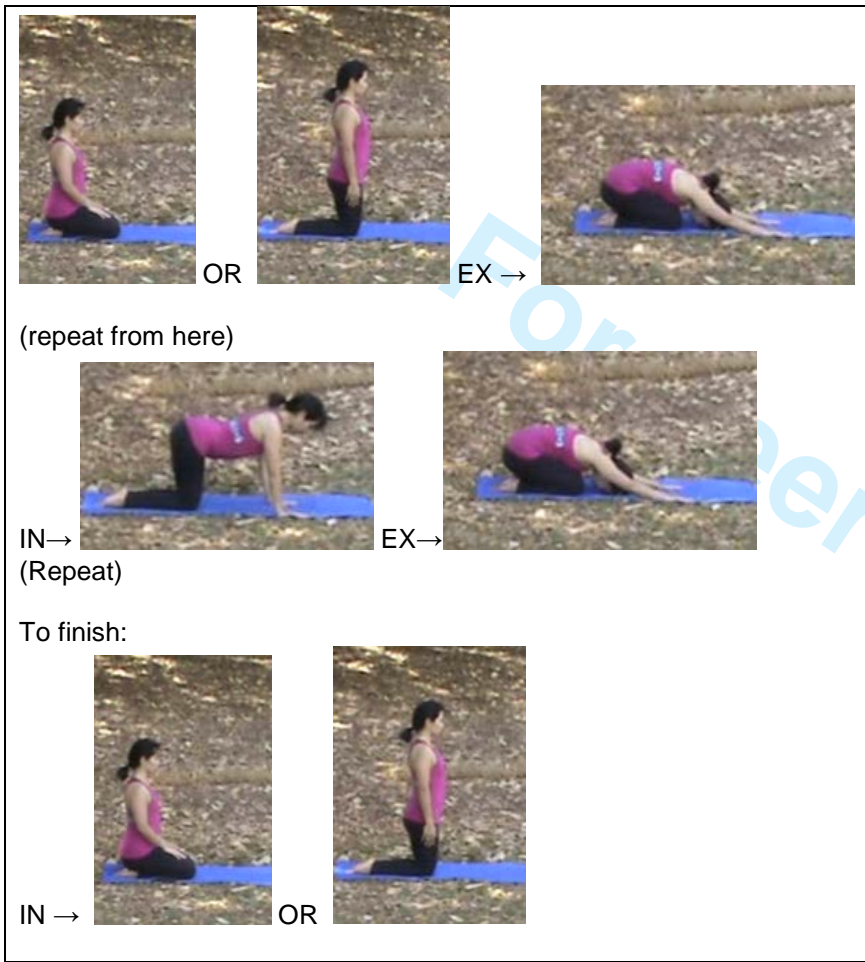
- muscles in the front of the body

A blanket can be place under hips and lower ribs for comfort

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 <p>(Repeat from here)</p>  <p>IN → EX → (Repeat 4x)</p> <p>To Finish:</p> 	<p><b>Superman</b></p>	<p><b>Strengthens:</b></p> <ul style="list-style-type: none"> <li>• arms</li> <li>• torso</li> <li>• back muscles</li> <li>• neck muscles</li> <li>• gluteal muscles</li> </ul> <p><b>Lengthens:</b></p> <ul style="list-style-type: none"> <li>• muscles in the front of the body</li> </ul>	<p>A blanket can be place under hips and lower ribs for comfort.</p>
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**Cat – back**

**Strengthens:**

- arms
- quadriceps muscles

**Lengthens and relaxes:**

- neck muscles
- shoulders
- back muscles and spine




If required, provide physical support at elbow on the involved side to help children maintain straight arm.



Also, verbal prompts to remind children to have hands flats on the floor.



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<p style="text-align: right;">(repeat from here)</p>  <p>EX → IN →</p> <p>EX → IN →</p> <p>EX → IN →</p> <p>(One round; Repeat four times)</p> <p>To finish:</p>  <p>IN →</p>	<p><b>Cat - legs</b></p>	<p><b>Strengthens:</b></p> <ul style="list-style-type: none"> <li>• arms</li> <li>• back muscles</li> <li>• quadriceps muscles</li> <li>• leg muscles</li> </ul> <p><b>Lengthens and relaxes:</b></p> <ul style="list-style-type: none"> <li>• back muscles and spine (in child's pose)</li> </ul>	<p>Children may find lifting their legs straight up one at a time in this sequence too difficult, they may like to try to extend it straight out behind them by sliding their foot along the floor without lifting their legs.</p> 
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rest hands behind →

bend knees →

flex toes →

Stay for 4 to 6 breaths

**Alternative boat:**



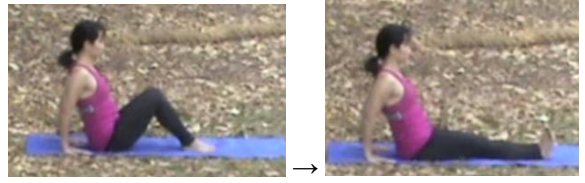
Lift one foot off the floor, swap legs



Balance with both feet off the floor

Stay for 4 to 6 breaths

to finish:



**Boat Pose**

**Strengthens:**

- abdominal muscles
- back muscles
- quadriceps muscles





**Lengthens:**

- back muscles and spine (in child's pose)

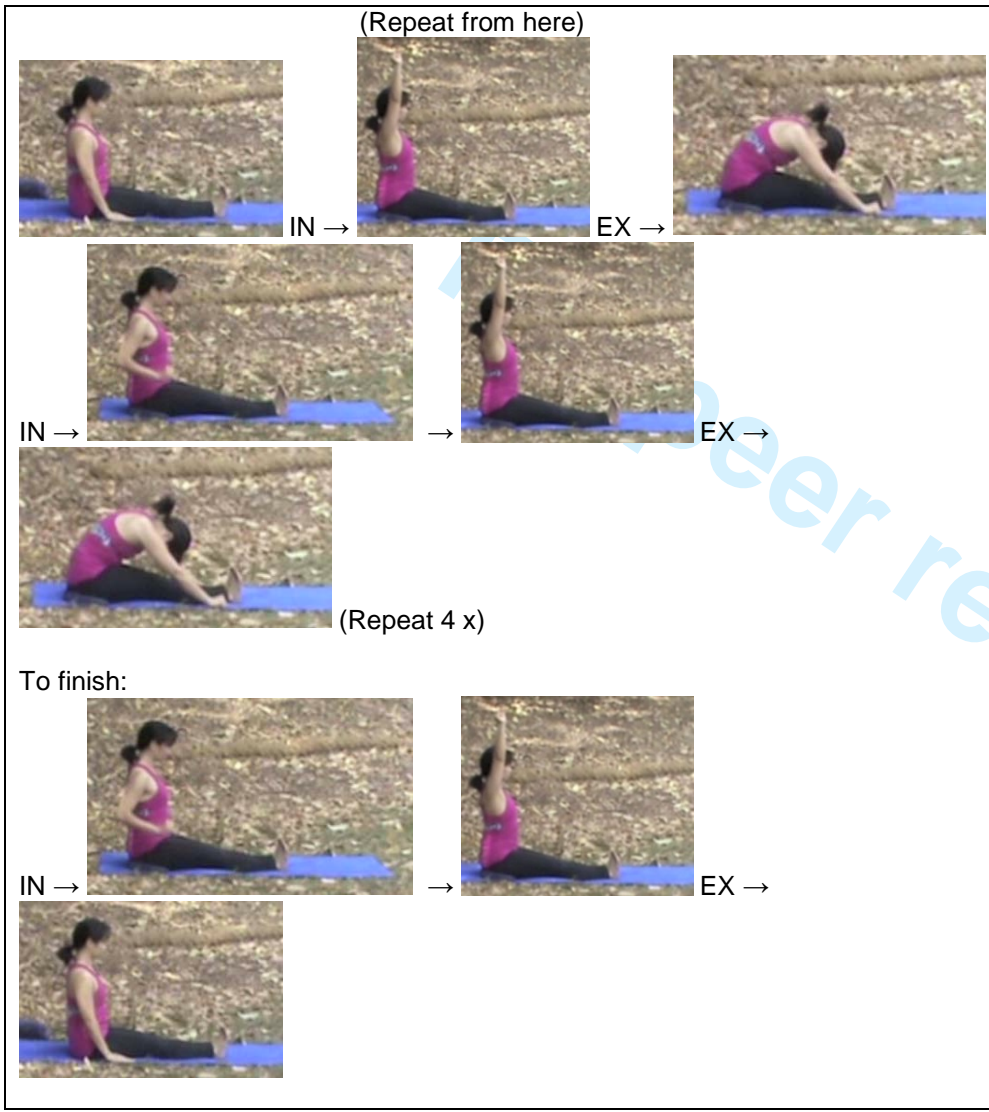
This posture may be done with elbows and forearm on the floor or with back rest on the floor arms by the side. With knees bent and feet flat on the floor, lift one heel off the floor at a time - aim to have shin and foot parallel to the floor.



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<p><b>One leg at a time</b></p>  <p>(Repeat from here)</p> <p>IN → EX →</p> <p>(Repeat 4x)</p> <p>To finish:</p>  <p>IN → EX → IN →</p>	<p><b>Seated forward bend – one leg at a time</b></p> <p><b>Rowing boat</b></p>	<p><b>Strengthens:</b></p> <ul style="list-style-type: none"> <li>• arms</li> <li>• torso</li> </ul> <p><b>Lengthens:</b></p> <ul style="list-style-type: none"> <li>• back of the body</li> <li>• hamstring muscles</li> <li>• calf muscles</li> </ul>	<p>This posture can be performed sitting on firm cushions, bolsters or folded blankets to help lift pelvis</p>  <p>A strap or belt can also be used to assist with lengthening the body and leg</p>  <p>Verbal prompts may be provided to help children keep their legs straight.</p>
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**Seated forward bend – both legs**

**Rowing boat**



- Strengthens:**
- arms
  - torso
- Lengthens:**
- back of the body
  - hamstring muscles
  - calf muscles

This posture can be performed sitting on firm cushions, bolsters or folded blankets to help lift pelvis and a strap or belt can be used to assist with lengthening the body and legs



Verbal prompts may be provided to help children keep their legs straight.

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<p>(Repeat from here)</p>  <p>(Repeat a few times)</p> <p>To finish:</p> 	<p><b>Butterfly</b></p>	<p><b>Lengthens:</b></p> <ul style="list-style-type: none"> <li>inner thigh muscles</li> </ul> <p>Increases flexibility in the hips.</p>	<p>This posture can be performed sitting on firm cushions, bolsters or folded blankets to help lift pelvis and lengthen the body.</p>  <p>If required, this posture can also be performed sitting with back against a wall for support.</p>
	<p><b>Shavasana or the relaxed star pose</b></p>	<p>This pose helps to assimilate the benefits of all the movements in the practice.</p>	<p>A rolled blanket, bolster or pillow can be placed under the knees and/or under head for comfort..Children may also like to be covered with a blanket for warmth. Props such as belts, rolled mats or towels and bolsters may also be used for alternate supported relaxation postures.</p> 

## Appendix C

## BRIEF HEALTH QUESTIONNAIRE (BHQ) - Caregiver

Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Phone: ( ) \_\_\_\_\_ (W)

Phone: ( ) \_\_\_\_\_ (H)

Age: \_\_\_\_\_

DOB: \_\_\_\_\_

Relationship to Child: \_\_\_\_\_

*Please read the following questions very carefully. If you have any difficulty please advise the health professional.*

**1. Personal medical history.** Indicate symptoms that apply to you.

- Pain or discomfort in chest following exercise
- Poor exercise tolerance
- Frequent dizziness
- Frequent headaches
- Frequent backache
- Frequent aches or pains in an joints

Details \_\_\_\_\_

- Other current symptoms that exercise may affect

Details \_\_\_\_\_

**2. Lungs: Do you have any of the following conditions?**

Asthma

 Yes No

Details \_\_\_\_\_

Emphysema

 Yes No

Details \_\_\_\_\_

Bronchitis

 Yes No

Details \_\_\_\_\_

1  
2  
3 Shortness of Breath

4  Yes

5  No

6 Details \_\_\_\_\_

7  
8  
9 3. **Do you have any heart condition/problems that might preclude you from exercise?**

10  Yes

11  No

12 Details \_\_\_\_\_

13  
14  
15 4. **Seizures, fainting, blackouts and loss of consciousness?**

16  Yes

17  No

18 Details \_\_\_\_\_

19  
20  
21 5. **Headaches**

22  Yes

23  No

24 Details \_\_\_\_\_

25  
26  
27 6. **Sight or hearing difficulties**

28  Yes

29  No

30 Details \_\_\_\_\_

31  
32  
33 7. **Cervical Spine instability (e.g. Atlanto-axial)**

34  Yes

35  No

36 Details \_\_\_\_\_

37  
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39 8. **Spinal problems that cause pain or preclude exercise**

40  Yes

41  No

42 Details \_\_\_\_\_

43  
44  
45 9. **Are you pregnant?**

46  Yes (number of weeks \_\_\_\_; due\_\_\_\_\_)

47  No

48 Details \_\_\_\_\_

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51 10. **Medication.** Are you taking any medication prescribed by your Doctor or other Health  
52 Care provider? If so, list details, i.e., type of drugs, dosage.

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## BRIEF HEALTH QUESTIONNAIRE – Child (caregiver report)

Name (child): \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Phone: ( ) \_\_\_\_\_ (W)

Phone: ( ) \_\_\_\_\_ (H)

Age: \_\_\_\_\_

DOB: \_\_\_\_\_

*Please read the following questions very carefully. If you have any difficulty please advise the health professional.*

1. **Personal medical history.** Indicate symptoms that apply to you.
 Pain or discomfort at rest or with exercise

Details \_\_\_\_\_

 Frequent dizziness

 Frequent colds or flu

 Frequent headaches

 Frequent backache

 Other current symptoms that exercise may affect

Details \_\_\_\_\_

2. **Seizures, fainting, blackouts and loss of consciousness?**
 Yes

 No

Details \_\_\_\_\_

3. **Headaches**
 Yes

 No

Details \_\_\_\_\_

4. **Sight or hearing difficulties**
 Yes

 No

Details \_\_\_\_\_

5. **Cervical Spine instability (e.g. Atlanto-axial)**
 Yes

 No

Details \_\_\_\_\_



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6. **Spinal problems that cause pain or preclude exercise**

Yes

No

Details \_\_\_\_\_

7. **Medication.** Are you taking any medication prescribed by your Doctor or other Health Care provider? If so, list details, i.e., type of drugs, dosage.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

For peer review only

## Appendix D

Participant ID: \_\_\_\_\_

DOB: \_\_\_\_\_

Age at Assessment: \_\_\_\_\_

<b>Date</b>		<b>Examiner:</b>	
<b>CLASSIFICATION</b>			
CP motor type:	1 <sup>st</sup>	2 <sup>nd</sup>	Comments:
No. of limbs involved	Comments:		
GMFCS level	Comments:		
FMS level			
Handedness	Right / Left / Mixed		
MACS			
Preferred sitting position	W-sitting Long sitting- symmetrical	Ring sitting	Side sitting- right left Asymmetrical (right/left)
<b>STANDING</b>			
Unaided/ Aided	Equipment Used:		
<b>GAIT</b>			
Unaided/ aided Typically developing <b>Comments:</b>			
<b>Gait pattern:</b> True Equinus/ Apparent Equinus / Jump Knee / Crouch gait; Gage Type:			
<b>SUPINE</b>			<b>Comments</b>
Thomas Test (FFD)			
Abduction in Flex			
Dynam Abd in Flex			
Abduction in Ext			
Dynam Abd in Ext			
Popliteal angle			
Dynamic Hamstrings			
Kn Exten (Hip 0 deg)			
Dorsiflex (Kn in Ext)			
Dynam DF (Kn in Ext)			
<b>PRONE</b>			
Hip Int Rotation			
Hip Ext Rotation			
Femoral Neck angle (FNA)			
Staheli test			
<b>SPINE</b>			
Scoliosis	Yes / No	Convex to R/L	
Rotation	Yes / No	To R / L	
Spondylolisthesis	Yes/ No		
Other	Yes/No		
<b>Current skills:</b>			
<b>Medical Hx Check:</b>			
Past surgery			
Pain levels			
Seizures			
Medication			
Botox			
Past therapy			
Compliance in therapy			
<b>Comments:</b>			
<b>Spine at Risk: Yes/ No</b>			
<b>Action:</b>			

## Appendix E

## MiYoga Session Mindfulness Measure

We are interested in your experiences what you just experienced during our group session. **Read** each sentence. Then, circle the number that tells **how true** each sentence is about **your experience during our group session.**

	Never True	Rarely True	Sometimes True	Often True	Always True
1. I stopped myself having thoughts or feelings that I don't like.	0	1	2	3	4
2. I was moving without noticing what I was doing.	0	1	2	3	4
3. I noticed my thoughts or feelings.	0	1	2	3	4
4. It was hard for me to pay attention to what I was meant to be doing.	0	1	2	3	4
5. I was focused on what I was doing.	0	1	2	3	4

Appendix F

**Mood Scale**



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**2**

**3**

**4**

**5**

Very Bad

Bad

Neutral

Good

Very Good

Appendix G

### Session Feedback Scale

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Name \_\_\_\_\_ Age (Yrs):\_\_ Gender:\_\_\_\_\_

Session # \_\_ Date: \_\_\_\_\_

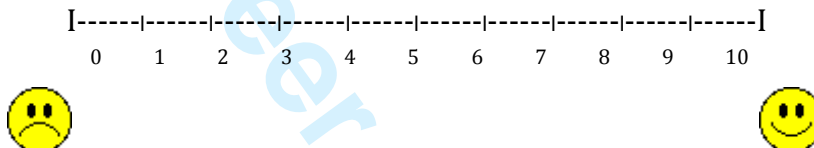
Who is filling out this form? Please check one: Child\_\_\_\_ Caretaker\_\_\_\_\_

If caretaker, what is your relationship to this child? \_\_\_\_\_

How was our time together today? Please put a mark on the lines below to let us know how you feel.

What we did today was uncomfortable and did not suit my needs and

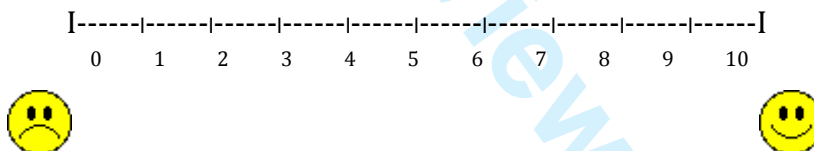
#### Comfort



What we did today was comfortable and suited my needs and ability

I did not like what we did today.

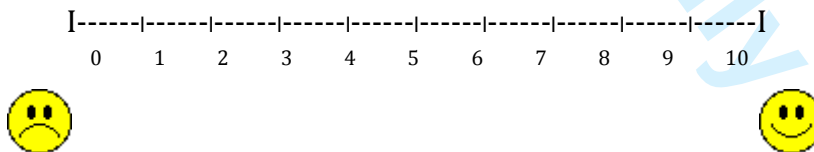
#### Enjoyment



I liked what we did today.

I did not always notice how my body was moving during

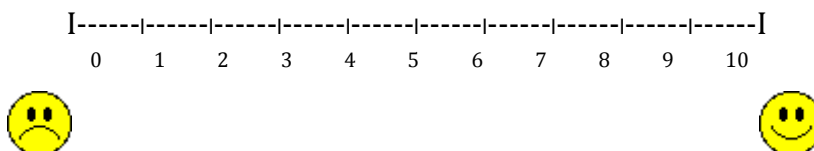
#### Body Awareness



I noticed how my body was moving during the session.

Overall I disliked this

#### Overall



Overall I liked the session

## Appendix H

**MiYoga**  
**Qualitative Interview Script and Questions**

---

**Interviewer - Introduce yourself**

- I am post-graduate student from School of Psychology at The University of Queensland who is unrelated to the MiYoga study in anyway. Advise participants to express their views and opinions about the program freely.
- I would like to find out from you how you experienced your involvement in MiYoga. This will help us to ensure that we are optimizing this therapy.
- To make sure that I accurately report your views, with your permission I would like to audio record our conversation.
- This recording will be transcribed and your name replaced by a number to make sure the information remains confidential.

**Questions for parents:**

- 1) What did you like best about the MiYoga program?  
*Potential Follow Up Questions: "Why did you like X the best?"*
- 2) What did you NOT like about the MiYoga program?  
*Potential Follow Up Questions: "Why did you not like X?"*
- 3) What do you think could have been different in the MiYoga program?  
*Potential Follow Up Questions: "What are your reasons for thinking X could have been different?"*
  - Amount of home practice expected?
  - Number of sessions per week?
  - Therapist interaction?
- 4) Did you notice any changes in yourself after participating in MiYoga?  
*If so, ask: "In what way?" or "What changes have you noticed after participating in MiYoga?"*
  - Personal tasks?
  - Work tasks?
  - Leisure tasks?
- 5) Did you notice changes in mindfulness in everyday life?  
*Potential Follow Up Questions: "Would you be able to provide some examples of these changes you have noticed in mindfulness in your everyday life please?"*
  - Personal tasks?
  - Work tasks?
  - Leisure tasks?
- 6) Did you notice any changes in your child after participating in MiYoga?  
*If so, ask: "In what way?" or "What were the changes you noticed in your child after participating in MiYoga?"*
  - Personal care tasks?
  - School tasks?
  - Leisure tasks?
- 7) Did you notice any changes in your child's mindfulness in everyday life?  
*Potential Follow Up Questions: "Would you be able to provide some examples of these changes you have noticed in your child's mindfulness in their everyday life please?"*

- *Personal care tasks?*
- *School tasks?*
- *Leisure tasks?*

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5 8) Is your child better or worse at paying attention after participating in MiYoga?

