

Supplementary Online Content

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eMethods 1. MY-PD Protocol Development

Background

In order to understand the illness experience of patients with Parkinson's disease (PD), we have conducted a sequential mixed-method, which applied a cross-sectional correlation study followed by individual qualitative interviews (1). From the correlational study, more than half of the participants (54.5%) experienced psychological distress, whereas 49.6% and 59.3% showed anxiety and depressive symptoms, respectively. In the hierarchical linear regression, the severity of motor symptoms and psychological distress were significantly associated with impaired health-related quality of life (HRQOL). After adjustments for socio-demographic and disease characteristics, psychological distress further accounted for 42.4% of the variance of HRQOL. The qualitative findings revealed that functional impairment was found to be a major concern for the participants. At the same time, exercise was a commonly adopted strategy for them to maintain functioning and stay active. Besides, emotional needs of people with PD were found unattended under the routine healthcare system. The high level of psychological distress resulting from the disease readjustment process further aggravated the motor symptoms, contributed to poor health outcomes and impaired HRQOL in this vulnerable group. Hence, the focus of the program was to strengthen their body and address their emotional needs along the illness trajectory.

Strengthening the body

Given the functional decline and limitations in the physical capability of patients with PD, the gentle and easy-to-follow nature of mind-body exercises was deemed appropriate for this vulnerable group to practice safely.

In our previous systematic review and meta-analysis (2), mind-body exercises such as yoga, Tai Chi and dance therapy demonstrated immediate moderate-to-large beneficial effects on physical outcomes such as motor symptoms, postural instability and functional mobility amongst individuals with mild-to-moderate PD. In particular, yoga was the most effective one in improving motor symptoms and was thus adopted as the fundamental component of the programme.

Healing the mind

Acceptance was identified as the underpinning goal of the readjustment process to ascertain a good sense of well-being (3). Thus, acceptance-based practice (that is, mindfulness) was integrated and emphasised in the design of the yoga intervention.

From our systematic review and meta-analysis of mind-body exercises in the PD population(2), evidence on the effects of mind-body exercises on psychological well-being was found lacking. Hence, this experimental study of a mindfulness yoga programme on psychological distress management for the PD population is novel and of high originality and can generate new and significant knowledge to inform future healthcare practice.

Conceptual framework

The design of the mindfulness yoga program for people with PD, which was based on the above-mentioned understanding, focused on not only strengthening their body but also calming their mind through the mindfulness practice of movement, breath and mind. Underpinned by the nursing theory of self-transcendence (4, 5), the structure of the program was basically built on its construct which aimed to increase one's awareness of the dimensions greater than the self and expand personal boundaries within intrapersonal, interpersonal, temporal and transpersonal domains, as illustrated in Figure 1.

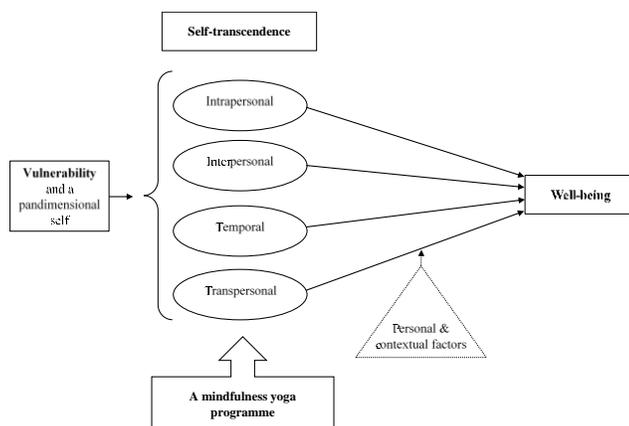


Figure 1. Conceptual framework of the study guided by the nursing theory of self-transcendence (4, 5) Intra-personally, the mindfulness of body and mind could enhance one's attention and introspective awareness of sensations, feelings, emotions and thoughts. Interpersonally, the mindfulness practice, particularly loving kindness and compassion meditation and dyad practice, facilitates one to reach out and relate to others, nature and the environment. Temporally, the moment-to-moment mindfulness practice increases one's awareness of associations amongst thoughts, sensations and experiences, which help make sense of the present moment. Transpersonally, mindfulness is a practice to cultivate one's openness beyond the typically discernible way of thinking, thereby leading to great acceptance and spiritual consciousness.

This content coverage of the program provides a diversified yet balanced sequence for participants to practice in an easy, friendly and motivating way. The program is expected to enhance their psychological, physical and spiritual wellbeing and HRQOL, to facilitate the dynamic readjustment process towards the unpredictable illness journey. The overview of the mindfulness yoga program is shown in Table 1.