6 *Potential Follow Up Questions: "Would you be able to provide some examples of these changes in*  
7 *your child's ability at paying attention please?"*  
8

9  
10 9) Did you enjoy participating in MiYoga with your child?

11  
12 10) Did your child enjoy participating in MiYoga?

13  
14 11) Have you noticed any changes in your relationship with your child since participating in MiYoga?

15 *Potential Follow Up Questions: "How has your relationship with your child changed?" or*  
16 *"Would you be able to provide some examples of these changes in your relationship with your child*  
17 *please?"*  
18

19  
20 12) How did you find integrating MiYoga practices into your daily life?

21  
22 13) Would you participate in this program again?

23  
24 14) Would you recommend MiYoga to other families?

25  
26 15) Are you planning on continuing to practice Yoga with your child?

27 *If so, why? If not, why not?*  
28

29  
30 16) Anything else you would like to tell me?  
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**Questions for children:**

- 1) What did you like best about the MiYoga program?  
*Potential Follow Up Questions: "Why did you like X the best?"*
  - Any particular postures you liked best?
  - Any particular games you liked best?
- 2) What did you NOT like about the MiYoga program?  
*Potential Follow Up Questions: "Why did you not like X?"*
  - Any particular games you didn't like?
  - Any particular postures you didn't like?
  - How often the sessions were?
  - How often you had to practice at home?
- 3) What do you think could have been different in the MiYoga program?  
*Potential Follow Up Questions: "Why do you think X could have been different?"*
  - Amount of home practice expected?
  - Number of times per week?
  - Therapist interaction?
- 4) Can you tell me about anything that made it hard for you to practice MiYoga at home?
  - Other commitments - homework/extracurricular activities?
- 5) Did you notice any changes in yourself after participating in MiYoga?  
*If so, ask: "In what way?" or "What changes have you noticed after participating in MiYoga?"*
  - At home?
  - At School?
  - Leisure tasks?
- 6) Did you enjoy participating in MiYoga?
- 7) What was it like to do MiYoga with your mum/dad?
- 8) Would you participate in this program again?
- 9) Would you recommend MiYoga to other children?
- 10) Do you want to keep practicing Yoga?  
*If so, why? If not, why not?*
- 11) Anything else you would like to tell me?





SPIRIT 2013 Checklist: Recommended items to address in a clinical trial protocol and related documents\*

Section/item	Item No	Description	Addressed on page number
<b>Administrative information</b>			
Title	1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym	___ ✓ _p1___
Trial registration	2a	Trial identifier and registry name. If not yet registered, name of intended registry	___ ✓ _p3___
	2b	All items from the World Health Organization Trial Registration Data Set	___ ✓ _p3, p1, p13-14, p17, p23-34, p35, p37, ___
Protocol version	3	Date and version identifier	___ ✓ _footer___
Funding	4	Sources and types of financial, material, and other support	___ ✓ _p37___
Roles and responsibilities	5a	Names, affiliations, and roles of protocol contributors	___ ✓ _p1___
	5b	Name and contact information for the trial sponsor	___ N/A ___
	5c	Role of study sponsor and funders, if any, in study design; collection, management, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication, including whether they will have ultimate authority over any of these activities	___ N/A ___

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	5d	Composition, roles, and responsibilities of the coordinating centre, steering committee, endpoint adjudication committee, data management team, and other individuals or groups overseeing the trial, if applicable (see Item 21a for data monitoring committee)	___ N/A ___
--	----	--	-------------

**Introduction**

Background and rationale	6a	Description of research question and justification for undertaking the trial, including summary of relevant studies (published and unpublished) examining benefits and harms for each intervention	___ ✓ _p4-11_
	6b	Explanation for choice of comparators	___ ✓ _p20_
Objectives	7	Specific objectives or hypotheses	___ ✓ _p11-12_
Trial design	8	Description of trial design including type of trial (eg, parallel group, crossover, factorial, single group), allocation ratio, and framework (eg, superiority, equivalence, noninferiority, exploratory)	___ ✓ _p14_

**Methods: Participants, interventions, and outcomes**

Study setting	9	Description of study settings (eg, community clinic, academic hospital) and list of countries where data will be collected. Reference to where list of study sites can be obtained	___ ✓ _p20_
Eligibility criteria	10	Inclusion and exclusion criteria for participants. If applicable, eligibility criteria for study centres and individuals who will perform the interventions (eg, surgeons, psychotherapists)	___ ✓ _p13_
Interventions	11a	Interventions for each group with sufficient detail to allow replication, including how and when they will be administered	___ ✓ _p17-20_
	11b	Criteria for discontinuing or modifying allocated interventions for a given trial participant (eg, drug dose change in response to harms, participant request, or improving/worsening disease)	___ N/A ___
	11c	Strategies to improve adherence to intervention protocols, and any procedures for monitoring adherence (eg, drug tablet return, laboratory tests)	___ ✓ _p20_ (MiYoga diaries), p21 (video recording)___

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3		11d	Relevant concomitant care and interventions that are permitted or prohibited during the trial <span style="float: right;">___✓___p14___</span>
4	Outcomes	12	Primary, secondary, and other outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to event), method of aggregation (eg, median, proportion), and time point for each outcome. Explanation of the clinical relevance of chosen efficacy and harm outcomes is strongly recommended <span style="float: right;">___✓___p23-34___</span>
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10	Participant timeline	13	Time schedule of enrolment, interventions (including any run-ins and washouts), assessments, and visits for participants. A schematic diagram is highly recommended (see Figure) <span style="float: right;">___✓___p14 &amp; Figure 1___</span>
11			
12			
13	Sample size	14	Estimated number of participants needed to achieve study objectives and how it was determined, including clinical and statistical assumptions supporting any sample size calculations <span style="float: right;">___✓___p35___</span>
14			
15			
16	Recruitment	15	Strategies for achieving adequate participant enrolment to reach target sample size <span style="float: right;">___✓___p20___</span>
17			
18			
19	<b>Methods: Assignment of interventions (for controlled trials)</b>		
20	Allocation:		
21			
22	Sequence generation	16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions <span style="float: right;">___✓___p15___</span>
23			
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25	Allocation concealment mechanism	16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned <span style="float: right;">___✓___p15___</span>
26			
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28	Implementation	16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions <span style="float: right;">___✓___p15___</span>
29			
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31	Blinding (masking)	17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how <span style="float: right;">___N/A_p15___</span>
32			
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34		17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial <span style="float: right;">___N/A___</span>
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49**Methods: Data collection, management, and analysis**

Data collection methods	18a	Plans for assessment and collection of outcome, baseline, and other trial data, including any related processes to promote data quality (eg, duplicate measurements, training of assessors) and a description of study instruments (eg, questionnaires, laboratory tests) along with their reliability and validity, if known. Reference to where data collection forms can be found, if not in the protocol	___ ✓ _p20___
	18b	Plans to promote participant retention and complete follow-up, including list of any outcome data to be collected for participants who discontinue or deviate from intervention protocols	___ ✓ _p20___
Data management	19	Plans for data entry, coding, security, and storage, including any related processes to promote data quality (eg, double data entry; range checks for data values). Reference to where details of data management procedures can be found, if not in the protocol	___ ✓ _p20-21___
Statistical methods	20a	Statistical methods for analysing primary and secondary outcomes. Reference to where other details of the statistical analysis plan can be found, if not in the protocol	___ ✓ _p35-36___
	20b	Methods for any additional analyses (eg, subgroup and adjusted analyses)	___ N/A ___
	20c	Definition of analysis population relating to protocol non-adherence (eg, as randomised analysis), and any statistical methods to handle missing data (eg, multiple imputation)	___ ✓ _p35___
<b>Methods: Monitoring</b>			
Data monitoring	21a	Composition of data monitoring committee (DMC); summary of its role and reporting structure; statement of whether it is independent from the sponsor and competing interests; and reference to where further details about its charter can be found, if not in the protocol. Alternatively, an explanation of why a DMC is not needed	___ ✓ _p15___
	21b	Description of any interim analyses and stopping guidelines, including who will have access to these interim results and make the final decision to terminate the trial	___ N/A ___
Harms	22	Plans for collecting, assessing, reporting, and managing solicited and spontaneously reported adverse events and other unintended effects of trial interventions or trial conduct	___ ✓ _p15___
Auditing	23	Frequency and procedures for auditing trial conduct, if any, and whether the process will be independent from investigators and the sponsor	___ N/A ___

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3 **Ethics and dissemination**  
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5	Research ethics approval	24	Plans for seeking research ethics committee/institutional review board (REC/IRB) approval	_____ ✓ _p1, 12, 36_____
8	Protocol amendments	25	Plans for communicating important protocol modifications (eg, changes to eligibility criteria, outcomes, analyses) to relevant parties (eg, investigators, REC/IRBs, trial participants, trial registries, journals, regulators)	_____ ✓ _p12_____
12	Consent or assent	26a	Who will obtain informed consent or assent from potential trial participants or authorised surrogates, and how (see Item 32)	_____ ✓ _p12_____
16		26b	Additional consent provisions for collection and use of participant data and biological specimens in ancillary studies, if applicable	_____ N/A_____
19	Confidentiality	27	How personal information about potential and enrolled participants will be collected, shared, and maintained in order to protect confidentiality before, during, and after the trial	_____ ✓ _p21_____
22	Declaration of interests	28	Financial and other competing interests for principal investigators for the overall trial and each study site	_____ ✓ _p39_____
25	Access to data	29	Statement of who will have access to the final trial dataset, and disclosure of contractual agreements that limit such access for investigators	_____ N/A_____
28	Ancillary and post-trial care	30	Provisions, if any, for ancillary and post-trial care, and for compensation to those who suffer harm from trial participation	_____ ✓ _p15_____
31	Dissemination policy	31a	Plans for investigators and sponsor to communicate trial results to participants, healthcare professionals, the public, and other relevant groups (eg, via publication, reporting in results databases, or other data sharing arrangements), including any publication restrictions	_____ ✓ _p37_____
35		31b	Authorship eligibility guidelines and any intended use of professional writers	_____ N/A_____
37		31c	Plans, if any, for granting public access to the full protocol, participant-level dataset, and statistical code	_____ N/A_____

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40 **Appendices**  
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Informed consent materials	32	Model consent form and other related documentation given to participants and authorised surrogates	<u>    ✓    </u>
Biological specimens	33	Plans for collection, laboratory evaluation, and storage of biological specimens for genetic or molecular analysis in the current trial and for future use in ancillary studies, if applicable	<u>    N/A    </u>

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\*It is strongly recommended that this checklist be read in conjunction with the SPIRIT 2013 Explanation & Elaboration for important clarification on the items. Amendments to the protocol should be tracked and dated. The SPIRIT checklist is copyrighted by the SPIRIT Group under the Creative Commons "[Attribution-NonCommercial-NoDerivs 3.0 Unported](#)" license.

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# BMJ Open

## MiYoga: A randomized controlled trial of a mindfulness movement program based on hatha yoga principles for children with cerebral palsy - A study protocol

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Keywords:	COMPLEMENTARY MEDICINE, EDUCATION & TRAINING (see Medical Education & Training), Developmental neurology & neurodisability < PAEDIATRICS

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Manuscripts

**Study Protocol**

**Title:** MiYoga: A randomized controlled trial of a mindfulness movement program based on hatha yoga principles for children with cerebral palsy - A study protocol

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**KEYWORDS:** Cerebral Palsy, Children, Adolescents, Parent, Caregiver, Mindfulness, Yoga, Mindful Movement, Embodiment, Attention, Executive function, Physical function, Wellbeing

**WORD COUNT:** 10817 words



## ABSTRACT

**Introduction:** Cerebral Palsy (CP) is the most common childhood physical disability, with life-long impacts for 1.77 in 1000 children. Although CP is primarily a physical disability, children with CP have an increased risk of experiencing cognitive difficulties, particularly attention and executive function deficits. Impairment in cognitive abilities can lead to subsequent impairment in independent functioning, education, employment, and interpersonal relationships. This paper reports the protocol of a randomized controlled trial of a novel family-centered lifestyle intervention based on Mindfulness and Hatha Yoga principles (MiYoga). MiYoga aims to enhance child and parent outcomes for children with CP.

**Methods and analysis:** The aim is to recruit 36 child-parent dyads (children 6-16 years old; bilateral or unilateral CP; GMFCS I-III) who will be randomly assigned to two groups: MiYoga and waitlist control. The MiYoga program will be facilitated in a group format for 8 weeks. Assessments will be administered at baseline, prior to MiYoga, following completion of MiYoga, and at 6-month follow-up (retention). The primary outcome will be the child's sustained attentional ability as measured by the Conner's Continuous Performance Test (CPT II). Other outcomes of interest for children with CP consists of attentional control, physical functioning, behavioural and wellbeing. For parents, the outcomes of interest are mindfulness, psychological flexibility and wellbeing. Data will be analyzed using general linear models, specifically analysis of covariance and analysis of variance.

**Ethics and dissemination:** Full ethical approval for this study has been obtained by the Children's Health Queensland Hospital and Health Service Research Ethics Committee (HREC/12/QRCH/120) and The University of Queensland (2012000993). If MiYoga is proven effective, its dissemination would assist children with CP and complement their on-

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3 going therapy by; improving the ability of the child to pay attention at school and in therapy,  
4  
5 and alleviating environmental stressors for both the child and their parents.  
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7 **Trial Registration:** ACTRN12613000729729;

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10 <http://www.ANZCTR.org.au/ACTRN12613000729729.aspx>

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12 **Date of Trial Registration:** prospectively registered on 2/07/2013 – present (ongoing).

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14 **Findings to Date:** Recruitment is complete. Data is still being collected at present. We aim  
15  
16 to complete data collection by Feb 2017.  
17

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19 **Strengths and Limitations of this study:**

- 20  
21 • To our knowledge this is the first randomized controlled trial exploring the benefits of  
22  
23 a mindfulness-based movement intervention for children with cerebral palsy.  
24  
25 • MiYoga is designed to be a lifestyle intervention so that children and parents will be  
26  
27 able to continue practice at home in their everyday lives after the complete of the  
28  
29 program.  
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31 • MiYoga is fun and developmentally appropriate and is adaptable to the needs of the  
32  
33 child and/or parent.  
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35 • All participants will be offered MiYoga before completion of the study for ethical  
36  
37 reasons.  
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39 • Participants in this study span across a broad age range (6-16 years) and within which  
40  
41 there maybe variability in cognition and executive function. EF is a secondary  
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43 measure in the study.  
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45 • There is a high number of secondary outcomes in this study which would be  
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47 exploratory in nature as this is the first RCT to investigate the effects of mindfulness  
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49 and yoga in children with cerebral palsy.  
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## INTRODUCTION

Cerebral Palsy (CP) is the most common physical disability in childhood with life-long impacts for 1.77 in 1000 children.<sup>1</sup> Cerebral palsy is caused by non-progressive damage to the fetal or infant brain that results in motor and postural difficulties.<sup>2</sup> In addition to physical impairments, which are the diagnostic features of CP, children can also experience cognitive and psychological difficulties.<sup>3-5</sup> The motor and cognitive difficulties are often accompanied by disturbances of sensation, communication, perception, behavior problems, and/or by a seizure disorder.<sup>2,4</sup>

Present therapies focus primarily on physical difficulties faced by children with CP,<sup>6</sup> despite the fact that children with CP also have an increased risk of experiencing cognitive difficulties. In 2009, the Australia Cerebral Palsy Register reported that 1 in 3 children with CP experience cognitive difficulties.<sup>7</sup> More recent studies reported that 1 in 2 children with CP had an intellectual disability,<sup>4</sup> and compared to typically developing children those with CP are more likely to have attention and executive function deficits.<sup>8-10</sup> The deficits may explain why children with CP have increased social and learning problems.<sup>11</sup> It is therefore important to consider interventions that target attention, in addition to the existing physical therapy, for children with CP.

### Attention

The attention system underpins most cognitive and neuropsychological functions in everyday life, such as self-control (inhibition), decision-making, goal setting, planning, problem solving, emotional responses and behavior. Typically, the attention system is understood using the 'three network model', comprising the alerting network, and the orienting and executive networks.<sup>12</sup>

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2  
3 The alerting network is a 'bottom-up', stimulus-driven (or exogenous) attention system that  
4 automatically responds to external stimulus, such as visual, auditory input.<sup>13</sup> For example, a  
5 sudden loud noise or motion can attract our attention and we attend to them whether we want  
6 to or not. This network is thought to involve both the parietal and temporal areas of the brain,  
7 as well as the brain stem arousal systems.<sup>12</sup>

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14 Orienting and executive networks are the other networks in this model. In contrast to the  
15 alerting network, they are both 'top-down' processes, responding to internally determined  
16 goals. Together, these two attentional networks are also known as goal-driven, endogenous  
17 attention, attentional control or executive attention networks.<sup>12</sup> They determine our ability to  
18 voluntarily select, and orient, attention to relevant stimuli or tasks, mediated primarily by the  
19 frontal cortex and basal ganglia.<sup>12 14</sup>

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29 The orienting network determines our ability to consciously orient attention in a spatial  
30 setting. Functionality of this network can be measured by the speed and accuracy of  
31 responses to cues that indicate where a future stimulus may occur on a computer screen.

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In contrast, the executive network involves mechanisms for monitoring and resolving conflict  
when two responses are simultaneously called for by an external stimulus. This network aids  
attentional switching, and provides the ability to disengage from distracting stimuli and re-  
engage attention to the relevant task or stimulus. Previous studies have confirmed that these  
two 'top down' networks are related to executive functions,<sup>12 15</sup> working memory<sup>16</sup> and  
conflict resolution and inhibition.<sup>17</sup>

Both orienting and executive networks of attention are involved in sustained attention, which  
is the ability to maintain and focus attention on a given task. Sustained attention is a core  
executive function, typically defined as the ability to maintain an alert, goal-directed focus in  
the absence of an external stimulation.<sup>18</sup> Difficulty maintaining sustained attention can

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2  
3 interfere with non-cognitive aspects of therapy and rehabilitation, including for children with  
4 CP. Impairments in attention in children may lead to reading problems,<sup>19</sup> poor math  
5 achievements,<sup>20 21</sup> poor self-confidence and cognitive impairments,<sup>22</sup> poor executive function  
6 and executive attention (such as working memory) leading to poor social skills,<sup>11 23</sup> as well as  
7 problem behaviors.<sup>11</sup> Furthermore, the capacity to self-sustain attention has been shown to  
8 predict motor recovery in adults following a right hemisphere stroke over a 2-year period.<sup>24</sup>  
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10 These findings suggests sustained attention deficits in the development of interventions and  
11 rehabilitation programs are a worthwhile target for interventions, particularly in children with  
12 CP, where poor attention may hinder their ability to benefit from existing physical therapies.  
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### 24 **Cognitive Abilities in Children with CP**

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27 Attention, executive function, and other intellectual capabilities, are impaired in 1 in 2  
28 children with CP.<sup>3 4 8 9 25</sup> One cross-sectional study of sustained attention in 10 adolescents  
29 with CP, using a visual Continuous Performance Test (CPT),<sup>26</sup> indicated that sustained  
30 attention ability was affected by CP, even after controlling for motor deficits by using eye  
31 movements to measure sustained attention.<sup>9</sup> Another study investigated attention and  
32 executive function in children with unilateral and bilateral spastic CP.<sup>8</sup> Four subtests from  
33 the Wechsler Intelligence Scale for Children (WISC-III)<sup>27</sup> – information, similarities,  
34 comprehension, and vocabulary – were used to measure general cognitive functioning. They  
35 also used three subtests from the Test of Everyday Attention for Children (TEA-Ch)<sup>28</sup> to  
36 measure selective attention (Sky Search), sustained attention (Score!) and divided attention  
37 (Sky Search Dual Task). Executive functions were assessed by the Contingency Naming  
38 Test (CNT) and the teacher version of the Behavior Rating Inventory of Executive Function  
39 (BRIEF)<sup>29</sup>. The results demonstrated that impairments in sustained attention, divided  
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3 attention, inhibition, switching and general executive function were present in children with  
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5 CP.  
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8 Few therapeutic interventions aim to increase a child's ability to sustain their attention on  
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10 task, or selectively focus their attention on appropriate stimuli. Previous research has  
11  
12 explored attention and problem-solving training for children with Attention Deficit  
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14 Hyperactivity Disorder (ADHD),<sup>30</sup> children with learning disabilities and co-morbid  
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16 ADHD.<sup>31</sup> In addition, some studies investigated efficacy of interventions that may increase  
17  
18 attentional abilities in children with traumatic brain injury<sup>30 32</sup> and for the late effects of  
19  
20 treatment for childhood cancer.<sup>33</sup> There is a paucity of research on interventions to improve  
21  
22 attention in children with CP.  
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### 26 27 **Mindfulness and Attention**

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30 Several investigators have recently proposed theoretical explanations of how the practice of  
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32 focused attention through Mindfulness (awareness of the present moment) training can  
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34 enhance and develop attention regulation.<sup>34 35</sup> Mindfulness practice involves sustaining  
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36 attention on a chosen object, such as one's breath, an object, or a mantra, and directing  
37  
38 attention to that object while sustaining this focused attention for as long as possible.<sup>34-38</sup> In  
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40 order to sustain this focus, one must monitor the quality of this focus. For example, while  
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42 focusing on the rise and fall of the chest with each breath, one might notice their attention has  
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44 shifted to something that happened during the day, or what they would like for dinner later.  
45  
46 At some point they would realize their focus has wandered and let go of their distraction and  
47  
48 re-attend to their breath. Mindfulness is the state of awareness of the thoughts or feelings that  
49  
50 arise when our minds wander. This awareness provides the opportunity to inhibit the more  
51  
52 dominant response of rumination and switch our attention back to the point of focus.  
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56 It has been proposed<sup>35</sup> that this type of monitoring of one's attention and focus consists of  
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3 three types of attention regulation; (i) monitoring the present-moment (i.e. detect mind  
4 wandering), (ii) attentional switching (i.e. disengage from a distracting object/thought  
5 without further involvement), and (iii) selective attention (i.e. ability to redirect focus  
6 promptly back to target object). Researchers reason that Mindfulness training entails  
7 extended practice of these attentional abilities.<sup>34 35 37</sup>

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15 These proposed theoretical models of the cognitive mechanism of Mindfulness have inspired  
16 experimental research examining the effects of Mindfulness training on attention  
17 performance. The effects of Mindfulness practice on the three attentional networks (alerting,  
18 orienting, and executive) were examined by Jha and colleagues (2007)<sup>37</sup> using the Attention  
19 Network Test (ANT).<sup>39</sup> Attentional efficiency was assessed before and after an eight-week  
20 Mindfulness-Based Stress Reduction (MBSR)<sup>40</sup> course administered to meditation-naïve  
21 participants, as well as a one-month intensive Mindfulness retreat attended by experienced  
22 meditators, compared to an eight-week no treatment control group. The retreat group  
23 (experienced meditators) showed better conflict monitoring at baseline than participants in  
24 the control and MBSR groups (both groups with meditation-naïve participants), suggesting  
25 that executive attention improves with long-term exposure to Mindfulness meditation. The  
26 retreat group had improved alerting among the previously experienced meditators. The  
27 authors concluded that Mindfulness training improves voluntary (top-down; endogenous)  
28 attentional control leading to improved orienting and conflict monitoring, and prior  
29 experience with concentrative meditation allows for the development of improved bottom-up,  
30 receptive attention involved in alerting. It may be that Mindfulness training improves the  
31 functioning of each of the attentional subsystems at various points in the course of  
32 Mindfulness training.

## 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 **Yoga**

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3 Traditional yoga is a Mindfulness practice that directs attention towards the present  
4 moment.<sup>41</sup> The aim of yoga is to calm and unify the mind, body and breath to promote  
5 positive health, self-awareness and spirituality.<sup>42</sup> Yoga postures, known as *asana* in Sanskrit,  
6 are the third of the eight 'limbs', or practices, of yoga according to the traditional texts of the  
7 Yoga Sūtras of Patañjali. *Asana* directly translates to "posture" and was derived from the  
8 Sanskrit root word *as* which means "to be", "to sit", "to stay" or "to be established in a  
9 particular posture".<sup>43</sup> The Yoga Sūtras of Patañjali describe *asana* as having two important  
10 qualities. The first is steadiness and alertness, and the second is the ability to remain  
11 comfortable in a posture.<sup>42</sup> When practicing *asana*, both of these qualities should be present.  
12 The combination of performing *asana* with pranayama (breathing techniques), comprise the  
13 style of yoga commonly referred to as Hatha Yoga. Hatha Yoga unites the actions of the  
14 body, breath and mind by the synchronization of movement with the breath which in turn  
15 directs the practitioner's attention and awareness to the present. The unity of body and mind  
16 is what makes traditional Hatha Yoga an embodied mindfulness practice.

### 34 35 **Mindfulness and Yoga for Children**

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38 In the pediatric literature, it has been documented that Mindfulness and yoga improves  
39 memory in school children,<sup>44</sup> cognitive function in children with mental retardation,<sup>45</sup>  
40 planning abilities and executive function in healthy school aged girls,<sup>46</sup> as well as attention,  
41 behavior and emotional control in healthy children, and children with ADHD.<sup>47</sup> Yoga has  
42 been shown to improve balance, motor skills and strength, as well as the quality of life and  
43 general well-being, in a range of different participant groups.<sup>48-51</sup>

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52 Mindfulness-based Stress Reduction<sup>52</sup> programs combine Mindfulness and Hatha Yoga  
53 techniques to cultivate greater awareness of the unity of mind and body, as well as of the  
54 ways the unconscious thoughts, feelings, and behaviors can undermine emotional, physical,  
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3 and spiritual health. The underlying principles for MBSR programs are to (a) be non-  
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5 judgmental, (b) be patient, (c) see the world as if for the first time, (d) accept seeing things as  
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7 they are without trying to change anything, (e) and let go of attachment to repetitive thoughts,  
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9 actions or beliefs. MBSR programs usually feature group interaction, formal and informal  
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11 meditation practice, daily homework, and/or silent retreats.<sup>52</sup> The formal practice includes  
12  
13 Mindfulness meditation and mindful movements in the form of Hatha Yoga. The informal  
14  
15 practices include mindful eating and walking. Although a number of studies explored the  
16  
17 effectiveness of MBSR in the adult population,<sup>53 54</sup> there is a paucity of randomized  
18  
19 controlled trials that explore the effects of a developmentally appropriate MBSR program for  
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21 children.  
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26 A systematic review<sup>55</sup> investigating the efficacy of mindfulness-based interventions identified  
27  
28 thirteen randomized control trials that met the inclusion criteria. Out of the thirteen identified  
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30 studies,<sup>56-68</sup> five studies found a statistically significant intervention effect for at least one  
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32 outcome measure of attention or executive function with medium to large effects sizes (0.3 –  
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34 32.03).<sup>57 59 61 63 66</sup> The overall findings from the review suggested that mindfulness-based  
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36 interventions targeting attention are a promising approach for children and adolescents. This  
37  
38 systematic review did not find RCT of mindfulness-based interventions with children or  
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40 adolescents with CP. Quality trials are therefore needed to assess the effectiveness of  
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42 mindfulness-based interventions targeting attention in children and adolescents with CP.  
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47 By adapting a Mindfulness-base program for children, with a focus on mindful movements  
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49 through Hatha Yoga, it may provide a developmental approach to Mindfulness training.

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51 Yoga has been shown to improve body awareness in adults,<sup>69</sup> and it may teach children and  
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53 adolescents about their growing bodies as they become more aware of their bodies and their  
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55 movements. School-age children have also been found to be interested in yoga as a mind-  
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57 body therapy for pain and other ailments.<sup>70</sup> As children are naturally more active, teaching  
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3 them Mindfulness through movements using traditional Hatha Yoga postures along with the  
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5 some Mindfulness exercises to begin with, may be more developmentally appropriate than  
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7 teaching them the more traditional seated Mindfulness meditations. This remains to be tested.  
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10 The mindful movement program in this project, MiYoga, combines both cognitive  
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12 (mindfulness) and physical (yoga postures) aspects into therapy. It has the potential to assist  
13  
14 children with CP to alleviate negative effects of environmental stressors by improving their  
15  
16 ability to focus attention on the present moment, ultimately helping them to focus on  
17  
18 activities at school, in therapy, or when interacting with peers. At the same time, Hatha Yoga  
19  
20 may provide additional physical benefits to complement the on-going therapy for children  
21  
22 with CP.  
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26 MiYoga will be delivered to both the children and their parents, to enable parents to facilitate  
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28 and monitor the MiYoga approach, which is may improve translation and implementation of  
29  
30 techniques into everyday life. This project will test the efficacy of a mindful movement  
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32 (MiYoga) program administered to children with CP, and one of their parents. The MiYoga  
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34 program would be an adjunct to children's on-going rehabilitation therapy.  
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### 37 **Aim**

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40 The focus of this study is to design and test a novel mindful movement program, MiYoga,  
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42 and to investigate its efficacy for enhancing sustained attention in children with CP. Efficacy  
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44 will be tested in a randomized controlled trial (N=36) with an intervention group (MiYoga  
45  
46 program + standard care) compared to a wait-list control group receiving standard care alone.  
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48 This enables all participating children to receive the intervention, maximizing participant  
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50 recruitment and retention, and fulfilling ethical obligations to participating children and  
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52 families. Outcomes measures will be taken at baseline, immediately post-intervention and at  
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54 follow-up 6 months post intervention.  
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3 Qualitative interviews will also be conducted with each child and parent participant  
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5 individually. The aim of these interviews is to collect the participants' perceptions of the  
6  
7 MiYoga program.  
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## 10 **Hypotheses**

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12 It is hypothesized that, compared to the waitlist control group, the MiYoga group will show  
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14 improvements in the following child outcomes:

- 15  
16 1) Sustained attention (Conner's Continuous Performance Test II (CPT II))<sup>26</sup>;
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18 2) Executive function (information processing, attentional control, cognitive flexibility,  
19  
20 working memory and behavioral manifestations of executive function in daily life);  
21  
22 3) Psychological functioning (Strengths and Difficulties Questionnaire (SDQ))<sup>71</sup>;
- 23  
24 4) Physical capacity including functional strength (Sit-to-stand, Half-kneel to stand and  
25  
26 Lateral step up tests),<sup>72</sup> and flexibility (Sit and Reach test);  
27  
28 5) Present-moment awareness (Child and Adolescence Mindfulness Measure  
29  
30 (CAMM))<sup>73</sup>;
- 31  
32 6) Quality of life (CP-QOL-Child or CP-QOL-Teen)<sup>74 75</sup>

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35 In addition, it is hypothesized that the MiYoga group will show improvements in the  
36  
37 following parent outcomes:

- 38  
39 7) Mindfulness (Mindfulness Awareness Attention Scale (MAAS))<sup>76</sup>;
- 40  
41 8) Parent psychological wellbeing (Depression Anxiety and Stress Scale (DASS))<sup>77</sup>;
- 42  
43 9) Parent's psychological flexibility (Acceptance and Action Questionnaire ((AAQ-2))<sup>78</sup>;
- 44  
45 10) Parent's personal wellbeing (Personal Wellbeing Index – Adults (PWI-A))<sup>79</sup>; and  
46  
47 11) Child-parent relationship (Child-Parent Relationship Scale (CPRS))<sup>80</sup>.

## 48 **METHODS AND ANALYSIS**

### 49 **Ethics**

1  
2  
3 Full ethical approval for this study has been obtained by the Behavioral and Social Sciences  
4  
5 Ethical Review Committee of The University of Queensland (2012000993) and Children's  
6  
7 Health Queensland Hospital and Health Service Research Ethics Committee  
8  
9 (HREC/12/QRCH/120). Protocol modifications and amendments will be submitted to the  
10  
11 ethical committees for approval. This trial has been registered with the Australian New  
12  
13 Zealand Clinical Trials Registry (ACTRN12613000729729). All families will be given  
14  
15 written informed consent to participate and their parents or guardians prior to entering into  
16  
17 the trial.  
18  
19

### 20 21 **Recruitment**

22  
23 Thirty-six children with a diagnosis of CP with spastic motor type, either diplegia (bilateral  
24  
25 CP) or hemiplegia (unilateral CP) motor distribution, and one of their parents, will be  
26  
27 recruited into the MiYoga study. Children must also have sufficient co-operation and  
28  
29 cognitive understanding to follow simple instructions. The primary parent of eligible  
30  
31 children will participate alongside their child. Children with co-morbid diagnoses to CP are  
32  
33 included.  
34  
35

36  
37 Children will be excluded if they have (i) received upper-limb or lower-limb surgery in the  
38  
39 previous 6 months; (ii) unstable epilepsy (i.e. frequent seizures not controlled by medication);  
40  
41 (iii) spinal instability or other spinal problems that would prevent them from participating  
42  
43 safely in the MiYoga program; (iv) have a medical condition that would prevent them from  
44  
45 participating safely in the MiYoga program; or (v) parents/guardians who are pregnant as a  
46  
47 safety precaution. Diagnosis of CP must be confirmed by the treating pediatrician or  
48  
49 clinician and in accordance with published recommendations.  
50  
51

52  
53 Eligible children living in South East Queensland, Australia, will be recruited through patient  
54  
55 databases of Queensland Cerebral Palsy Rehabilitation Research Centre (QCPRRC) at the  
56  
57

1  
2  
3 Royal Children's Hospital and the Queensland Cerebral Palsy Register, and via referrals from  
4  
5 clinicians in the Queensland Pediatric Rehabilitation Service (QPRS). Potential participants  
6  
7 will be invited to participate in the study via letters and follow up phone calls. Flyers and  
8  
9 posters will displayed in the reception areas of clinics, and clinicians will be informed of the  
10  
11 study, and encouraged to refer appropriate patients to the program. External advertising will  
12  
13 include a webpage on The University of Queensland School of Psychology website and a  
14  
15 study flyer or a brief description of the study will also be advertised in some South East  
16  
17 Queensland schools' newsletters and notice boards.  
18  
19

20  
21 Participants will be assessed for eligibility and enrolled in the study by the study coordinator.  
22  
23 The study will be explained to parents by a member of the research team, and signed written  
24  
25 consent will be obtained, acknowledging that the children and parents are aware of all study  
26  
27 requirements, consent to take part, give permission for researchers to access their child's  
28  
29 medical records, agree to the video-recording and photographs of sessions, and understand  
30  
31 that they are free to withdraw their consent at any time. It is anticipated that enrolment will  
32  
33 commence in September 2013.  
34  
35

### 36 **Design**

37  
38 This study will utilize a randomized controlled trial design to evaluate the efficacy of the  
39  
40 MiYoga program compared to waitlist control (care as usual) for children with CP, aged 6 to  
41  
42 16 years old (see Figure 1 for Flowchart of MiYoga Study Design). After each child and  
43  
44 parent completes their baseline assessments they will be randomly allocated to one of two  
45  
46 groups:  
47  
48

- 49  
50 1. Immediate MiYoga Group (Group 1) – Families commence MiYoga program  
51  
52 immediately for 8 weeks.
- 53  
54 2. Waitlist MiYoga Control (Group 2) - Families continue care as usual for 8 weeks and  
55  
56 then are re-assessed before commencing a future MiYoga Program. Care as usual  
57  
58  
59  
60

1  
2  
3 consists of any therapies (for example, occupational therapy, physiotherapy,  
4  
5 psychologist) usually provided by public or private services and visits to their treating  
6  
7 pediatrician or general practitioner.  
8

9  
10 To limit confounding variables during the immediate intervention period (baseline to 8 week  
11  
12 follow up), children scheduled to receive casting, splinting, or intramuscular botulinum toxin  
13  
14 type A [BoNT-A] injections during the immediate intervention period will not be eligible.  
15  
16 Participants who have received intramuscular BoNT-A prior to beginning the study will have  
17  
18 their baseline assessments postponed until one month after their standard follow up has been  
19  
20 completed. Questionnaires will record the type, frequency and duration of any concurrent  
21  
22 therapies provided by public and private services during the study for all participants.  
23  
24

### 25 26 **Randomization**

27  
28 Prior to the intervention, participants will be asked to complete baseline assessments and  
29  
30 questionnaires. Once these are completed, participants will be randomly assigned to either  
31  
32 the wait-list group or immediate group and informed of the dates and times of their group.  
33  
34 The randomization sequence will be computer-generated. Treatment allocations will be  
35  
36 recorded pieces of paper, which will be folded and placed inside sealed, numbered, opaque  
37  
38 envelopes by a staff member not involved in the study. A staff member not involved in the  
39  
40 study will also open consecutive envelopes as each participant returns their baseline  
41  
42 questionnaires. After the randomization process is complete, study personnel will be  
43  
44 informed of group allocation and information packs will be sent out to families. Given the  
45  
46 nature of the study, no parties will be blinded to group assignment. The experimental design  
47  
48 and outcome measures are depicted in Figure 1.  
49  
50

### 51 52 **Figure 1. INSERT FLOWCHART OF MIYOGA STUDY DESIGN**

### 53 54 55 **Adverse Events**

56  
57  
58  
59  
60

1  
2  
3 There are no known health or safety risks associated with participation in the described study,  
4  
5 and the risk of adverse events is low. The ethical review process and conduct of the trial is  
6  
7 monitored by the two ethics committees, therefore no additional Data Monitoring Committee  
8  
9 is considered necessary.

10  
11 Any minor or major events associated with intervention or usual care groups will be  
12  
13 monitored throughout the 8-week program duration. The chief investigators KW and RB will  
14  
15 review any adverse events or unintended effect detected.  
16  
17

### 18 19 **Study Procedure**

20  
21 All participants will attend baseline assessments (T1) before being randomly allocated into  
22  
23 either the immediate MiYoga group or the waitlist control group. Participants in the  
24  
25 immediate group will begin the 8 week MiYoga program within three weeks of their baseline  
26  
27 assessment, while the waitlist group will continue care as usual for the next 8 weeks. When  
28  
29 the immediate group has completed the MiYoga program, all participants from both groups  
30  
31 (immediate and waitlist) will be re-assessed (T2) at. The waitlist group can then commence a  
32  
33 future MiYoga group of their choice. For each participant, data will be collected at Baseline  
34  
35 (T1) and following the immediate MiYoga group's completion of the program at 8 weeks  
36  
37 (T2). The waitlist group will also complete assessments after they have completed the  
38  
39 MiYoga program at 16 weeks (T3). Both groups will complete their follow up assessments  
40  
41 24 weeks after completing the MiYoga program – this will be 32 weeks post-baseline for the  
42  
43 immediate group and 40 weeks post-baseline for the waitlist group (T4). Participants will  
44  
45 complete their assessments within three weeks of the target time-points (in weeks) listed  
46  
47 above.  
48  
49  
50

51  
52  
53 The principal researcher (CM) is a registered psychologist and a qualified yoga teacher, will  
54  
55 conduct all the assessments and MiYoga sessions. A physiotherapist from the QCPRRC will  
56  
57  
58  
59  
60

1  
2  
3 perform the physical screen assessment for each child at baseline. In addition, they will be  
4  
5 present at the initial assessment to provide professional advice to the child, the  
6  
7 parent/guardian and to the psychologist/yoga teacher regarding the child's ability to perform  
8  
9 various yoga postures and the adaptations that may be necessary. Either a physiotherapist or  
10  
11 the principal researcher (CM) will conduct the physical assessments. Participants are  
12  
13 encouraged to complete their online questionnaires in person during their assessment session,  
14  
15 if they prefer they may also complete them online from home (via Qualitrics Insight  
16  
17 Platform). Registered clinical and developmental psychologist (KW) will provide regular  
18  
19 supervision. In addition, study coordinator will be able to consult with Professor Boyd (RB),  
20  
21 a registered physiotherapist, if there are any physical concerns.  
22  
23  
24  
25

### 26 **MiYoga Intervention**

27  
28  
29 Following randomization (immediate MiYoga group), or the Time 2 neuropsychological and  
30  
31 physical assessments (waitlist control group), participants and their parents will complete the  
32  
33 MiYoga program. All MiYoga sessions will be delivered in a group format where possible.  
34  
35 Child-parent dyads in the waitlist control group will also receive the same intervention after a  
36  
37 delay. In two-parent families, one of the parents will be invited to attend all sessions, and the  
38  
39 same parent will complete all the questionnaire measures.  
40  
41  
42

43 The MiYoga program itself is an 8-week program that consists of six 90-minute sessions over  
44  
45 the initial six weeks, then two phone or Skype consultations over the last 2 weeks of the  
46  
47 program. Over these 8 weeks, children and their parent or guardian are asked to partake in a  
48  
49 minimum of 20 minutes daily home practice. To assist with participants' home practice, a  
50  
51 MiYoga DVD and a MiYoga poster developed by the principal researcher will be provided at  
52  
53 the first MiYoga session. The MiYoga DVD is based on the Mindfulness exercises and *asana*  
54  
55 delivered in the group sessions. The MiYoga poster shows pictorially the *asana* delivered in  
56  
57  
58  
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1  
2  
3 the group sessions. In addition, it includes child specific modifications identified from the  
4 initial assessment session. Each MiYoga poster will contain general instructions as well as  
5 general and specific modifications for how parents may assist their child. Where possible a  
6 photo of the child performing the postures with their modifications will also be included.  
7  
8  
9  
10  
11 Researchers will assess the child's abilities in each of the yoga postures and provide  
12 modifications for the child as required in each posture. These modifications will be  
13 documented and put into the respective child's poster for them to take home and practice.  
14  
15  
16  
17 This will ensure that participants will not attempt any new exercises or poses at home without  
18 assistance and guidance from a therapist (see Appendix A for a MiYoga program summary).  
19  
20  
21  
22

23  
24 There are formal and informal Mindfulness activities in MiYoga. The formal Mindfulness  
25 activities consist of mindful movements in the form of Hatha Yoga and short Mindfulness  
26 meditations. The yoga postures selected for the program aim to help them build strength and  
27 increase flexibility (see Appendix B for a table and illustrations of the MiYoga postures for  
28 children with cerebral palsy). The informal activities present Mindfulness techniques as  
29 game-like explorations, based on exploring our internal and external worlds with the five  
30 senses as well as consciously reflecting on thoughts and feelings. These activities and games  
31 were developed based on literature on mindfulness and yoga for both children and adults.<sup>42 43</sup>

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41 52 81-91  
42

43  
44 One of the informal activities involves children having to guess what they are eating while  
45 blind folded. This game will involve the child to consciously notice the food with all their  
46 senses, such as by feeling the texture of the food in their hands and mouth, smelling and  
47 tasting it, and possibly even hearing the sounds the food makes when chewing it (and  
48 subsequently noticing crunchy, chewy or soft foods). Children may have to identify an object  
49 by exploring it only with their hands (sense of touch) and then describe how the object feels  
50 in their hands to another person without naming the object. This game encourages the child to  
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1  
2  
3 use their sense of touch to explore their environment and increase their awareness of how the  
4  
5 sense of touch provides them with information about their surroundings. Such activities are  
6  
7 both interesting for the participants, but are also mindful practices that stimulate a state of  
8  
9 awareness.  
10

11  
12 The Hatha Yoga techniques or postures in this study were based on Viniyoga principles<sup>39</sup>  
13  
14 and they were tailored for children with cerebral palsy. The synchronization of breath and  
15  
16 movement is a key element as it helps to focus the mind on the present (i.e. moving through  
17  
18 yoga postures with the breath) providing a mindful movement practice. To make  
19  
20 synchronizing breath and movement more natural and fun for children, participants will be  
21  
22 invited to make sounds along with the instructor, such as “Ahh...”, in the asana sequences to  
23  
24 assist with their exhalation. The yoga postures will be modified as required for each  
25  
26 participant. Some of the modifications will use supports such a wall, chair, or blocks, to  
27  
28 ensure correct posture, adequate support and comfort, or to accommodate muscle shortness or  
29  
30 postural difficulties. For example, some children may sit on a block to keep their pelvis level  
31  
32 and to accommodate their shorter hamstring muscles and leading to posture pelvic tilt within  
33  
34 long sitting. These physical modifications will be individualized to each child’s need based  
35  
36 on the baseline physical screen by a Physiotherapist. The physical adaptations may not be the  
37  
38 same for all children with CP while some children did not require any physical modifications.  
39  
40 For this reason Appendix B mainly illustrates non-adapted postures and only some examples  
41  
42 of possible modifications. In addition to the physical modifications, verbal prompts will  
43  
44 guide the children into the postures. For example “going as far as it is comfortable for you,  
45  
46 this may be coming forward to thighs or your knees” or “notice the sensation in the back of  
47  
48 your legs as you fold forward, you may like to explore how it feels for you to keep your  
49  
50 knees straight as you come forward”. A verbal prompt for children to sit with good  
51  
52  
53  
54  
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1  
2  
3 alignment (avoid W-sitting) may be “as we sit back onto our heels be mindful that your knees  
4  
5 and big toes are together”.