Table 1. Overview of the MY-PD program

Title of the program

The title of this program, namely, 正念瑜伽展柏力, has the connotation of letting people with PD rejuvenate their potential energy. When mentioning PD, the public generally comes up with an image of a person with tremors, shuffling gait, forward-stooped posture and masked face. People with PD commonly perceive a sense of losing mastery and a diminished image of the self because of being limited by motor symptoms. In this program, people with PD are given opportunities to challenge and acknowledge their mind and body through the practice of mindfulness yoga. This custom program adopts a stepwise approach to guide them to explore and realign their bodily functions, sensations and thoughts. The essence is for them to increase awareness of themselves in the present moment and unfold the experience nonjudgmentally moment by moment, thereby redefining their illness experiences to ascertain an improved sense of well-being.

Themes of the program

The mindfulness yoga program has three themes: (i) introducing mindfulness to our body and life, (ii) embracing mindfulness of the body and mind and (iii) bringing loving kindness and compassion to life. As discussed above, the three major components embedded in the program are (i) mindfulness of movement (that is, yoga poses), (ii) mindfulness of breath (that is, breathing exercises) and (iii) mindfulness of mind (that is, meditation).

Week	1-2	3-4	5-6	7-8
Theme	Introducing mindfulness yoga to our body and life	Mindfulness of the body and content of mind		Loving-kindness and compassion
Breathing exercise (15 min)	Controlled breathing <ul style="list-style-type: none"> - Bee breath - Lion Breath - Cooling breath - Alternate Nostril Breath 			
Mindfulness practice (15 min)	Mindfulness of breath and body meditation (body scan)	Mindfulness of body and thoughts meditation (body scan)	Mindfulness of feelings and movement meditation (mindful walking)	Loving-kindness and open awareness meditation (dyad practice)
Yoga practice (60 min)	Warm up exercise (15 min) <ul style="list-style-type: none"> - Child pose - Cat and cow - Bridge - Lying hamstring stretch 			
	12 poses of sun salutation with modifications (30 min) <ul style="list-style-type: none"> - Mountain pose - Upward salute pose - Standing forward bend - Lunge - Plank pose - Knees, chest and chin pose - Cobra pose - Downward-facing dog pose - Lunge - Standing forward bend - Upward salute pose - Mountain pose 			
	Cool down exercise (15 min) <ul style="list-style-type: none"> - Child pose - Knee to chest - Corpse pose - Easy pose 			

Components of the program

Mindfulness of movement

Yoga practice emphasises the moment-to-moment awareness of sensations in the body and of breathing whilst it is moving, stretching or holding a position. All movements are readily adjustable depending on individual strength and mobility in the present moment. In this program, a sequence of 12 basic hatha yoga poses, known as sun salutations (surya namaskar), is used. This set of yoga sequence is regarded as a gentle yet dynamic form of exercises that involve static stretching whilst exerting optimal stress on the cardiorespiratory system. It has also been described as the most complete set of yoga exercise (6).

In early PD, one starts to experience rigidity and changes in posture such as stooped posture with a forward-leaned head and neck, rounded shoulders, kyphosed spine and posteriorly tilted pelvis. As the disease progresses, the muscle weakness, rigidity and spasm lead to further impairment in balance and gait changes such as shortened stride and shuffling walk. In addition, the loss of control over the proprioception messaging system contributes to the

impaired coordination in the nerve messaging system, especially in coordinating the body to act in set sequences. As a result, people with PD stumble and encounter difficulty in sequencing and coordination, and they are fearful of losing balance and falling.

Sun salutation consists of a mixing sequence of symmetrical and unilateral yoga poses, including mountain pose, upward salute pose, standing forward bend, lunge (right leg forward), plank pose, knees–chest–and–chin pose, cobra pose, downward-facing dog pose, lunge (left leg forward), standing forward bend, upward salute pose and mountain pose. This set of flow sequence targets the enhancement of strength, stability, balance, alignment and coordination of different body parts. The mindfulness practice of this yoga sequence not only builds strength and coordination of the body but also uplifts self-confidence for participants to overcome their fear. In addition, the simplicity and the combination of symmetrical and unilateral training of this sequence are especially suitable for people with PD to practice. PD symptoms usually progress unilaterally and then bilaterally. Thus, the mindful practice of a symmetrical pose sequence for unilateral body side could increase patients' awareness of body sensations and control side by side, thereby improving the alignment of the body for physical benefits. The benefits of each pose for PD are discussed as follows.