6  
7  
8 Each session will be 90 minutes with guided instruction throughout each component of  
9  
10 Mindfulness practice. During Hatha Yoga postures, instructions will be provided on safe  
11  
12 ways to get in and out of the positions, pose modification, and use of props to suit needs and  
13  
14 limitations of each child. For instance the supine twist can be performed on a chair rather  
15  
16 than on the ground. Blankets, cushions, bolsters, straps, and other props may be used to  
17  
18 maintain body alignment, structural support, and comfort (see Appendix B’s possible  
19  
20 modification column for more details). Emphasis will be placed on building length along the  
21  
22 spine while maintaining neutrality of spinal position, keeping awareness of the breath, and  
23  
24 using breath and sensations within the body to anchor attention to the present moment.  
25  
26

### 27 28 **Locations**

29  
30 It is expected that groups and assessments will be conducted in Brisbane, and various  
31  
32 locations in South East Queensland. Locations in Brisbane will include The University of  
33  
34 Queensland, St Lucia and Herston campuses, and the Centre for Children’s Health Research  
35  
36 in South Brisbane. If participants are located outside of Brisbane then suitable locations will  
37  
38 be organized with the participating families in those areas.  
39  
40

### 41 42 **Participation and Data Management**

43  
44 To maximize participation and retention, email reminders will be sent to participants three  
45  
46 days prior to their scheduled appointments, and text message reminders will be sent to  
47  
48 participants the day prior to their appointments and their weekly MiYoga sessions. To  
49  
50 further promote recruitment, participation, and retention, the study offers a waitlist control  
51  
52 group so that all participants have an opportunity to take part in the MiYoga program. It is  
53  
54 also possible to extend the period of recruitment and the delivery MiYoga groups should  
55  
56  
57  
58  
59  
60

1  
2  
3 recruitment be more challenging than anticipated. The number of participants recruited and  
4  
5 participant retention will be recorded throughout the trial period.  
6  
7

8 Treatment dose will be calculated based on participants' attendance at the weekly MiYoga  
9  
10 sessions, as well as the amount of home practice completed by participants between sessions.  
11

12 The therapist will record participant attendance after each weekly MiYoga session, and  
13  
14 parent participants will record the amount of home practice they completed each week in  
15  
16 their MiYoga diary. The MiYoga diaries will be collected weekly and monitored by the  
17  
18 therapist. Strategies to facilitate and support engagement in the program will be discussed  
19  
20 with the participant and their parents throughout the duration of the MiYoga program in the  
21  
22 group sessions as well as via individual phone calls.  
23  
24

25  
26 A protocol checklist will be completed by the therapist (first author) at the end of each  
27  
28 MiYoga session. This protocol checklist will be used to monitor therapy fidelity and to  
29  
30 ensure that all the MiYoga content was delivered as per protocol.  
31  
32

33  
34 Paper copy data will be de-identified and physically stored in a locked file cabinet at the  
35  
36 QCPRRC. These physical documents may be scanned (after de-identification) and password  
37  
38 protected in a computer file on a secure server. Computer files will be de-identified and  
39  
40 password protected on a secure server.  
41  
42

43  
44 Video files of the MiYoga sessions will be used to assess for therapist integrity and  
45  
46 consistency across groups. These video files will be managed and kept on a secure  
47  
48 online database run through QCPRRC and back up files may be kept on a external harddrive  
49  
50 or CD in a locked cabinet.  
51  
52

53 Study updates and general outcomes will be sent to participants in a newsletter format. A  
54  
55 summary report of the overall study findings will also be sent to participants at the conclusion  
56  
57  
58  
59  
60

1  
2  
3 of the project. Feedback on the specific formal assessments will be provided when requested  
4  
5 by the participant or parent.  
6  
7

### 8 **Participant Characteristic Measures**

9  
10 The following questionnaires and assessments will be completed prior to the intervention to  
11  
12 gather baseline information about the sample of children and their parents:  
13

#### 14 *Gross Motor Function Classification System (GMFCS)*<sup>92</sup>

15  
16 The GMFCS classifies, across 5 levels, a child's ability to carry out self-initiated sitting and  
17  
18 walking movements.<sup>92</sup> A correlation between the GMFCS and the Gross Motor Function  
19  
20 Measure (GMFM) of  $r=0.91$  suggests construct validity has been obtained.<sup>93</sup> GMFCS also  
21  
22 has good inter observer reliability between professionals as well as between professionals and  
23  
24 parents in children with CP.<sup>94</sup>  
25  
26

#### 27 *Brief Health Questionnaire (BHQ)*

28  
29 The Brief Health Questionnaire (BHQ) screens for existing medical conditions that may  
30  
31 prevent the child or the parent to participant in MiYoga, with separate questionnaires for  
32  
33 children and parents. (see Appendix C).  
34  
35

#### 36 *Physical screening clinical examination*

37  
38 A physiotherapist will conduct this examination to determine if the participating child has  
39  
40 any physical conditions that might preclude them from exercise (see Appendix D).  
41  
42

43  
44 *Wechsler Intelligence Scale for Children–Fourth Edition Short Form (WISC-IV;*  
45  
46 *Wechsler, 2003)*<sup>95</sup>  
47

48  
49 Intellectual functioning will be assessed using the Wechsler Intelligence Scale for  
50  
51 Children fourth edition short form (WISC-IV).<sup>95</sup> The WISC-IV comprises seven subtests that  
52  
53 generate the four indices of verbal comprehension (VCI), perceptual reasoning (PRI),  
54  
55 working memory (WM), and processing speed (PSI). From these overall short form index  
56  
57 scores a full scale intelligence quotient (FSIQ) score can be calculated. In the WISC-IV short  
58  
59  
60

1  
2  
3 form the VCI index is made up of the Vocabulary and Similarities subtests. The Vocabulary  
4 subtest assesses knowledge of word meanings and will require participants to name pictures  
5 or provide spoken definitions of words (e.g., “what is a bicycle?”). The Similarities subtest  
6 assesses verbal abstraction and reasoning and will require participants to describe how two  
7 words are similar (e.g., “how are anger and joy alike”). The Block Design and Matrix  
8 Reasoning subtests make up the PRI index in the WISC-IV short form. Block design will  
9 require participants to construct abstract visual designs with a set of red-and-white 3D blocks  
10 within a specified time period. Matrix Reasoning, will require participants to use their non-  
11 verbal abstract reasoning and problem solving skills in order to select the correct picture from  
12 an array of five options that fits into the missing space of a visual design. The WMI index is  
13 made up of the Digit Span subtest in which participants will be required to repeat a number of  
14 verbally presented digits in forward and reverse order. Finally, the PRI index is made up of  
15 the Coding and Symbol Search subtests, each of which has a two-minute time limit and  
16 therefore require participants to work as quickly as possible without making mistakes. For  
17 the Coding subtest, participants will need to match abstract symbols with a number key while  
18 for Symbol Search, participants will be required to detect the presence of one or more  
19 symbols in a sequence of five.<sup>96</sup>

20 Scaled scores will be derived from index scores in accordance with normative data based on  
21 the child’s age and gender (mean=100, standard deviation [SD]=15).<sup>95 97</sup> All index scores of  
22 the WISV-IV SF have shown moderate to high levels of internal consistency ( $\alpha=0.87-0.96$ )  
23 and are equivalent to those documented for the full WISV-IV, with the exception of the WMI  
24 which is marginally lower than its full length equivalent.

## 52 **Primary Outcome Measures**

### 55 *Attention*

57 The Conner’s Continuous Performance Test II (CPT II)<sup>26</sup> will be used to measure sustained  
58  
59  
60

1  
2  
3 attention performance. It is a standardized 14-minute computer administered test in which  
4  
5 participants are asked to observe letters displayed on a computer screen and click at the  
6  
7 appearance of each letter, except for that of the letter 'X'. The stimuli appear at random  
8  
9 intervals (1, 2 or 4 seconds) and the duration of each stimulus is 250 milliseconds. This test  
10  
11 measures the time to process information (e.g. Reaction Time (RT)) and errors such as false  
12  
13 negatives or false positives. The test is divided into six equal blocks of 20 trials.

14  
15  
16  
17 Twelve indices from the Conners' CPT will be analyzed. These indices are: (i) Number of  
18  
19 Omissions: the number of letters, other than X, not detected (test retest correlation  
20  
21 coefficients  $r = 0.84$ ); (ii) False positives/ Commissions: the number of responses to the letter  
22  
23 X ( $r = 0.65$ ); (iii) Hit Reaction time (RT;  $r = 0.55$ ); (iv) Hit RT Standard error (Hit RT SE;  $r$   
24  
25 = 0.65) and (v) Variability of RT: indicates consistency of RTs between blocks ( $r = 0.60$ );  
26  
27 (vi) Detectability ( $d$  prime): RT distribution of target vs. non-target (X) ( $r = 0.76$ ); (vii)  
28  
29 Perseverations: responses with a RT too short (5100 ms) indicating anticipatory responding  
30  
31 or responses to a previous stimuli (suggesting very slow responses/inattentiveness) ( $r = 0.43$ );  
32  
33 (viii) Response style: indicates an over-cautious vs. a highly impulsive response ( $r = 0.62$ );  
34  
35 (ix) Hit RT block change: a high score implies that, as the test progresses, RTs are longer ( $r =$   
36  
37 0.28); (x) Hit SE block change: a high score implies that as the test progresses, RT variation  
38  
39 increases ( $r = 0.08$ ); (xi) Hit RT Inter-Stimulus Intervals (ISI) change: a high score implies  
40  
41 that, as the stimulus interval increased, the RTs became longer ( $r = 0.51$ ); and (xii) Hit SE ISI  
42  
43 change: a high score implies that RT variation increased as the stimulus interval increased ( $r$   
44  
45 = 0.05).<sup>26</sup> Some of these indices make up different variables, namely, sustained attention,  
46  
47 inattention and vigilance.  
48  
49  
50  
51  
52

53  
54 The primary variable of interest in this study is sustained attention. This is observed through  
55  
56 the participant's responding pattern on the CPT's Hit RT block change, Commissions block  
57  
58 change, and Omissions block change indices. A decrease in sustained attention performance  
59  
60

1  
2  
3 is captured by significant slowing in participant's Hit RT, and significant increase in errors  
4  
5 (omissions and commissions) as the task progresses. Participant's performance across blocks  
6  
7 1, 2 and 3 will be compared to their performance across blocks 4, 5 and 6 of the same  
8  
9 administration.

10  
11  
12 The indices that measure participant's inattention are poor detectability, a high number of  
13  
14 omission and commission errors, a slow Hit RT, and high variability in RT (Hit RT SE).

15  
16 While the indices that measure participant's vigilance (participant's performance at different  
17  
18 stimulus frequency or inter-stimulus intervals), is captured by performance on the Hit RT ISI  
19  
20 change.  
21  
22

## 23 24 **Secondary Outcome Measures**

### 25 26 *Executive functioning*

27  
28 A neuropsychological test battery will be used to evaluate executive attention abilities such as  
29  
30 selective attention, attentional control, cognitive flexibility, and working memory. This  
31  
32 neuropsychological test battery is comprised of subtests from the Wechsler Intelligence Scale  
33  
34 for Children Fourth Edition (WISC-IV),<sup>97</sup> and the Delis-Kaplan Executive Function System  
35  
36 (D-KEFS).<sup>98</sup> A parent-rated questionnaire, the Behavior Rating Inventory of Executive  
37  
38 Function (BRIEF),<sup>99</sup> will be used as a measure of day-to-day behavioral manifestations of  
39  
40 executive functioning.  
41  
42  
43  
44

45  
46 *Digit Span (from the WISC-IV).*<sup>97</sup> The WISC-IV Digit Span subtest is a verbal  
47  
48 memory task requiring participants to repeat a sequence of digits in forwards and backwards  
49  
50 order. It measures a child's working memory and their ability to temporarily store  
51  
52 information. Digit Span Forward requires the child to repeat a series of numbers given  
53  
54 verbally by the examiner, increasing one digit per item from two digits to a maximal of nine  
55  
56 digits. Digit Span Backward requires the child to repeat given number series in the reverse  
57  
58  
59  
60



1  
2  
3 order (e.g., if the examiner said “5 – 7 – 4” the child should say “4 – 7 – 5”). A score of one  
4  
5 will be given to each string correctly answered and a total score will be generated (Digit Span  
6  
7 Backward range = 0 – 16). Raw scores can be converted into scaled scores (M = 10, SD = 3).  
8  
9 Digit Span Backward has a good internal consistency ( $\alpha = .80$ )<sup>97</sup> and a high test–retest  
10  
11 reliability ( $r = .74$ ).<sup>97</sup>  
12  
13

14  
15 *Symbol Search (from the WISC-IV).*<sup>97</sup> The WISC-IV Symbol Search subtest will be  
16  
17 used as a measure of selective attention. Participants will be required to visually scan a group  
18  
19 of symbols and indicate whether a target symbol is present in the group by placing a line  
20  
21 through the word ‘yes’ or ‘no’ for every target item on this subtest. Participant scores are  
22  
23 calculated by taking away the total number of incorrectly identified symbols from the total  
24  
25 number of correctly identified symbols. Symbol search has adequate internal consistency ( $\alpha$   
26  
27 = 0.79) and a high level of test-retest reliability ( $r = 0.80$ ).<sup>97</sup>  
28  
29

30  
31 *Color-Word Interference Test (from the D-KEFS).*<sup>98</sup> The inhibition condition (cond  
32  
33 3) of the Color-Word Interference Test will be used to measure attentional control, while the  
34  
35 inhibition/switching condition (cond 4) will be used to measure attentional control and  
36  
37 cognitive flexibility. In the inhibition condition (cond 3), children will be required to name  
38  
39 the ink color that color words are printed in. The total number of errors and the time it takes  
40  
41 to complete the task will be used as outcome measures of attentional control, with the longer  
42  
43 times and more errors indicating poorer attentional control. In the inhibition/switching  
44  
45 condition (cond 4) children will be required to switch between naming the color of the ink  
46  
47 that the word is printed in (like in cond 3) and reading the word (if it is presented in a box).  
48  
49 The total time it takes to complete the task will be used as outcome measures of cognitive  
50  
51 flexibility, while the total number of errors will be used as outcome measures of attentional  
52  
53 control. The Color-Word Interference Test has excellent test-retest reliability ( $r = 0.79$ -  
54  
55 0.90).<sup>100</sup>  
56  
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59  
60

1  
2  
3 *Trail Making Test (D-KEFS).*<sup>98</sup> The number-letter switching condition (cond 4) from  
4 the Trail Making Test will be used to measure attentional control and cognitive flexibility. In  
5 condition 4 of the Trail Making Test, children will be required to switching back and forth  
6 between connecting numbers in numerical order and letters in alphabetical order, for  
7 example, 1 to A to 2 to B to 3 to C and so on all the way to P. The number of errors and the  
8 time it takes to complete the task will be recorded and the more error and the longer it takes  
9 to complete the task indicates greater difficulty with attention control and cognitive  
10 flexibility. Trail Making Test has moderate test-retest reliability ( $r=0.20-0.82$ ) has been  
11 documented.<sup>100</sup>

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23  
24 *Brief Rating Inventory of Executive Function (BRIEF).*<sup>29</sup> The BRIEF is a parent-rated  
25 questionnaire for assessing day-to-day behavioral manifestations of executive function.  
26 Parents will be required to rate 86 items (e.g., “gets stuck on one topic or activity”) on a  
27 three-point Likert scale, from 1 (*never*) to 3 (*often*). The provided normative data in the  
28 manual will allow raw scores to be converted into *T* scores (M = 50, SD = 10). Eight  
29 subscales are combined to form the Behavioral Regulation Index (BRI; Initiate, Working  
30 Memory, Plan/Organize, Organization of Materials, and Monitor subscales) and the  
31 Metacognition Index (MCI; Inhibit, Emotional Control, and Shift subscales). Together these  
32 form the overall Global Executive Composite (GEC). *T* scores of 65 or more (1.5 SD above  
33 the mean) indicate elevated levels on the corresponding subscales and indices. Higher *T*  
34 scores indicate greater executive dysfunction. In this study, the GEC will be used as primary  
35 measures of executive function in everyday life. The BRIEF has been shown to be a valid  
36 measure of executive functioning and has good internal consistency ( $\alpha = 0.80 - 0.98$ ) and  
37 high test-retest reliability on the GEC ( $r=0.86$ ).<sup>101</sup>

### 54 55 *Mindfulness*

1  
2  
3 Child and Adolescent Mindfulness Measure (CAMM)<sup>73</sup> assesses present-moment awareness  
4 and nonjudgmental, non-avoidant responses to thoughts and feelings. In this 10-item  
5 questionnaire, children are asked to indicate how each item reflects their experience using a  
6 5-point scale ranging from 0 (Never true) to 4 (Always true). A total acceptance-Mindfulness  
7 score will be generated by reverse scoring negatively worded items and summing the item  
8 total, yielding a possible range in scores from 0-100. The higher scores indicate higher levels  
9 of acceptance and Mindfulness. This test has been shown to have good internal consistency  
10 ( $\alpha = 0.81$ ).<sup>73</sup>

### 21 Behavioral

22  
23  
24 Strengths and Difficulties Questionnaire (SDQ)<sup>71 102</sup> is a 25-item parent-report questionnaire  
25 designed to assess their child's behavior and adjustment. The items are divided into 5 scales  
26 to assess the frequency within the last six months of emotional symptoms, conduct problems,  
27 inattention/hyperactivity, peer problems and prosocial behavior. These items are rated on  
28 three-point scale, from zero (*not true*) to two (*certainly true*), allowing for a total score for  
29 each scale (0-10) to be calculated, along with an overall difficulties score that takes into  
30 account overlapping elements of each score (0-40). Higher scores indicate more distress on  
31 all scales except prosocial behavior. In this study, the SDQ total score will be used as  
32 primary measures of children's behavior. SDQ total score has been shown to have a  
33 moderate to high level of internal consistency ( $\alpha = 0.73-0.82$ )<sup>103 104</sup> and a moderate to high  
34 test-retest reliability ( $r=0.77 - 0.85$ ).<sup>102 104</sup>

### 49 Physical Outcome Measures

#### 51 Flexibility

52  
53  
54 Lower back and hamstring muscle flexibility will be assessed by the Sit and Reach test (reach  
55 distance). Participants sit on the floor with both legs extended as straight as possible in front,  
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1  
2  
3 heels placed on the floor, and feet flat against a wall so that the ankle is dorsiflexed to  
4  
5 approximately 90 degrees. Participants are instructed to stretch their arms straight in front  
6  
7 with hands overlapping (middle fingers overlapping too) and slowly bend forward at the hip  
8  
9 joint reaching as far as possible towards their toes. The maximum reach must be held for 2  
10  
11 seconds, and the distance between the tips of the middle fingers to the wall at the top of the  
12  
13 toes is recorded.  
14

### 15 16 17 *Lower Limb Functional Strength*

18  
19 The following functional exercises will be used to assess strength.  
20

21  
22 *Lateral step-up.* Lateral step-up records the number of steps up on to a step from the  
23  
24 floor that the child can perform during 30 seconds.<sup>72</sup> The test will be performed on a 10cm  
25  
26 high step for all children, with a complete up and down step being one full cycle. The child  
27  
28 stands parallel to the step with the leg being tested on the step, and the non-testing leg on the  
29  
30 floor. They are asked to extend their test leg (on the step) straight and lift their non-test leg  
31  
32 off the ground and onto the step and then lower the non-test leg back down to the floor until  
33  
34 the foot touches the ground.<sup>105</sup> This is then repeated for the other leg. Reliability for this test  
35  
36 is strong (ICC=0.94) and mean repetitions for the lateral step up were 13.2 (SD=10.5;  
37  
38 standard error of measurement (SEM)=2.4 reps; CV=17.8%) for the left side, and 12.6  
39  
40 (SD=10.4; SEM=2.6 reps; CV=22.7%) for the right side.<sup>72</sup>  
41  
42  
43  
44

45  
46 *Sit-to-stand.* The sit-to-stand functional strength test records the number of sit-stand-  
47  
48 sit repetitions that the child can perform within 30 seconds.<sup>72</sup> The test will be performed on a  
49  
50 chair where the child's knees and hips are at 90° flexion, upper legs parallel to the floor and  
51  
52 feet flat on the floor. The child will be asked to stand up straight so that their hips and knees  
53  
54 are extended and then sit back down. Reliability for this test was strong (intra class  
55  
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2  
3 correlation (ICC) =0.91) and the mean number of repetitions was 14.4 (SD=5.0; SEM=2.6  
4  
5 reps; CV=22.7%).<sup>72</sup>  
6

7  
8 *Half-kneel to stand.* Half-kneel to stand records the number of repetitions from half  
9  
10 kneel to stand the child can perform within 30 seconds.<sup>72</sup> The child is positioned on a mat,  
11  
12 with one leg kneeling on the floor while the other leg is in front with the knee at 90° flexion  
13  
14 and foot flat on the floor. From this half-kneeling position the child is asked to assume a  
15  
16 standing position. Repetitions are counted each time the participant achieves a standing  
17  
18 position where both legs and hips are extended as much as possible. This is then repeated  
19  
20 with the other leg in front. Reliability for this test was strong (ICC=0.93 to 0.96) and mean  
21  
22 repetitions was 7.5 reps (SD=5.5; SEM=1.1 reps; CV=28.6%) for the left side and 6.0  
23  
24 (SD=5.3; SEM=1.4 reps; CV=39.9%) for the right side.<sup>72</sup>  
25  
26

27  
28 *Submaximal motor capacity test.* The 6-minute walk test (6MWT)<sup>106</sup> is a submaximal  
29  
30 clinical exercise test which measures the distance the child can walk in six minutes.<sup>106</sup> The  
31  
32 child will be asked to walk as many laps as they can without running for 6 minutes along a  
33  
34 straight, flat a corridor, between two markers set 10m apart. The 6MWT will be conducted  
35  
36 with standardized verbal encouragement and the child will be advised on the time remaining  
37  
38 every minute and the number of laps they have completed as it happens. The 6MWT has  
39  
40 been demonstrated to be reliable in independently ambulant adolescents with CP and the test-  
41  
42 retest is excellent (ICC=0.98).<sup>106</sup>  
43  
44

#### 45 46 47 *Mobility*

48  
49 The MobQues28 questionnaire measures mobility limitations a child with CP experiences in  
50  
51 everyday life as rate by their parents.<sup>107 108</sup> The MobQues28 is score on a 5 point scale from  
52  
53 0-4, with 0 being *Impossible without help*; 1 being *Very difficult*; 2 being *Somewhat difficult*;  
54  
55 3 being *Slightly difficult*; and 4 being *Not difficult at all*. Item scores (range 0–4) are added  
56  
57  
58  
59  
60

1  
2  
3 together and then divided by the maximum possible score and multiplied by 100 to obtain  
4  
5 total scores on a scale of 0 to 100 (lower scores indicate severe limitations in mobility):  
6  
7  $MobQues28 = (\sum \text{item} / 112) \cdot 100$ . Construct validity was demonstrated as MobQues28 scores  
8  
9 decreased with increasing GMFCS level ( $p < 0.001$ ) and in a sub group of 162 children,  
10  
11 MobQues28 score was positively correlated to GMFM-66 ( $r = 0.67$ ,  $p < 0.001$ ).<sup>108</sup> The  
12  
13 MobQues28 has been demonstrated to be reliable with high the interrater reliability  
14  
15 (ICC=0.87), standard error of measurement (SEM) was 8.9. The intra-rater reliability was  
16  
17 higher (ICC=0.96-0.97; SEM=4.4-4.9).<sup>107</sup>  
18  
19

### 20 21 *Quality of Life*

22  
23  
24 *CP QOL-Child.* The CP QOL-Child is a condition-specific quality of life measure for  
25  
26 children with cerebral palsy.<sup>74</sup> Two versions of the CP QOL-Child will be used in this study;  
27  
28 the CPQOL-Child parent report version will be used for all participants under 12 years of  
29  
30 age, and the CPQOL-Child self-report version will be used for children 9-12 years of age.  
31  
32 The parent-report measure of child quality of life is a 66-item questionnaire and the child  
33  
34 self-report version is a 53-item questionnaire. Results of factor analysis demonstrated that  
35  
36 the CPQOL measures 7 broad domains of quality of life: social wellbeing and acceptance,  
37  
38 functioning, participation, physical health, emotional wellbeing, access to services, pain,  
39  
40 impact of disability and family health. In this study, the GEC will be used as primary  
41  
42 measures of executive function in everyday life. The CPQOL-Child has a high internal  
43  
44 consistency ( $\alpha = 0.74-0.92$  for parent report and  $\alpha = 0.80-0.90$  for child self-report), good test-  
45  
46 retest reliability (ICC=0.76-0.89) and it is moderately correlated with generic QOL and health  
47  
48 measures ( $r = 0.30-0.51$ ).<sup>109 110</sup>  
49  
50  
51

52  
53  
54 *CP QOL-Teen.* The CP QOL-Teen is a condition specific quality of life measure for  
55  
56 adolescents with cerebral palsy.<sup>75</sup> Two versions of this CP-QOL will also be use: the  
57  
58  
59  
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1  
2  
3 CPQOL-Teen parent report version will be completed by parents of participants aged 13-18  
4  
5 and the CP-QOL-Teen self-report version will be completed by participants 13-18 years of  
6  
7 age.<sup>75</sup> This measure has strong internal consistency ( $\alpha=0.81-0.95$  for the primary parent  
8  
9 report, and  $\alpha=0.84-0.96$  for the adolescent self-report), good test re-test reliability for primary  
10  
11 parents (ICC=0.72-0.92) and adolescents (ICC=0.84-0.87). All domains of the CPQOL-Teen  
12  
13 parent report ( $r=0.40-0.46$ ) and adolescent report ( $r=0.58-0.68$ ) were correlated with a generic  
14  
15 QOL instruments.<sup>111</sup>

### 18 19 *Pain*

20  
21  
22 The Baker-Wong Faces™ Pain Rating Scale will be used to assess the child's pain level.<sup>112</sup>  
23  
24 Children will be asked to match which of the six hand-drawn faces show their pain level,  
25  
26 with faces ranging from smiling ('no hurt') to crying ('hurts worst'), with the scale scored  
27  
28 from 0 to 5. It has been documented that Baker-Wong Faces™ Pain Rating Scale has an  
29  
30 excellent test-retest reliability over 15 minutes, 8 hours and immediately post-procedure in  
31  
32 children 3–18 years old ( $r = 0.90 - 0.84$ ).<sup>113 114</sup> There are also strong positive correlations  
33  
34 between the Wong-Baker FACES Pain Scale and other well-established self-report measures  
35  
36 ( $r = 0.74 - 0.78$ ) (e.g., Pieces of Hurt tool, Faces Pain Scale, and a visual analogue scale).<sup>113</sup>  
37  
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39  
40 115-117

### 41 42 43 **Parent Outcome Measures**

44  
45  
46 The following tests will be used to assess the psychological well-being of parents. These  
47  
48 assessments will be completed at baseline, pre-intervention, post-intervention, and at a 6-  
49  
50 month follow-up.  
51

### 52 53 *Mindfulness Attention Awareness Scale (MASS)*<sup>76</sup>

1  
2  
3 The Mindfulness Attention Awareness Scale (MASS) will be used to measure each parents'  
4 tendency to be mindful of moment-to-moment experiences.<sup>76</sup> The MAAS is a 15 item  
5 instrument focusing on the presence or absence of attention and awareness of their present  
6 immediate environment. Participants are asked to indicate how frequently they have the  
7 experience described in each of the 15 statements using a 6-point Likert scale from 1 (almost  
8 always) to 6 (almost never). For example, one statement is "It seems I am 'running on  
9 automatic', without much awareness of what I'm doing", while another is "I snack without  
10 being aware that I am eating". The total score is used as outcome measure, with higher  
11 scores reflecting more Mindfulness. This scale has been shown to relate to various aspects of  
12 well-being and to how effectively people deal with stressful life events.<sup>76</sup> The MAAS also  
13 has good internal consistency, with alphas ranging of .82 in student sample.<sup>76</sup>  
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#### 28 *Acceptance and Action Questionnaire (AAQ-II)*<sup>78</sup>

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31 The Acceptance and Action Questionnaire (AAQ) assesses the construct referred to as  
32 acceptance, experiential avoidance, or psychological inflexibility.<sup>118</sup> This 7 item  
33 questionnaire has been documented to have a satisfactory structure, reliability, and validity,  
34 with a mean alpha coefficient of 0.84 (0.78–0.88), and the 3- and 12-month test–retest  
35 reliability is 0.81 and 0.79, respectively.<sup>118</sup>  
36  
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42

#### 43 *Depression Anxiety Stress Scale (DASS)*<sup>77</sup>

44  
45  
46 The Depression Anxiety Stress Scale (DASS) is a 42-item questionnaire that assesses the  
47 presence of psychological symptoms in adults.<sup>77</sup> In this study, a total score will be  
48 computed, falling in the range 0–126, with higher scores indicating suboptimal states. The  
49 measure has shown high internal consistency for depression ( $\alpha = 0.91$ ), anxiety ( $\alpha = 0.84$ )  
50 and stress ( $\alpha = 0.90$ ) scales. The DASS also has good discriminate and concurrent  
51 validity.<sup>77 119</sup>  
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3 *Personal Wellbeing Index – Adult (PWI-A)*<sup>79</sup>  
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5

6 The Personal Wellbeing Index – Adult (PWI-A) is an eight item questionnaire that assesses  
7  
8 the ones' level of satisfaction with life as a whole.<sup>79</sup> Each item corresponds to a quality of  
9  
10 life domain, such as standard of living, health, achieving in life, relationships, safety,  
11  
12 community-connectedness, future security, and spirituality/religion.  
13

14  
15  
16 *Child–Parent Relationship Scale (CPRS)*<sup>80</sup>  
17

18 The Child–Parent Relationship Scale (CPRS) is a 15-item questionnaire that use a 5-point  
19  
20 rated scale and it is completed by the parent to assess the quality of the parent–child  
21  
22 relationship.<sup>80 120</sup> The CPRS is an adaptation of the Student–Teacher Relationship Scale  
23  
24 (STRS) , which has been used extensively in studies of relationship quality in the US  
25  
26 (National Institute of Child Health and Development Early Child Care Research Network,  
27  
28 n.d.).<sup>121</sup> In this study, the overall conflict score and closeness score will be used as  
29  
30 measures of parent-child relationship quality.  
31  
32  
33  
34

35 **MiYoga Session Measures**  
36

37  
38 The following tests have been developed in order to measure the mechanism of change due to  
39  
40 the MiYoga intervention. Both child and parent participants will complete these measures  
41  
42 either before and after or just after each MiYoga session.  
43  
44

45 *Mindfulness*  
46

47  
48 MiYoga Session Mindfulness Measure is a 5-item scale adapted from the CAMM. It  
49  
50 measures children and parent's Mindfulness in the MiYoga session they have just completed.  
51  
52 Each child and parent will complete this Mindfulness scale at the end of each MiYoga  
53  
54 session (see Appendix E).  
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### *Mood*

The Mood Scale is a short scale used to measure participants' mood or how they are feeling before and after each MiYoga session. It is a 1 to 5 scale with 5 being very good and 1 being very bad where 5 matched with a happy face, 3 is matched with a neutral face and 1 is matched with a sad face (see Appendix F).

### *Session feedback*

At the end of each MiYoga session, children and parents will each be asked to complete a Session Feedback Scale. This is a short four item questionnaire asking the participants about the session in regards to comfort, enjoyment, body awareness and overall satisfaction. Each of these questions is also on a 0 to 10 scale, with 10 being high (or very good) and 0 being low (or very bad; see Appendix G).

### **Qualitative Interviews**

A registered psychologist (or a probationary psychologist under supervision) will conduct a short interview with individual participants at the end of the MiYoga program. The interviewer will be unrelated to the MiYoga study to avoid bias, and to encourage participants to express their view and opinions about the program freely. The aim of these interviews is to gather qualitative information about the participants' views of the program, such as what they liked or disliked, and which parts worked (or not) for them. This qualitative information will help with program refinement and translation. For example, it will provide information on how Mindfulness and yoga can be integrated into participants' everyday life (see Appendix H for qualitative interview script and questions).

### **STATISTICAL ANALYSIS**

#### **Sample Size**

1  
2  
3 The reaction time of children with CP was two standard deviations below healthy controls on  
4 the Continuous Performance Test (CPT).<sup>9</sup> The present study is interested in detecting a  
5 difference of one standard deviation between the immediate treatment and control group at  
6  
7 Time 2 (post-intervention) to determine the clinical significance of the MiYoga program  
8 compared to waitlist control.<sup>122</sup> Based on Lehr's equation, with alpha set at 0.05, and power  
9 set at 0.80, to detect a difference of one standard deviation between groups, a sample size of  
10 16 participants per group would be needed.<sup>123</sup> If a retention rate of 90% is assumed, a total of  
11 36 children will need to be recruited.  
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### 20 21 **RCT data analysis**

22  
23 Analysis will follow standard principles for RCTs, using two-group comparisons on all  
24 participants on an intention-to-treat basis. All the participants will be analysed within the  
25 group they were randomized for all the outcome measures. Any missing data in the event of  
26 withdrawal or loss to follow up, a participant's assessment from the last available time-point  
27 will be carried forward. External and internal validity of results will be checked using  
28 baseline and general descriptive information available for all eligible families. This will be  
29 done by comparing the characteristics of families who completed the study with those who  
30 enrolled in the study but did not complete, and those who did not enroll. The primary  
31 comparison immediately post intervention (T2) will be scores from the Continuous  
32 Performance Test.  
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47 Analysis will follow standard methods for randomized controlled trials using comparisons  
48 between the two groups (MiYoga and wait-list control). The experimental unit will be the  
49 child and their participating parent. Attrition analysis will be conducted. Data will be  
50 analyzed using Statistical Package for the Social Sciences (SPSS). The hypotheses relating to  
51 intervention efficacy will be tested using general linear models, specifically via analysis of  
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3 covariance (ANCOVA). In addition, predictors of treatment outcome will be explored using  
4  
5 regression analyses. Non-parametric methods will be used for simple comparisons in cases  
6  
7 where continuous data exhibit substantial skewness not overcome by transformation.  
8  
9

### 10 11 **Qualitative data analysis**

12  
13  
14 A descriptive thematic analysis will be undertaken to analyze the qualitative data collected in  
15  
16 this study (as per Braun and colleagues<sup>124</sup>). The interviews will be audio recorded and  
17  
18 transcribed verbatim. Transcripts will be read and coded by two study investigators. Coding  
19  
20 will involve identifying thematic patterns, such as ideas, concepts, terminology or phrases.  
21  
22 Once these themes are identified, the investigators will discuss the appropriateness of the  
23  
24 themes and develop a coding framework based on their themes until consensus is achieved.  
25  
26 The researchers will then re-read the transcripts and organize the themes into categories and  
27  
28 sub categories based on the coding framework they have developed.  
29  
30  
31

### 32 33 **ETHICS AND DISSEMINATION**

34  
35 Full ethical approval for this study has been obtained by the Behavioral and Social Sciences  
36  
37 Ethical Review Committee of The University of Queensland (2012000993) and Children's  
38  
39 Health Queensland Hospital and Health Service Research Ethics Committee  
40  
41 (HREC/12/QRCH/120). Protocol modifications and amendments will be submitted to the  
42  
43 ethical committees for approval. This trial has been registered with the Australian New  
44  
45 Zealand Clinical Trials Registry (ACTRN12613000729729). All families will be given  
46  
47 written informed consent to participate and their parents or guardians prior to entering into  
48  
49 the trial. If found to be effective, MiYoga has the potential to be disseminated as a lifestyle  
50  
51 intervention for families. The study results will be disseminated through publication in  
52  
53 scientific journals, presentation at relevant conferences and directly to the families who  
54  
55 participated in the study. The dissemination would assist children with CP and complement  
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3 their on-going therapy by; improving the ability of the child to pay attention at school and in  
4  
5 therapy, and alleviating environmental stressors for both the child and their parents.  
6  
7

## 8 **DISCUSSION**

9  
10 This paper has presented the background and design for a randomized waitlist controlled trial  
11  
12 investigating the efficacy of an 8 week Mindfulness and Yoga program to for children and  
13  
14 adolescents with an CP and one of their parents. To our knowledge this study is the first to  
15  
16 investigate the effects of a family-centered Mindfulness-based yoga program for children and  
17  
18 adolescents with CP. Furthermore, we will be evaluating the children's cognitive, physical,  
19  
20 behavior and emotional outcomes, as well as parents' psychological well-being. The  
21  
22 qualitative information, such as what the participants liked or disliked about the program, will  
23  
24 help provide information on how Mindfulness and yoga can be integrated effectively into  
25  
26 participants' everyday lives. It is anticipated that the results of this study will be  
27  
28 disseminated through peer reviewed journals and national and international academic  
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30 conferences.  
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36 Current models of rehabilitation for children with CP solely focus on physical rehabilitation.  
37  
38 MiYoga provides a more holistic approach by combining Mindfulness and yoga techniques  
39  
40 that can be integrated easily into the child and their families' everyday life. If MiYoga is  
41  
42 found to be effective, multi-disciplinary teams will have an evidence-based mode of therapy  
43  
44 to offer that is an engaging lifestyle intervention, incorporates cognitive rehabilitation, and  
45  
46 provides valuable tools and skills to families.  
47  
48  
49

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4  
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### 8 **Contributions**

9  
10 CM is the chief investigator (CI) and together with KW and RB designed and established this  
11  
12 research study. CM was responsible for ethics applications and reporting. CM was  
13  
14 responsible for recruitment. CM was responsible for data collection and implementation of  
15  
16 the training program. CM will take lead roles on preparation for publications on the clinical  
17  
18 outcomes of the study. KW, RB and RC will contribute to the preparation of publications  
19  
20 within their respective fields of expertise. CM will take on a lead role of the statistical  
21  
22 analysis for the study. CM drafted the final version of this manuscript. All authors critically  
23  
24 reviewed and approved the final version. All data from this study will be submitted to peer  
25  
26 review journals. CM will use the data from this study to contribute to her PhD thesis.  
27  
28  
29

### 30 **Competing Interests**

31  
32 MiYoga was developed by first author. There are no other competing interests to declare.  
33  
34  
35

### 36 **Ethics approval and consent to participate**

37  
38 Full ethical approval for this study has been obtained by the Behavioral and Social Sciences  
39  
40 Ethical Review Committee of The University of Queensland (2012000993) and Children's  
41  
42 Health Queensland Hospital and Health Service Research Ethics Committee  
43  
44 (HREC/12/QRCH/120). All families will be given written informed consent to participate  
45  
46 and their parents or guardians prior to entering into the trial.  
47  
48  
49

### 50 **Consent for Publication**

51  
52  
53  
54  
55 Consent to publish was obtained from both the individual and from the parent of the child  
56  
57 whose photographs are presented in this manuscript.  
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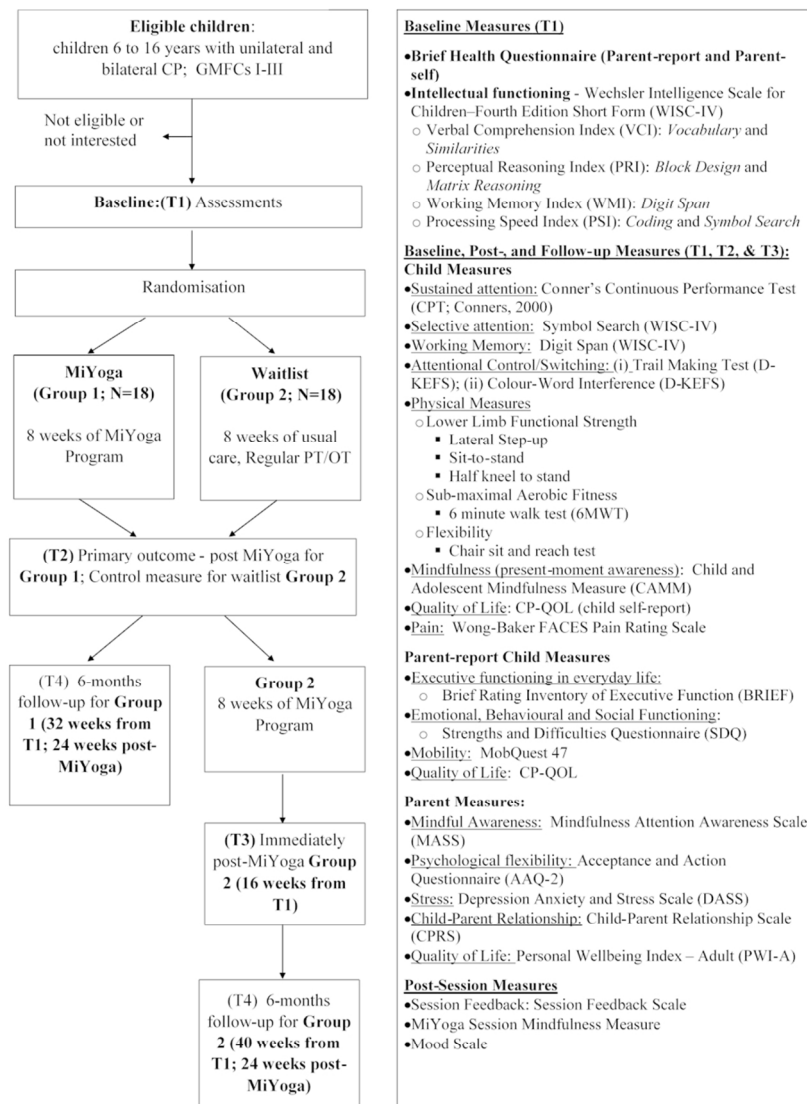


Figure 1. Flow chart of MiYoga study design

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Appendix A  
MiYoga Program Summary

Week	Theme	Welcome	Introduction to Mindfulness	Hatha Yoga	End of Session
<b>1</b>	Explore our everyday life with awareness in the present moment  Focus of session is on being mindful while performing yoga postures; and to teach participants their individualised modifications	Getting to know you – pass the ball around in a circle.  Explain the that over the next 6 weeks we are be training to be explorers of our feelings, our thoughts and things in our everyday life  <ul style="list-style-type: none"> <li>• Housekeeping</li> <li>• Give out MiYoga packs</li> <li>• Set group rules</li> </ul>	Introduction to mindfulness and mindful movements ie. raise arms with awareness and discuss if they feel any different.	Go through yoga postures.  Therapist will teach participant their modifications to each posture and teach participants how to safely go in and out of each posture.  <b><u>Mindfulness relaxation</u></b>  Progressive muscle relaxation exercise	Discussion - what they experienced through their exploration today and time for any questions.  Remind them of their homework 20 minutes of practice a day along with poster and CD and to record their daily practices in their diary.  Complete end of session questionnaires.
Week	Theme	Review and Mindfulness Explorations	Hatha Yoga	Mindfulness relaxation	End of Session
<b>2</b>	Senses: Feel/Touch	Review last session and briefly discuss home practice in the last week.  Introduction to Feel/Touch  Exploration exercises <ol style="list-style-type: none"> <li>1) Feel and describe object with hands</li> <li>2) Whose hands are they?</li> <li>3) Mirror Me</li> </ol>	Practise yoga postures.  Therapist will monitor participant's progress and continue to modify the poses as the child progresses in each posture.	Body Scan	Discuss what they experienced during the body scan and from the session.  Remind them of their homework 20 minutes of practice a day along with poster and CD and to record their daily practices in their diary.  Complete end of session questionnaires.