Mountain pose. Mountain pose is the starting pose for movement practice. This pose ensures awareness of the standing posture, such as alignment, posture and positioning of the shoulders and head, with active involvement of the core muscles. The conscious awareness of aligned posture not only counteracts PD symptoms but also enhances self-confidence and optimism in this open upright stance.

Upward salute pose. Upward salute pose is an energising pose which ensures awareness of the entire body. This pose helps in stretching the sides of the body, spine, shoulders, armpits and belly to combat rigidity. The continual practice of this pose can deepen breathing, promote calmness and improve posture and alignment through improved neck extension, straightened spine without extramuscular effort, and so on.

Standing forward bend. This pose is a therapeutic and revitalising pose in which the head level is below the heart; the increased blood flow to the head provides a good sense of mental clarity. The forward folds generate a space between every vertebra and promote circulation to gazillion nerves which in turn activate the parasympathetic nervous response to relieve stress and anxiety. This pose also stretches the hips, hamstrings and calves; strengthens the core, thighs and knees; and relieves tension in the spine, neck and back.

Lunge. This pose is comparatively strenuous and challenging as it requires mental focus and the strength and stability of the core and lower body. Lunge is a unilateral pose which trains one side of the body independently of the other. This unilateral training can vastly improve one's awareness, control and coordination of movement and balance. This pose can strengthen the glutes, quadriceps, hamstrings and core which are essential to improve balance, posture, stability and functional performance. This pose also increases the flexibility of the hip flexors and thus relieves lower back pain.

Plank. Plank is a foundation pose in yoga practice which strengthens the deep inner core muscles and reduces lower back pain. This pose also increases flexibility in the posterior muscle groups around the shoulders, collarbone, shoulder blades, hamstrings and arches of the feet and toes. Balance and posture can be improved through continual active engagement of the core muscles in this practice.

Knees-chest-and-chin pose. This pose helps in increasing the flexibility of the spine and neck with an open chest. Practising this pose helps in building strength throughout the entire body, including the arms, shoulders, legs and back, and paves the way for other arm balance or weight-bearing exercises.

Cobra pose. This pose is a strengthening backbend posture with an open chest that helps in maintaining an upright strong spine and combatting rounded shoulders and stooped postures in PD. In traditional yoga texts, the cobra pose is an energising pose for the awakening of being which could elevate mood and reduce anxiety and stress.

Downward-facing dog pose. This pose is a stretching and strengthening yoga pose for the upper and lower body. It trains the hands, arms, shoulders, back, calves, hamstrings and arches of the feet simultaneously. As an inverted posture, the downward-facing dog pose stimulates blood flow to the head and shoulders for improved mental clarity.

Mindfulness of breath

Mindfulness of breath is guided by controlled breathing exercises. Stress is commonly associated with short, tight upper-chest breathing. By contrast, relaxation comes with long, full and rhythmic breaths that originate from the diaphragm. Controlling breaths, that is, lengthening exhalation relative to inhalation, helps in reducing the 'fight or flight' impulse and maintains a healthy level of carbon dioxide in the blood, thereby promoting relaxation. Four basic breathing exercises are covered in this program: bee breath, lion breath, cooling breath and alternate nostril breath. The rationale for selecting each breathing exercise is described as follows.

Bee breath. Bee breath is a practice that resembles the typical humming sound of bees during exhalation. The practice lengthens exhalation without excessive strain. The vibrations of the humming sound fill the brain and forehead and introduce an immediate calming effect which frees the mind of negative emotions, such as agitation, frustration, anxiety and anger.

Lion breath. In this breathing exercise, the body and face are manipulated at once to invoke the force and intensity of a lion's roar. Lion breath is a powerful and energising breathing technique to awaken the body and dispel negativity. Roaring like a lion during exhalation adds a sense of humour and playfulness to the practice. According to traditional yoga texts, lion breath promotes good posture, increases one's confidence level and invokes a fiercely courageous attitude towards life, along with a renewed sense of pride, dignity and bravery. Addressing PD symptoms, such as masked face and impaired vocal tone, this practice promotes blood circulation and relieves tension in the face, tongue, jaw, throat, neck and chest and helps in stimulating and strengthening the platysma in the throat for a good vocal tone.

Alternate nostril breath. This breathing exercise involves alternating nostrils for exhalation by blocking the opposite nostril. In the yoga context, breathing through the left nostril by blocking off the right nostril can direct oxygen flow and energy into the right hemisphere of the brain, and vice versa. Alternate nostril breath helps harmonise the two hemispheres of the brain, resulting in a balanced physical, mental and emotional well-being. This alternate controlled breathing activates the parasympathetic nervous system to soften the intensity of an overly reactive emotional state. Alternate nostril breath also enhances respiratory functions, such as strength and endurance, and improves attention, mental clarity and fine motor coordination and performance.

Cooling breath. This practice introduces a soothing cooling effect to the body. In this practice, the tongue is initially folded to form a tube-like shape, and long inhalation through the mouth and slow exhalation through the nostrils are subsequently performed. This process contracts the muscles and promotes blood circulation in the mouth, thereby strengthening weakened vocal cords and relaxing stiff facial muscles

Mindfulness meditation

Mindfulness training cultivates attitudinal qualities of curiosity, kindness, patience, equanimity and openness to all experiences. The essence of mindfulness practices involves accepting and experiencing whatever arises without judgment—thoughts, body sensations and emotions—regardless of whether it is considered pleasant, unpleasant or neutral. In this program, four methods of meditation are covered: body scan, sitting meditation, walking meditation and loving-kindness and compassion meditation through dyad practice (7).

Body scan. Body scan is a foundation practice of mindfulness. Body scan trains attention and introspective awareness by systematically scanning through each body part over a sustained period of time and repeatedly bringing attention back to the body if the mind wanders without self-criticism or blame. Participants are instructed to notice the presence of sensations, such as tension, ache or pain, carefully with openness and curiosity and without trying to change them. If no sensations are noticed, then the absence of sensations is simply observed. This exercise differs from traditional relaxation exercises in which participants are not instructed to relax their muscles but simply witness and observe what it is. Through body scanning, a person can become increasingly aware of what is happening within the body and how the body is related to thoughts, feelings, emotions and the environment. This exercise provides an opportunity to practice several key mindfulness skills, such as intentionally paying attention in a particular manner; repeatedly noticing when attention has wandered and gently bringing it back to the present moment; and being open, curious, accepting and non-judgmental about the observed experience regardless of its nature.

Sitting meditation. Sitting meditation can be viewed as a continual practice of body scan to cultivate introspective awareness. Attention is directed initially to breathing and bodily sensations and subsequently to emotions being experienced, such as anger, sadness and desire, and noticing any thoughts or sensations associated with these emotions. As an invitation, participants are instructed to observe their thoughts as events that come and go and to notice the content of their thoughts briefly without becoming absorbed in it. As with all mindfulness practice, participants are instructed to notice these sensations or thoughts nonjudgmentally, with acceptance, openness and curiosity regardless of the nature of the experiences. The conscious awareness of bodily sensations, thoughts and emotions in the present moment can stop our mind from acting 'automatically' and becoming trapped in a reactive state of being without awareness. In this way, emotional distress is reduced(7).

Walking meditation. Walking meditation provides another technique to practice focusing on the sensations in the body while moving. The goal of walking meditation is simply to be aware of walking as it happens. Participants are initially instructed to walk slowly and deliberately. Then, attention is directed towards the movements, shifts of weight and balance and sensations in the toes, feet, legs and body associated with walking. As with other meditation exercises, participants are encouraged to gently bring back their attention to the sensations of walking when the mind wanders. The pace of walking meditation may start from slow to moderate-to-fast. This practice can be incorporated into daily life as it helps cultivate continuous awareness of the mind and body in the present moment.

This practice is physically and mentally challenging yet important for people with PD because of their impaired mobility, balance and coordination.

Loving-kindness and compassion meditation through dyad practice. Loving-kindness and compassion meditation focuses on affect and perspective training. This practice involves fostering feelings of loving, kindness and compassion towards a benefactor, the self and others with the use of certain phrases, such as ‘May you be healthy’, ‘May you be happy’ and ‘May you live with ease’. A mindful dyadic yoga practice is included as an extension to enhance playfulness and curiosity and thereby provide an opportunity to practice openness, acceptance, compassion and empathy towards oneself and others.

Dose

Cramer, Lauche, Langhorst, and Dobos (2013) conducted a systematic review and meta-analysis of yoga for depression (12 RCTs with 619 participants) and obtained moderated evidence of the beneficial effects of yoga compared with usual care. In this review, the median length of all yoga interventions was 8 weeks. Amongst the RCTs demonstrating the positive effects of yoga over the control, the lengths of the yoga programs ranged from 5 weeks to 12 weeks, whereas the time spent per week ranged from 30 min to 210 min, with a median of 90 min. By contrast, the remarkable Mindfulness-based Stress Reduction (MBSR) program (9), which consists of eight weekly 90 min mindful yoga sessions, has been shown to be an effective behavioural intervention for people with stress, anxiety disorders and chronic illnesses (10-12). In our previous systematic review, we found that a high-dose intervention becomes a barrier for low adherence and increased physical intolerance in the PD population (2). Therefore, a dose of eight weekly 60 min sessions of yoga was adopted for the proposed program. In addition, participants were encouraged to perform 20 min home-based practice twice a week.