Week	Theme	Review and Mindfulness Explorations	Hatha Yoga	Mindfulness relaxation	End of Session
3	Hearing	Review last session and briefly discuss home practice in the last week.  Exploration exercises What do you hear? Sound exercises - clasp hands over ears, what do you notice? Make sounds with our breath – practice the ocean breath, pranayama (yogic breathing exercises)	Practise yoga postures.  Incorporate ocean breath into the postures by linking movement with inhalation and exhalation.  Therapist will monitor participant's progress and continue to modify the poses as the child progresses in each posture.	Mindfulness of sound – Tibetan bowl	Discuss what they experienced/heard during the mindfulness exercise and from the session today.  Remind them of their homework 20 minutes of practice a day along with poster and CD and to record their daily practices in their diary.  Complete end of session questionnaires.
Week	Theme	Review and Mindfulness Explorations	Hatha Yoga	Mindfulness relaxation	End of Session
4	Seeing	Review last session and briefly discuss home practice in the last week.  Introduction to Seeing  Exploration exercises What colour eyes do your friends have? What did you see? Mindfulness of the hand	Sound exercises  Pranayama exercises  Incorporate sound into the postures by linking sounds with exhalation.  Therapist will monitor participant's progress and continue to modify the poses as the child progresses in each posture.	Short body scan and short imagery script	Discuss what they experienced from the session today.  Remind them of their homework 20 minutes of practice a day along with poster and CD and to record their daily practices in their diary.  Complete end of session questionnaires.

Week	Theme	Review and Mindfulness Explorations	Hatha Yoga	Mindfulness relaxation	End of Session
5	Taste & smell	Review last session and briefly discuss home practice in the last week.  Introduction to taste and smell  Exploration exercises 1) What are you eating? 2) Mindful eating 3) Mindful drinking	Eye movements  Sound exercises  Pranayama exercises  Practise yoga postures  Therapist will monitor participant's progress and continue to modify the poses as the child progresses in each posture.	Body Scan or Progressive muscle relaxation or Mindfulness of breath or Mindfulness of sound	Discuss their experienced from the session today.  Remind them of their homework 20 minutes of practice a day along with poster and CD and to record their daily practices in their diary.  Complete end of session questionnaires.
Week	Theme	Review and Mindfulness Explorations	Hatha Yoga	Mindfulness relaxation	End of Session
6	Thoughts & feelings	Review last session and briefly discuss home practice in the last week.  Introduction to feelings – can be pleasant and unpleasant but like senses it is helpful.  Exploration exercises 1) Explore thoughts and feelings through listening to short stories and/or music 2) Discussion of thoughts and feelings that arise in our lives. 3) Bubbles of thoughts and feelings exercise	Eye movements  Sound exercises  Pranayama exercises  Practise yoga postures  Therapist will monitor participant's progress and continue to modify the poses as the child progresses in each posture.	Short body scan and finding a comfortable place	Discuss thoughts and feelings about the session.  Remind them of their homework 20 minutes of practice a day along with poster and CD and to record their daily practices in their diary.  Organise times for phone/skype consultations  Complete end of session questionnaires.






Week 7	Theme	Review	Q & A and problem solve obstacles to practice	Planning and Setting Goals
<b>Phone consultation</b>	Maintaining MiYoga practice	Review and briefly discuss home practice in the last week Was daily practice maintained? What were barriers to practice? What helped/encourage practice? Any other questions regarding mindfulness or their practice?	Address participants questions Problem solve ways to overcome barriers to practice – be as specific as possible Revisit – reasons for practice - Benefits of yoga and mindfulness	Goals and plans in regards to practice for the next week - be as specific as possible
Week 8	Theme	Review	Q & A and problem solve obstacles to practice	Planning and Setting Goals
<b>Phone consultation</b>	Maintaining MiYoga practice	Review and briefly discuss home practice in the last week Was daily practice maintained? What were barriers to practice? What helped/encourage practice? Any other questions regarding mindfulness or their practice?	Address participants questions Problem solve ways to overcome barriers to practice – be as specific as possible Revisit – reasons for practice - Benefits of yoga and mindfulness	Goals and plans to continue practice - be as specific as possible Discuss maintaining practice over time

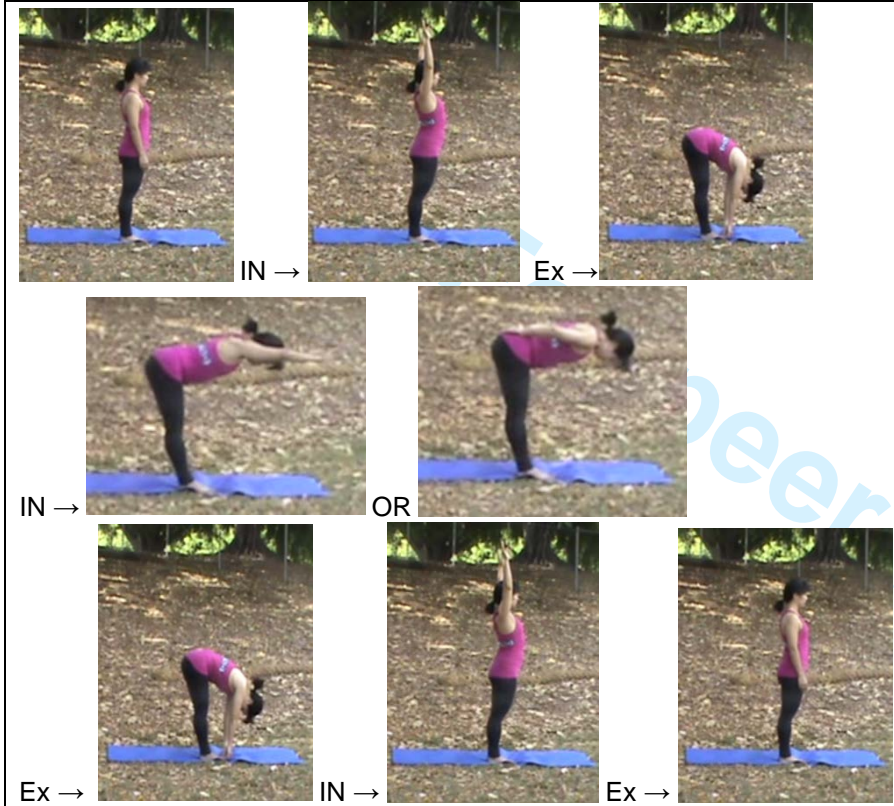
Appendix B

Table 1

MiYoga Postures

Illustration of Posture	Posture	Physical Benefits	Possible Modifications
	<p><b>Warm-Up</b></p>	<p><b>Strengthens:</b></p> <ul style="list-style-type: none"> <li>• legs</li> <li>• arms</li> <li>• torso</li> </ul> <p><b>Lengthens:</b></p> <ul style="list-style-type: none"> <li>• back of the body</li> <li>• back of the legs</li> </ul> <p>Induces balance</p>	<p>If required, have support (e.g. table/chair/wall) in front or to the required side.</p>  <p>This posture can also be performed in a chair or wheelchair</p>  <p>Provide prompts for children to keep their knees straight in forward bend (if standing) and only to go as far as they are comfortable when bending forward. Encourage children to bear weight evenly on both left and right sides.</p>

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**Half Forward Bend**

**Strengthens:**

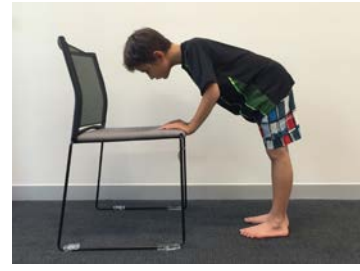
- legs
- arms
- torso

**Lengthens:**

- back of the body
- back of the legs

Induces balance

If required, have support (e.g. table/chair/wall) in front or to the required side.



Provide prompts for children to keep their knees straight in forward bend (if standing) and only to go as far as they are comfortable when bending forward. Encourage children to bear weight evenly on both left and right sides.

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To finish,



**Warrior sequence**

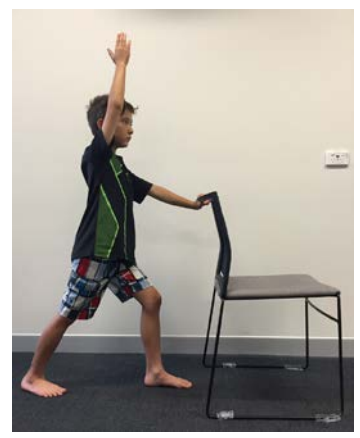
**Strengthens:**

- quadricep muscles
- arms
- torso

**Lengthens:**


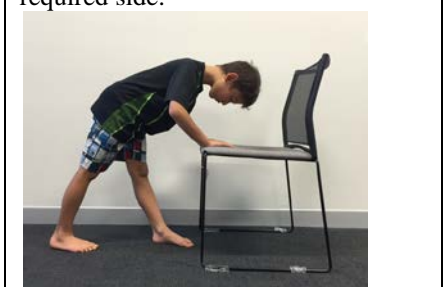
- hip flexor muscles
- calve muscles

If required, have support (e.g. table/chair/wall) in front or to the required side.

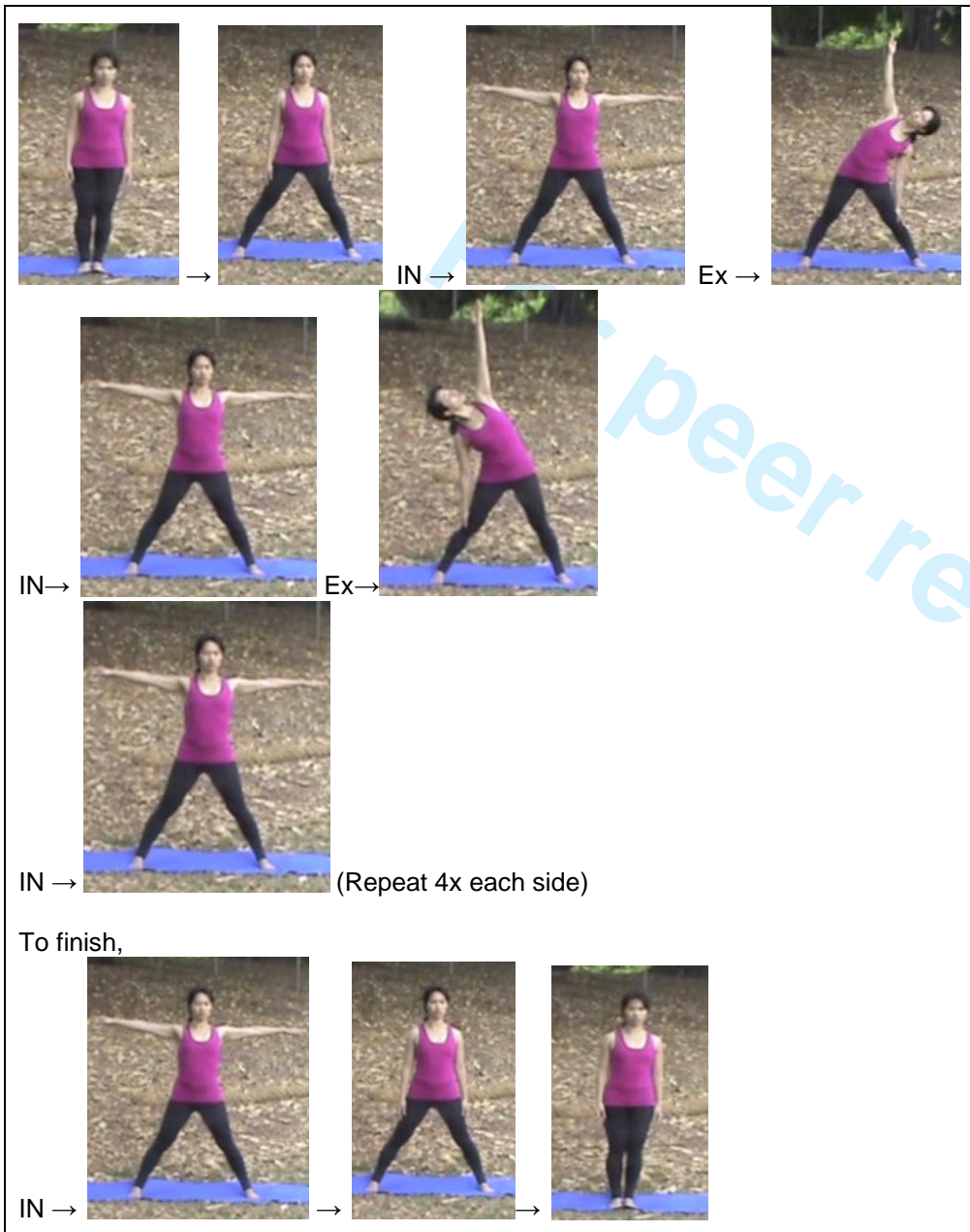


Provide prompts for children to keep both of their feet pointing forward if possible and aim to have the back heel on the ground. Encourage children to bear weight evenly on both left and right sides.

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 <p>IN → EX →</p> <p>IN → (repeat 4x)</p> <p>to finish,</p> <p>Ex →</p>	<p><b>One sided forward bend</b></p>	<p><b>Strengthens:</b></p> <ul style="list-style-type: none"> <li>• legs</li> <li>• arms</li> <li>• torso</li> </ul> <p><b>Lengthens:</b></p> <ul style="list-style-type: none"> <li>• hip flexor muscles</li> <li>• calve muscles</li> </ul> <p>Induces Balance</p>	<p>If required, have support (e.g. table/chair/wall) in front or to the required side.</p>  <p>Provide prompts for children to keep both of their feet pointing forward if possible and aim to have the back heel on the ground. Ask the children to explore with having the front knee as straight as it is comfortable for them. Encourage children to bear weight evenly on both left and right sides.</p>
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**Triangle**

**Strengthens:**

- legs
- arms
- torso

**Lengthens:**

- muscles along the side of the body

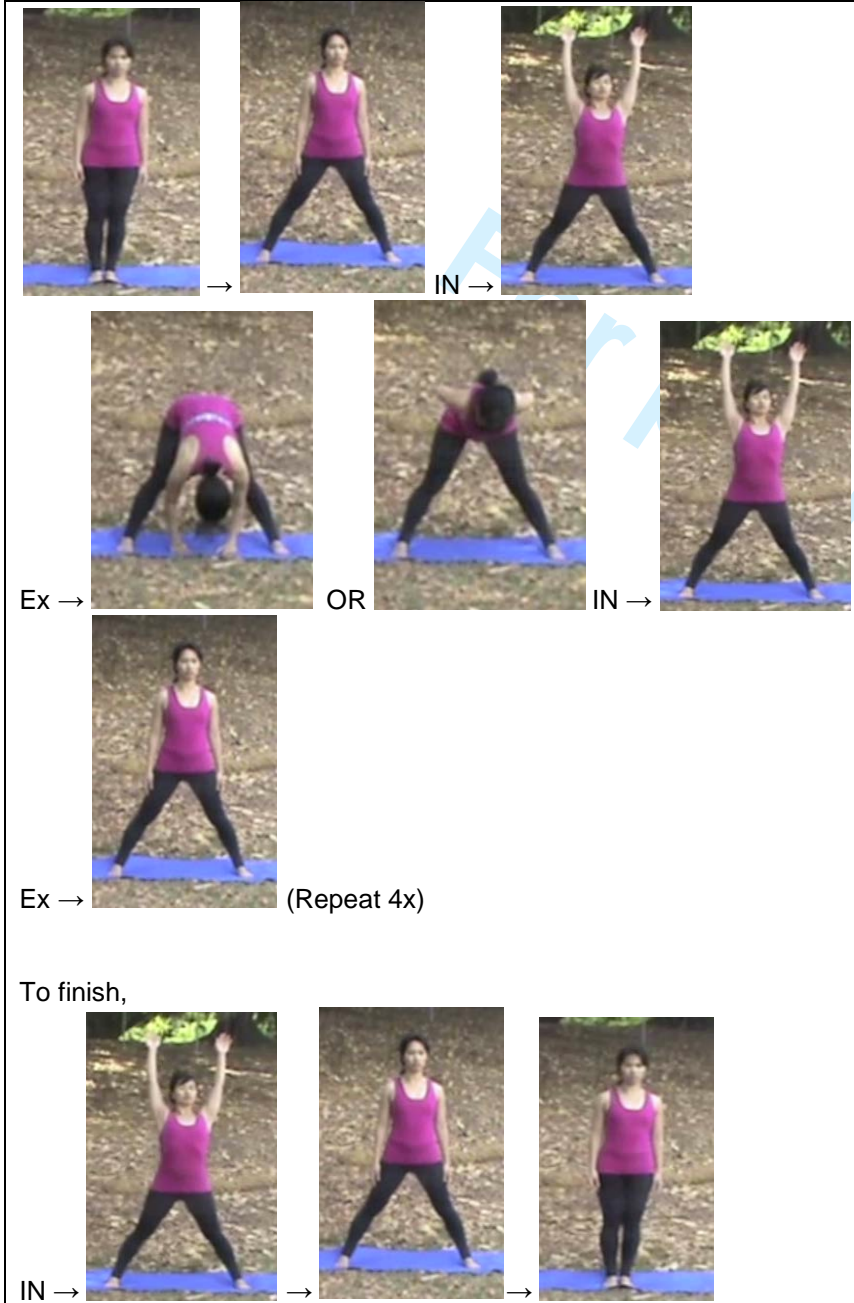
Induces Balance  
Increases hip flexibility

If required, this pose can be done with back gently against a wall and/or have support (e.g. table/chair) on either side.



Provide prompts for children to keep their knees straight in forward bend and only to go as far as they are comfortable when bending forward. Encourage children to bear weight evenly on both left and right sides.

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**Feet apart  
Forward  
Bend**

**Strengthens:**

- legs
- arms
- torso

**Lengthens:**

- muscles of the inner thighs and hamstrings

Induces Balance  
Increases hip flexibility

If required, have support (e.g. table/chair/wall/blocks) in front.



Provide prompts for children to have the feet pointing forward and to keep their knees straight in forward bend and only to go as far as they are comfortable when bending forward. Encourage children to bear weight evenly on both left and right sides.

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**Downward Dog**

- Strengthens:**
- legs
  - arms
  - upper body
  - torso
- Lengthens:**
- muscles in back of the body and legs

Provide prompts for children to keep their heels and big toes together in the kneeling postures. Encourage children to bear weight evenly on both left and right sides.

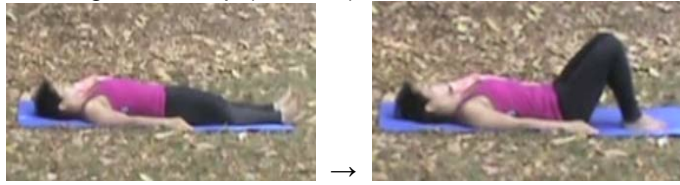
Downward dog pose can also be performed separately.

Downward dog can be performed from standing or seating in a chair by placing both hands against a wall or on a table/chair in front with the aim to flex hips, with back straight and shoulder blades back and down (retracted).





Bent legs with strap (or towel)



Place rolled towel/strap under Left foot  
(Repeat from here)



EX →



IN →



EX →



IN →



EX →



IN Stay



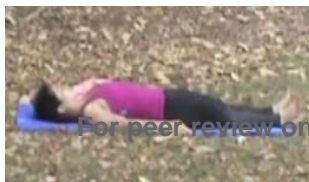
Ex →



(Repeat)

To Finish:

Release towel/strap from under foot



EX →

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Repeat on other

leg

**Supine Leg lift**

**Strengthens:**

- arms
- torso

**Lengthens:**

- muscles in back of the legs

Provides full range of motion from the hip to the toes.

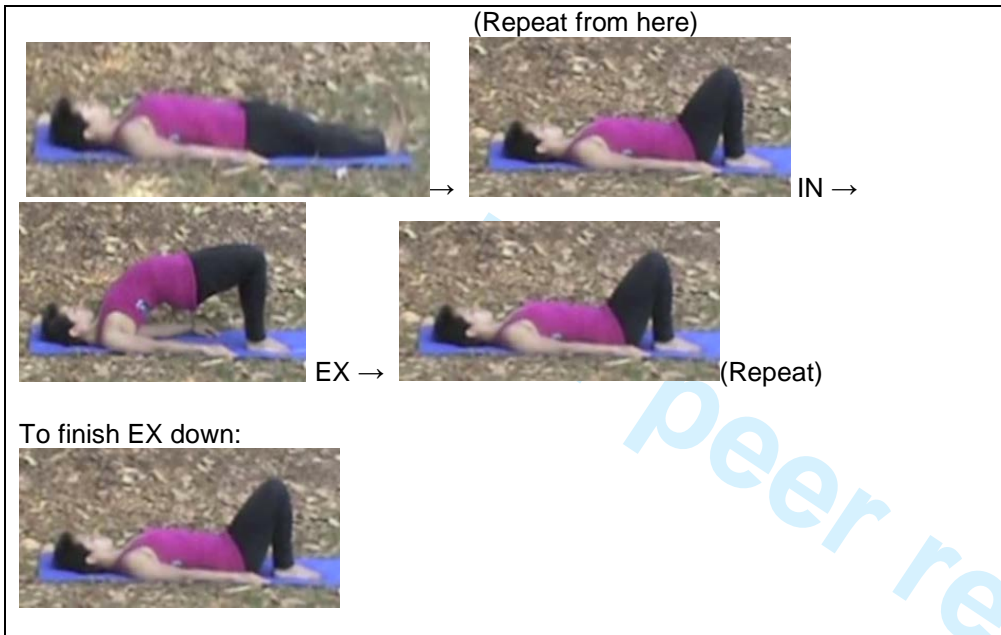
Increase circulation and release any tightness in the hips, knees, and ankles.

A rolled towel or belt is required for this sequence.

If possible keep the resting leg straight along the floor instead of bent. Feet of resting leg can be placed flat on a wall so that the ankle is at approximately 90degree dorsiflexion and prompt children to push their feet into the wall while they are lifting the other leg. This will help them keep the resting leg active and straight.



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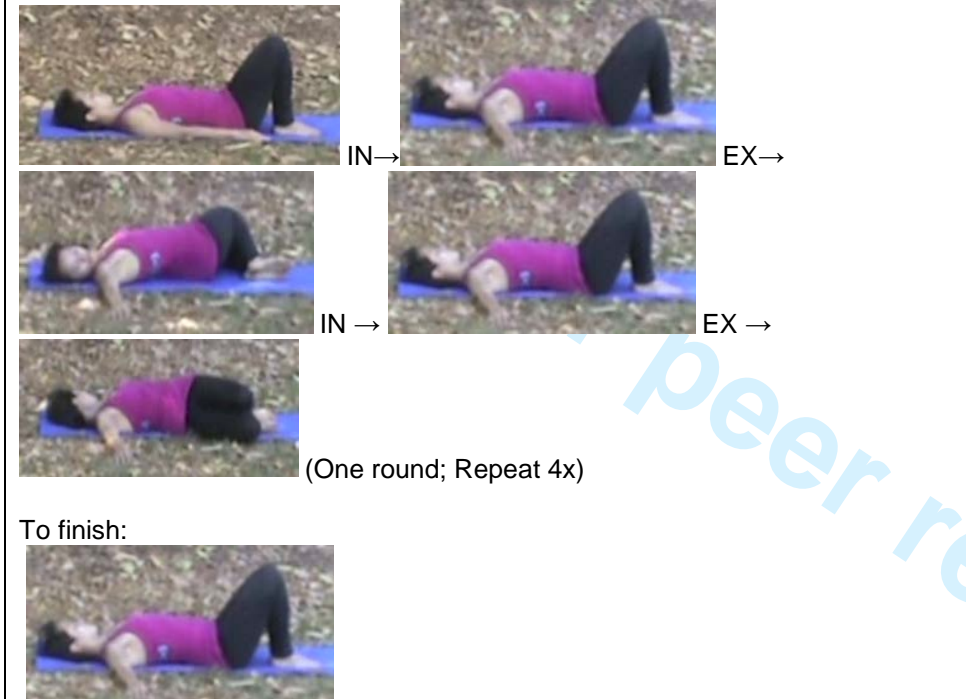

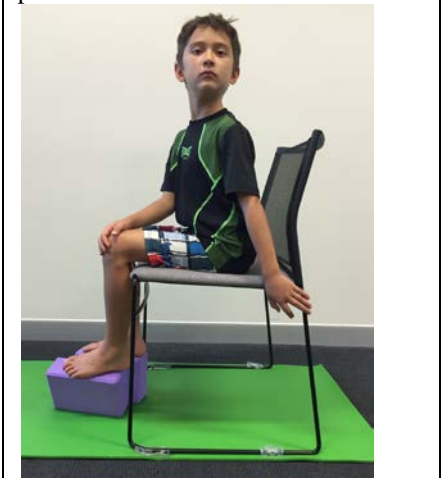
**Bridge**

- Strengthens:**
- core back muscles
  - gluteal muscles
- Lengthens:**
- hip flexor muscles
  - quadriceps muscles

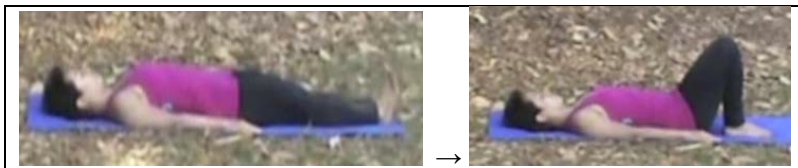
Children can hold the block between their knees while moving the hips up and down will help them engage their core muscles.

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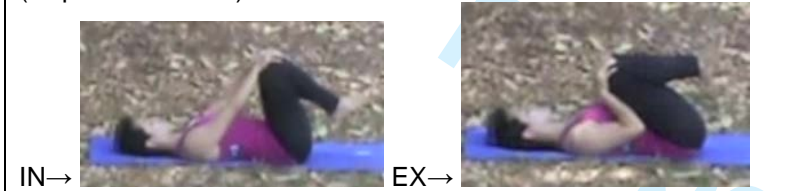
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<p style="text-align: center;">(Repeat from here)</p>  <p style="text-align: center;">(One round; Repeat 4x)</p> <p>To finish:</p> 	<p style="text-align: center;"><b>Supine Spinal Twist</b></p>	<p><b>Lengthens and relaxes:</b></p> <ul style="list-style-type: none"> <li>• back and spine</li> </ul>	<p>It is also possible to place rolled up blankets or a bolster on the floor in line with the knees (a few inches from the hip) on both sides to prevent any discomfort from rotating too far.</p> <p>This spinal twist can also be performed from standing or seating in chair. If standing place feet hip width apart, place hand across the body to the opposite waist and twist body (without moving feet). If seating in a chair place feet flat on the floor or on blocks. With back straight, place hand on opposite knee and twist body pass the knee the hand is on.</p> 
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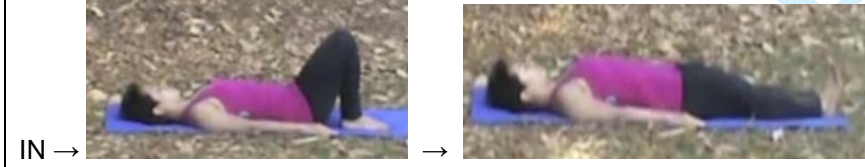


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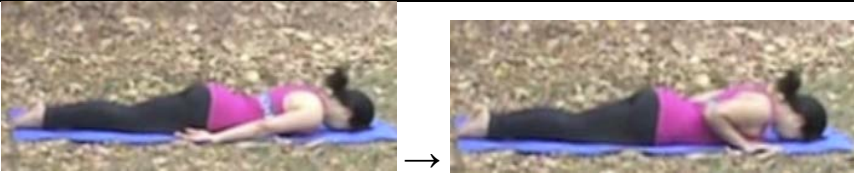
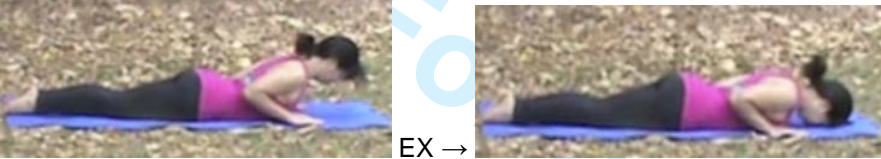

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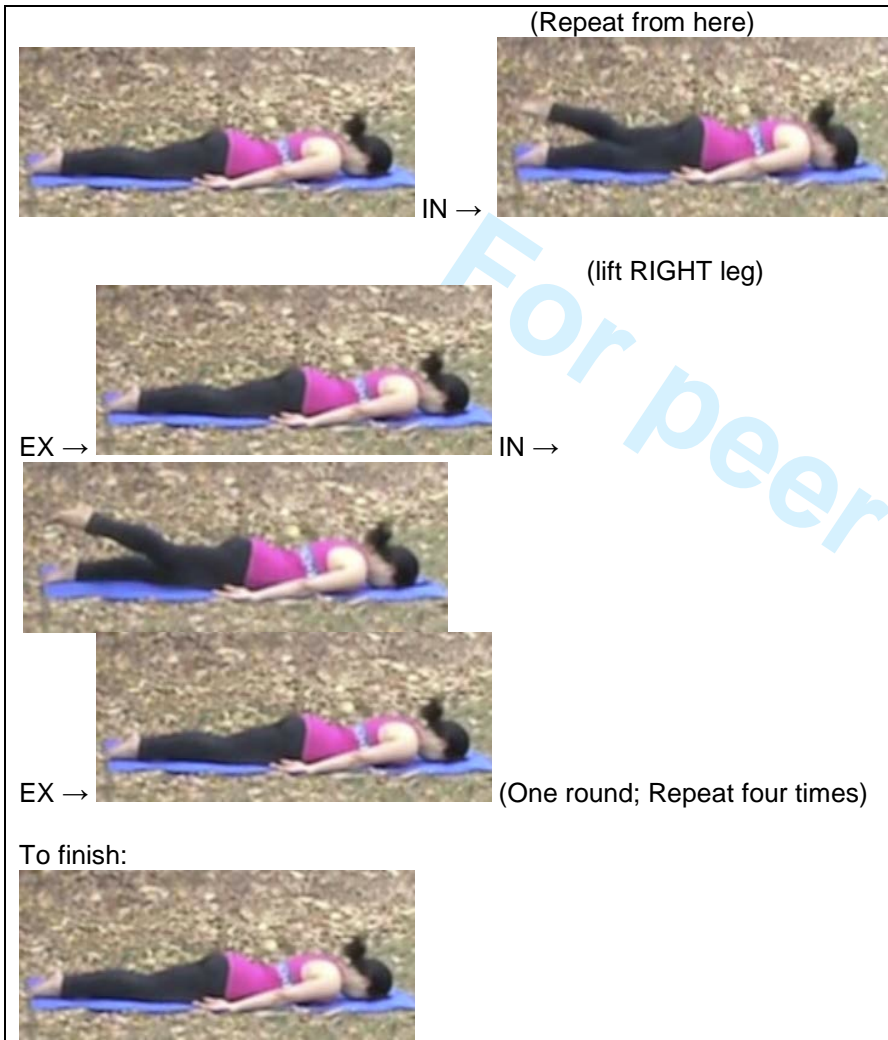


<p><b>Apanasana</b></p>	<p><b>Lengthens and relaxes:</b></p> <ul style="list-style-type: none"> <li>• back and spine</li> </ul>	<p>Verbal prompts to invite children to experiment with some hip movements, such as rocking slightly from side to side, or move knees and hips in small circles or simply staying still and observing sensations in their bodies while in this pose.</p>
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 <p>(Repeat from here)</p>  <p>(Repeat)</p> <p>To Finish:</p> 	<p><b>Cobra</b></p>	<p><b>Strengthens:</b></p> <ul style="list-style-type: none"> <li>• torso</li> <li>• back muscles</li> <li>• neck muscles</li> </ul> <p><b>Lengthens:</b></p> <ul style="list-style-type: none"> <li>• muscles in the front of the body</li> </ul>	<p>A blanket can be place under hips and lower ribs for comfort.</p>
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**Prone with legs**

**Strengthens:**

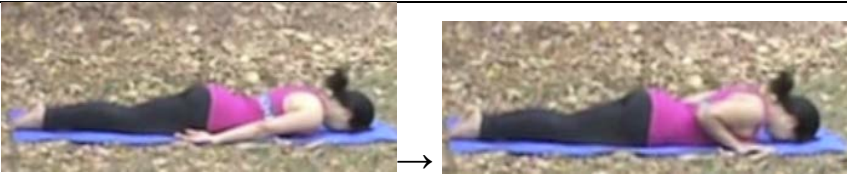
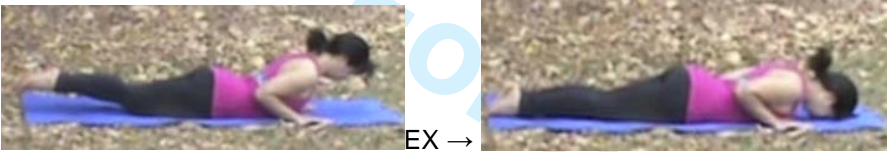

- torso
- back muscles
- gluteal muscles

**Lengthens:**

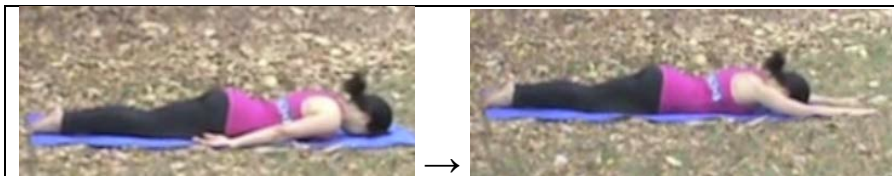
- muscles in the front of the body

A folded blanket can be used to help support the lifted leg if placed under the front of thighs (of the lifted leg).

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 <p>(Repeat from here)</p>  <p>IN → EX → (Repeat)</p> <p>To Finish:</p> 	<p><b>Lotus 2</b></p>	<p><b>Strengthens:</b></p> <ul style="list-style-type: none"> <li>• torso</li> <li>• back muscles</li> <li>• neck muscles</li> <li>• gluteal muscles</li> </ul> <p><b>Lengthens:</b></p> <ul style="list-style-type: none"> <li>• muscles in the front of the body</li> </ul>	<p>A blanket can be place under hips and lower ribs for comfort</p>
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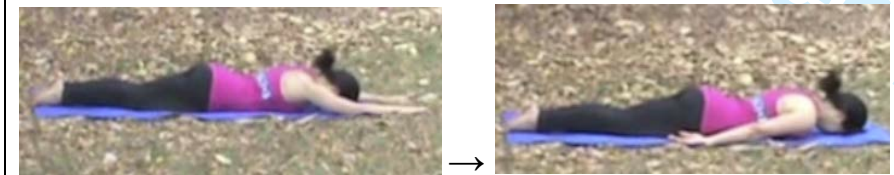


(Repeat from here)



(Repeat 4x)

To Finish:



**Superman**

**Strengthens:**

- arms
- torso
- back muscles
- neck muscles
- gluteal muscles

**Lengthens:**

- muscles in the front of the body

A blanket can be place under hips and lower ribs for comfort.



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<p>OR EX →</p> <p>(repeat from here)</p> <p>IN → EX →</p> <p>(Repeat)</p> <p>To finish:</p> <p>IN → OR</p>	<p><b>Cat – back</b></p>	<p><b>Strengthens:</b></p> <ul style="list-style-type: none"> <li>• arms</li> <li>• quadriceps muscles</li> </ul> <p><b>Lengthens and relaxes:</b></p> <ul style="list-style-type: none"> <li>• neck muscles</li> <li>• shoulders</li> <li>• back muscles and spine</li> </ul>	<p>If required, provide physical support at elbow on the involved side to help children maintain straight arm.</p> <p>Also, verbal prompts to remind children to have hands flats on the floor.</p>
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(repeat from here)

EX → IN →

EX → IN →

EX → IN →

(One round; Repeat four times)

To finish:

IN →

**Cat - legs**

- Strengthens:**
- arms
  - back muscles
  - quadriceps muscles
  - leg muscles
- Lengthens and relaxes:**
- back muscles and spine (in child's pose)

Children may find lifting their legs straight up one at a time in this sequence too difficult, they may like to try to extend it straight out behind them by sliding their foot along the floor without lifting their legs.

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rest hands behind →

bend knees → flex toes →

Stay for 4 to 6 breaths

**Alternative boat:**

Lift one foot off the floor, swap legs

Balance with both feet off the floor

Stay for 4 to 6 breaths

to finish:

**Boat Pose**


- Strengthens:**
- abdominal muscles
  - back muscles
  - quadriceps muscles
- Lengthens:**
- back muscles and spine (in child's pose)

This posture may be done with elbows and forearm on the floor or with back rest on the floor arms by the side. With knees bent and feet flat on the floor, lift one heel off the floor at a time - aim to have shin and foot parallel to the floor.




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**One leg at a time**




(Repeat from here)

IN → EX →



(Repeat 4x)

To finish:



IN → EX → IN →

**Seated forward bend – one leg at a time**

**Rowing boat**

- Strengthens:**
- arms
  - torso
- Lengthens:**
- back of the body
  - hamstring muscles
  - calf muscles

This posture can be performed sitting on firm cushions, bolsters or folded blankets to help lift pelvis

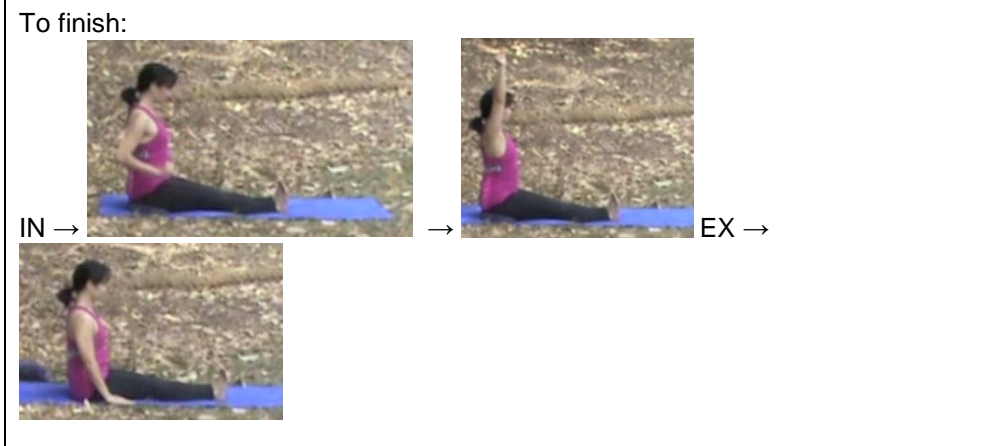
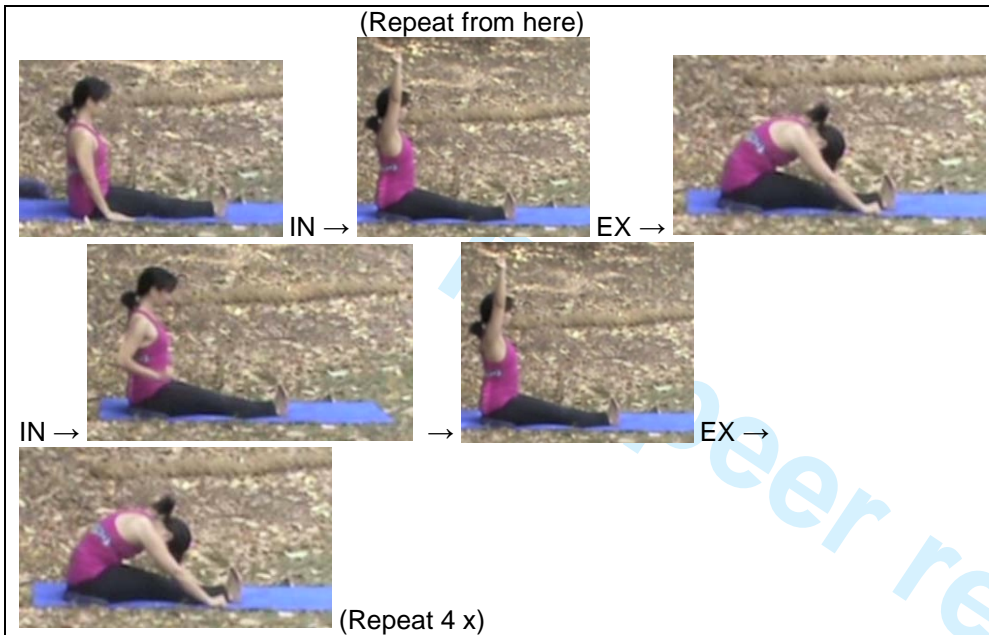


A strap or belt can also be used to assist with lengthening the body and leg



Verbal prompts may be provided to help children keep their legs straight.

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**Seated forward bend – both legs**  
**Rowing boat**

- Strengthens:**
- arms
  - torso
- Lengthens:**
- back of the body
  - hamstring muscles
  - calf muscles

This posture can be performed sitting on firm cushions, bolsters or folded blankets to help lift pelvis and a strap or belt can be used to assist with lengthening the body and legs



Verbal prompts may be provided to help children keep their legs straight.

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**Butterfly**

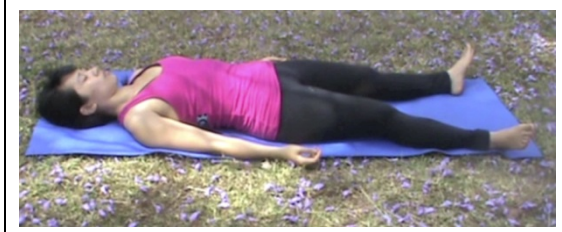
**Lengthens:**

- inner thigh muscles

Increases flexibility in the hips.

This posture can be performed sitting on firm cushions, bolsters or folded blankets to help lift pelvis and lengthen the body.

If required, this posture can also be performed sitting with back against a wall for support.



**Shavasana or the relaxed star pose**

This pose helps to assimilate the benefits of all the movements in the practice.

A rolled blanket, bolster or pillow can be placed under the knees and/or under head for comfort..Children may also like to be covered with a blanket for warmth.

Props such as belts, rolled mats or towels and bolsters may also be used for alternate supported relaxation postures.

## Appendix C

## BRIEF HEALTH QUESTIONNAIRE (BHQ) - Caregiver

Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Phone: ( ) \_\_\_\_\_ (W)

Phone: ( ) \_\_\_\_\_ (H)

Age: \_\_\_\_\_

DOB: \_\_\_\_\_

Relationship to Child: \_\_\_\_\_

*Please read the following questions very carefully. If you have any difficulty please advise the health professional.*

1. **Personal medical history.** Indicate symptoms that apply to you.

Pain or discomfort in chest following exercise

Poor exercise tolerance

Frequent dizziness

Frequent headaches

Frequent backache

Frequent aches or pains in an joints

Details \_\_\_\_\_

Other current symptoms that exercise may affect

Details \_\_\_\_\_

2. **Lungs: Do you have any of the following conditions?**

Asthma

Yes

No

Details \_\_\_\_\_

Emphysema

Yes

No

Details \_\_\_\_\_

Bronchitis

Yes

No

Details \_\_\_\_\_

Shortness of Breath

Yes

No

Details \_\_\_\_\_

3. **Do you have any heart condition/problems that might preclude you from exercise?**

Yes

No

Details \_\_\_\_\_

4. **Seizures, fainting, blackouts and loss of consciousness?**

Yes

No

Details \_\_\_\_\_

5. **Headaches**

Yes

No

Details \_\_\_\_\_

6. **Sight or hearing difficulties**

Yes

No

Details \_\_\_\_\_

7. **Cervical Spine instability (e.g. Atlanto-axial)**

Yes

No

Details \_\_\_\_\_

8. **Spinal problems that cause pain or preclude exercise**

Yes

No

Details \_\_\_\_\_

9. **Are you pregnant?**

Yes (number of weeks \_\_\_\_; due\_\_\_\_\_)

No

Details \_\_\_\_\_

10. **Medication.** Are you taking any medication prescribed by your Doctor or other Health Care provider? If so, list details, i.e., type of drugs, dosage.

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## BRIEF HEALTH QUESTIONNAIRE – Child (caregiver report)

Name (child): \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Phone: ( ) \_\_\_\_\_ (W)

Phone: ( ) \_\_\_\_\_ (H)

Age: \_\_\_\_\_

DOB: \_\_\_\_\_

*Please read the following questions very carefully. If you have any difficulty please advise the health professional.*

**1. Personal medical history.** Indicate symptoms that apply to you. Pain or discomfort at rest or with exercise

Details \_\_\_\_\_

 Frequent dizziness Frequent colds or flu Frequent headaches Frequent backache Other current symptoms that exercise may affect

Details \_\_\_\_\_

**2. Seizures, fainting, blackouts and loss of consciousness?** Yes No

Details \_\_\_\_\_

**3. Headaches** Yes No

Details \_\_\_\_\_

**4. Sight or hearing difficulties** Yes No

Details \_\_\_\_\_

**5. Cervical Spine instability (e.g. Atlanto-axial)** Yes No

Details \_\_\_\_\_

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6. **Spinal problems that cause pain or preclude exercise**

- Yes
- No

Details \_\_\_\_\_

7. **Medication.** Are you taking any medication prescribed by your Doctor or other Health Care provider? If so, list details, i.e., type of drugs, dosage.

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For peer review only

Appendix D

Participant ID: \_\_\_\_\_

DOB: \_\_\_\_\_

Age at Assessment: \_\_\_\_\_

<b>Date</b>		<b>Examiner:</b>	
<b>CLASSIFICATION</b>			
CP motor type:	1 <sup>st</sup>	2 <sup>nd</sup>	Comments:
No. of limbs involved	Comments:		
GMFCS level	Comments:		
FMS level			
Handedness	Right / Left / Mixed		
MACS			
Preferred sitting position	W-sitting Long sitting- symmetrical	Ring sitting	Side sitting- right left Asymmetrical (right/left)
<b>STANDING</b>			
Unaided/ Aided	Equipment Used:		
<b>GAIT</b>			
Unaided/ aided Typically developing <b>Comments:</b>			
<b>Gait pattern:</b> True Equinus/ Apparent Equinus / Jump Knee / Crouch gait; Gage Type:			
<b>SUPINE</b>		<b>Comments</b>	
Thomas Test (FFD)			
Abduction in Flex			
Dynam Abd in Flex			
Abduction in Ext			
Dynam Abd in Ext			
Popliteal angle			
Dynamic Hamstrings			
Kn Exten (Hip 0 deg)			
Dorsiflex (Kn in Ext)			
Dynam DF (Kn in Ext)			
<b>PRONE</b>			
Hip Int Rotation			
Hip Ext Rotation			
Femoral Neck angle (FNA)			
Staheli test			
<b>SPINE</b>			
Scoliosis	Yes / No	Convex to R/L	
Rotation	Yes / No	To R / L	
Spondylolisthesis	Yes/ No		
Other	Yes/No		
<b>Current skills:</b>			
<b>Medical Hx Check:</b>			
Past surgery			
Pain levels			
Seizures			
Medication			
Botox			
Past therapy			
Compliance in therapy			
<b>Comments:</b>			
<b>Spine at Risk: Yes/ No</b>			
<b>Action:</b>			

## Appendix E

## MiYoga Session Mindfulness Measure

We are interested in your experiences what you just experienced during our group session. **Read** each sentence. Then, circle the number that tells **how true** each sentence is about **your experience during our group session.**

	Never True	Rarely True	Sometimes True	Often True	Always True
1. I stopped myself having thoughts or feelings that I don't like.	0	1	2	3	4
2. I was moving without noticing what I was doing.	0	1	2	3	4
3. I noticed my thoughts or feelings.	0	1	2	3	4
4. It was hard for me to pay attention to what I was meant to be doing.	0	1	2	3	4
5. I was focused on what I was doing.	0	1	2	3	4

Appendix F

**Mood Scale**



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**2**

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**5**

Very Bad

Bad

Neutral

Good

Very Good

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Appendix G

### Session Feedback Scale

Name \_\_\_\_\_ Age (Yrs):\_\_ Gender:\_\_\_\_\_

Session # \_\_ Date: \_\_\_\_\_

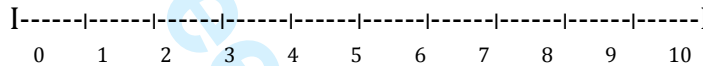
Who is filling out this form? Please check one: Child\_\_\_\_ Caretaker\_\_\_\_\_

If caretaker, what is your relationship to this child? \_\_\_\_\_

How was our time together today? Please put a mark on the lines below to let us know how you feel.

What we did today was uncomfortable and did not suit my needs and

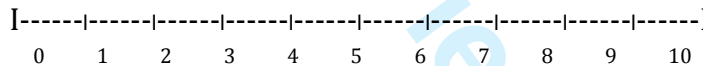
#### Comfort



What we did today was comfortable and suited my needs and ability

I did not like what we did today.

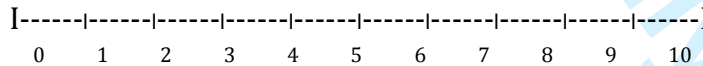
#### Enjoyment



I liked what we did today.

I did not always notice how my body was moving during

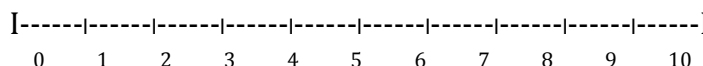
#### Body Awareness



I noticed how my body was moving during the session.

Overall I disliked this

#### Overall



Overall I liked the session

## Appendix H

**MiYoga**  
**Qualitative Interview Script and Questions****Interviewer - Introduce yourself**

- I am post-graduate student from School of Psychology at The University of Queensland who is unrelated to the MiYoga study in anyway. Advise participants to express their views and opinions about the program freely.
- I would like to find out from you how you experienced your involvement in MiYoga. This will help us to ensure that we are optimizing this therapy.
- To make sure that I accurately report your views, with your permission I would like to audio record our conversation.
- This recording will be transcribed and your name replaced by a number to make sure the information remains confidential.

**Questions for parents:**

- 1) What did you like best about the MiYoga program?  
*Potential Follow Up Questions: "Why did you like X the best?"*
- 2) What did you NOT like about the MiYoga program?  
*Potential Follow Up Questions: "Why did you not like X?"*
- 3) What do you think could have been different in the MiYoga program?  
*Potential Follow Up Questions: "What are your reasons for thinking X could have been different?"*
  - Amount of home practice expected?
  - Number of sessions per week?
  - Therapist interaction?
- 4) Did you notice any changes in yourself after participating in MiYoga?  
*If so, ask: "In what way?" or "What changes have you noticed after participating in MiYoga?"*
  - Personal tasks?
  - Work tasks?
  - Leisure tasks?
- 5) Did you notice changes in mindfulness in everyday life?  
*Potential Follow Up Questions: "Would you be able to provide some examples of these changes you have noticed in mindfulness in your everyday life please?"*
  - Personal tasks?
  - Work tasks?
  - Leisure tasks?
- 6) Did you notice any changes in your child after participating in MiYoga?  
*If so, ask: "In what way?" or "What were the changes you noticed in your child after participating in MiYoga?"*
  - Personal care tasks?
  - School tasks?
  - Leisure tasks?
- 7) Did you notice any changes in your child's mindfulness in everyday life?  
*Potential Follow Up Questions: "Would you be able to provide some examples of these changes you have noticed in your child's mindfulness in their everyday life please?"*

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- *Personal care tasks?*
  - *School tasks?*
  - *Leisure tasks?*

8) Is your child better or worse at paying attention after participating in MiYoga?

*Potential Follow Up Questions: "Would you be able to provide some examples of these changes in your child's ability at paying attention please?"*

9) Did you enjoy participating in MiYoga with your child?

10) Did your child enjoy participating in MiYoga?

11) Have you noticed any changes in your relationship with your child since participating in MiYoga?

*Potential Follow Up Questions: "How has your relationship with your child changed?" or "Would you be able to provide some examples of these changes in your relationship with your child please?"*

12) How did you find integrating MiYoga practices into your daily life?

13) Would you participate in this program again?

14) Would you recommend MiYoga to other families?

15) Are you planning on continuing to practice Yoga with your child?

*If so, why? If not, why not?*

16) Anything else you would like to tell me?



**Questions for children:**

- 1) What did you like best about the MiYoga program?  
*Potential Follow Up Questions: "Why did you like X the best?"*
  - Any particular postures you liked best?
  - Any particular games you liked best?
- 2) What did you NOT like about the MiYoga program?  
*Potential Follow Up Questions: "Why did you not like X?"*
  - Any particular games you didn't like?
  - Any particular postures you didn't like?
  - How often the sessions were?
  - How often you had to practice at home?
- 3) What do you think could have been different in the MiYoga program?  
*Potential Follow Up Questions: "Why do you think X could have been different?"*
  - Amount of home practice expected?
  - Number of times per week?
  - Therapist interaction?
- 4) Can you tell me about anything that made it hard for you to practice MiYoga at home?
  - Other commitments - homework/extracurricular activities?
- 5) Did you notice any changes in yourself after participating in MiYoga?  
*If so, ask: "In what way?" or "What changes have you noticed after participating in MiYoga?"*
  - At home?
  - At School?
  - Leisure tasks?
- 6) Did you enjoy participating in MiYoga?
- 7) What was it like to do MiYoga with your mum/dad?
- 8) Would you participate in this program again?
- 9) Would you recommend MiYoga to other children?
- 10) Do you want to keep practicing Yoga?  
*If so, why? If not, why not?*
- 11) Anything else you would like to tell me?



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SPIRIT 2013 Checklist: Recommended items to address in a clinical trial protocol and related documents\*

Section/item	Item No	Description	Addressed on page number
<b>Administrative information</b>			
Title	1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym	___ ✓ _p1___
Trial registration	2a	Trial identifier and registry name. If not yet registered, name of intended registry	___ ✓ _p3___
	2b	All items from the World Health Organization Trial Registration Data Set	___ ✓ _p3, p1, p13-14, p17, p23-34, p35, p37, ___
Protocol version	3	Date and version identifier	___ ✓ _footer___
Funding	4	Sources and types of financial, material, and other support	___ ✓ _p37___
Roles and responsibilities	5a	Names, affiliations, and roles of protocol contributors	___ ✓ _p1___
	5b	Name and contact information for the trial sponsor	___ N/A ___
	5c	Role of study sponsor and funders, if any, in study design; collection, management, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication, including whether they will have ultimate authority over any of these activities	___ N/A ___

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3		5d	Composition, roles, and responsibilities of the coordinating centre, steering committee, endpoint
4			adjudication committee, data management team, and other individuals or groups overseeing the trial, if
5			applicable (see Item 21a for data monitoring committee)
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11	<b>Introduction</b>		
12			
13	Background and	6a	Description of research question and justification for undertaking the trial, including summary of relevant
14	rationale		studies (published and unpublished) examining benefits and harms for each intervention
15			
16		6b	Explanation for choice of comparators
17			
18	Objectives	7	Specific objectives or hypotheses
19			
20	Trial design	8	Description of trial design including type of trial (eg, parallel group, crossover, factorial, single group),
21			allocation ratio, and framework (eg, superiority, equivalence, noninferiority, exploratory)
22			
23			
24	<b>Methods: Participants, interventions, and outcomes</b>		
25			
26	Study setting	9	Description of study settings (eg, community clinic, academic hospital) and list of countries where data will
27			be collected. Reference to where list of study sites can be obtained
28			
29	Eligibility criteria	10	Inclusion and exclusion criteria for participants. If applicable, eligibility criteria for study centres and
30			individuals who will perform the interventions (eg, surgeons, psychotherapists)
31			
32	Interventions	11a	Interventions for each group with sufficient detail to allow replication, including how and when they will be
33			administered
34			
35		11b	Criteria for discontinuing or modifying allocated interventions for a given trial participant (eg, drug dose
36			change in response to harms, participant request, or improving/worsening disease)
37			
38		11c	Strategies to improve adherence to intervention protocols, and any procedures for monitoring adherence
39			(eg, drug tablet return, laboratory tests)
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\_\_\_ N/A \_\_\_

\_\_\_ ✓ \_p4-11\_

\_\_\_ ✓ \_p20\_

\_\_\_ ✓ \_p11-12\_

\_\_\_ ✓ \_p14\_

\_\_\_ ✓ \_p20\_

\_\_\_ ✓ \_p13\_

\_\_\_ ✓ \_p17-20\_

\_\_\_ N/A \_\_\_

\_\_\_ ✓ \_p20\_

(MiYoga diaries), p21

(video recording)\_\_\_

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	11d	Relevant concomitant care and interventions that are permitted or prohibited during the trial	___✓___p14___
Outcomes	12	Primary, secondary, and other outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to event), method of aggregation (eg, median, proportion), and time point for each outcome. Explanation of the clinical relevance of chosen efficacy and harm outcomes is strongly recommended	___✓___p23-34___
Participant timeline	13	Time schedule of enrolment, interventions (including any run-ins and washouts), assessments, and visits for participants. A schematic diagram is highly recommended (see Figure)	___✓___p14 & Figure 1___
Sample size	14	Estimated number of participants needed to achieve study objectives and how it was determined, including clinical and statistical assumptions supporting any sample size calculations	___✓___p35___
Recruitment	15	Strategies for achieving adequate participant enrolment to reach target sample size	___✓___p20___

**Methods: Assignment of interventions (for controlled trials)**

Allocation:

Sequence generation	16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions	___✓___p15___
Allocation concealment mechanism	16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned	___✓___p15___
Implementation	16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions	___✓___p15___
Blinding (masking)	17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how	___N/A___p15___
	17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial	___N/A___

**Methods: Data collection, management, and analysis**

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26	Data collection methods	18a	Plans for assessment and collection of outcome, baseline, and other trial data, including any related processes to promote data quality (eg, duplicate measurements, training of assessors) and a description of study instruments (eg, questionnaires, laboratory tests) along with their reliability and validity, if known. Reference to where data collection forms can be found, if not in the protocol	_____ ✓ _p20_____
11 12 13		18b	Plans to promote participant retention and complete follow-up, including list of any outcome data to be collected for participants who discontinue or deviate from intervention protocols	_____ ✓ _p20_____
14 15 16 17	Data management	19	Plans for data entry, coding, security, and storage, including any related processes to promote data quality (eg, double data entry; range checks for data values). Reference to where details of data management procedures can be found, if not in the protocol	_____ ✓ _p20-21_____
18 19 20 21 22	Statistical methods	20a	Statistical methods for analysing primary and secondary outcomes. Reference to where other details of the statistical analysis plan can be found, if not in the protocol	_____ ✓ _p35-36_____
21 22		20b	Methods for any additional analyses (eg, subgroup and adjusted analyses)	_____ N/A _____
23 24 25 26		20c	Definition of analysis population relating to protocol non-adherence (eg, as randomised analysis), and any statistical methods to handle missing data (eg, multiple imputation)	_____ ✓ _p35_____
27 28	<b>Methods: Monitoring</b>			
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45	Data monitoring	21a	Composition of data monitoring committee (DMC); summary of its role and reporting structure; statement of whether it is independent from the sponsor and competing interests; and reference to where further details about its charter can be found, if not in the protocol. Alternatively, an explanation of why a DMC is not needed	_____ ✓ _p15_____
34 35 36		21b	Description of any interim analyses and stopping guidelines, including who will have access to these interim results and make the final decision to terminate the trial	_____ N/A _____
37 38 39 40	Harms	22	Plans for collecting, assessing, reporting, and managing solicited and spontaneously reported adverse events and other unintended effects of trial interventions or trial conduct	_____ ✓ _p15_____
41 42 43 44 45	Auditing	23	Frequency and procedures for auditing trial conduct, if any, and whether the process will be independent from investigators and the sponsor	_____ N/A _____

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3 **Ethics and dissemination**  
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5	Research ethics approval	24	Plans for seeking research ethics committee/institutional review board (REC/IRB) approval	_____ ✓ _p1, 12, 36_____
8	Protocol amendments	25	Plans for communicating important protocol modifications (eg, changes to eligibility criteria, outcomes, analyses) to relevant parties (eg, investigators, REC/IRBs, trial participants, trial registries, journals, regulators)	_____ ✓ _p12_____
12	Consent or assent	26a	Who will obtain informed consent or assent from potential trial participants or authorised surrogates, and how (see Item 32)	_____ ✓ _p12_____
16		26b	Additional consent provisions for collection and use of participant data and biological specimens in ancillary studies, if applicable	_____ N/A_____
19	Confidentiality	27	How personal information about potential and enrolled participants will be collected, shared, and maintained in order to protect confidentiality before, during, and after the trial	_____ ✓ _p21_____
22	Declaration of interests	28	Financial and other competing interests for principal investigators for the overall trial and each study site	_____ ✓ _p39_____
25	Access to data	29	Statement of who will have access to the final trial dataset, and disclosure of contractual agreements that limit such access for investigators	_____ N/A_____
28	Ancillary and post-trial care	30	Provisions, if any, for ancillary and post-trial care, and for compensation to those who suffer harm from trial participation	_____ ✓ _p15_____
31	Dissemination policy	31a	Plans for investigators and sponsor to communicate trial results to participants, healthcare professionals, the public, and other relevant groups (eg, via publication, reporting in results databases, or other data sharing arrangements), including any publication restrictions	_____ ✓ _p37_____
35		31b	Authorship eligibility guidelines and any intended use of professional writers	_____ N/A_____
38		31c	Plans, if any, for granting public access to the full protocol, participant-level dataset, and statistical code	_____ N/A_____

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40 **Appendices**  
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3	Informed consent	32	Model consent form and other related documentation given to participants and authorised surrogates	_____ ✓ _____
4	materials			
5				
6	Biological	33	Plans for collection, laboratory evaluation, and storage of biological specimens for genetic or molecular	_____ N/A _____
7	specimens		analysis in the current trial and for future use in ancillary studies, if applicable	
8				

9 \*It is strongly recommended that this checklist be read in conjunction with the SPIRIT 2013 Explanation & Elaboration for important clarification on the items.  
10 Amendments to the protocol should be tracked and dated. The SPIRIT checklist is copyrighted by the SPIRIT Group under the Creative Commons  
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