For a 60 min mindfulness yoga session, the time distributed to each component is outlined as follows.

- (i) Breathing exercises = 10 min
- (ii) Warm-up exercises = 10 min
- (iii) Flow sequence of sun salutations = 20 min
- (iv) Cool-down exercises = 10 min
- (v) Meditation = 10 min

Format and mode of delivery

Each yoga session was conducted by group under the supervision of an experienced yoga instructor in an activity room provided by the Hong Kong Society for Rehabilitation (HKSR). Each session was attended by 15-20 participants to provide adequate instructional attention to each participant and to allow the yoga instructor to perform the required training routines. During the yoga practice sessions, the participants were instructed by the experienced yoga instructor to replicate and practice the poses and movements, breathing exercises and meditation to maintain a conscious awareness of sensations, feelings and thoughts.

A recent meta-analysis has shown that guided self-help tools with multimedia components may be more effective than book-based approaches in the context of behavioural interventions for anxiety disorders (13). Hence, in addition to an information booklet, multimedia which included audios and videos were designed and produced by the investigator. The information booklet was disseminated to participants in class while multimedia materials were disseminated to participants through Whatsapp. These materials covered instructions for the yoga poses, breathing exercises and guided meditations and were given to each participant to facilitate their self-learning and practice. The use of these guided tools not only reinforced the content of the sessions but also ensured the consistency of the intervention. A self-recording activity log was given to the participants so that they could record the frequency of their self-practice at home and help monitor the compliance rate.

Content validity

The yoga protocol was reviewed by a representative panel of seven experts with clinical expertise to ensure the validity of the novel mindfulness yoga intervention, including its appropriateness, safety and applicability. The seven experts included one neurologist, one PD nurse specialist, one physical education researcher specialising in balance and fall, one physiotherapist specialising in sport rehabilitation, one occupational therapist, and two yoga instructors with more than 10 years of teaching experience. The two yoga instructors were experienced in teaching people with chronic illnesses, and one of them is a certificated MBSR instructor.

The content validity of each item of intervention was estimated by the item-content validity index (I-CVI) which guided the decisions of item revisions or rejections. An I-CVI of 0.78 or higher was considered good content validity (14). Meanwhile, comments from experts guided the development of any new item and the amendment of an existing item. A total of two rounds of panel review were conducted. Amongst the 20 poses, including 12 poses in the flow sequence of sun salutations and 8 warm-up and cool-down poses, the following modifications were made according to the expert’s opinions during the first round.

- (i) For the warm-up exercises for the yoga flow sequence (sun salutations), axial rotation in the reclined spinal twist pose was considered to be not highly relevant. This pose was replaced with the child pose, which involves gently stretching the shoulders, neck, back, hips, thighs and ankles, in the subsequent yoga practice.
- (ii) For the yoga sequence, the standing forward bend and downward-facing dog poses might be difficult for participants with postural instability. Therefore, these two poses were modified by keeping the feet–hip distance wide and bending the knees to make it easy for beginners or participants with postural instability
- (iii) An inquiry was raised to determine whether the corpse pose was a type of meditation. Actually, the corpse pose is a common cool-down exercise in yoga that puts the body in a neutral position of rest and relaxation. Thus, this pose remained unchanged with the purpose of enhancing one’s mindful awareness of breath, body and mind.

In the second round, the I-CVIs of all poses reached 1.0.

Feasibility study

Before the study, the mindfulness yoga program was pilot tested for its feasibility, acceptability and safety. The feasibility study was conducted from September 2016 to November 2016.

Methods

A total of 10 people with mild-to-moderate idiopathic PD were recruited and screened for eligibility from the HKSR. Written informed consent was obtained before any assessment and intervention. In this feasibility study, participants received 8 weekly 60 min yoga sessions. All intervention sessions were delivered by the same experienced yoga instructor. Baseline and post-intervention assessments were conducted. Outcome measures included psychological disease (HADS), motor symptoms (MDS UPDRS III), mobility, balance and fall risk (Timed Up and Go Test), spiritual well-being (HWS), and HRQOL (PDQ-8). *T* tests were used for preliminary data analysis. Process evaluation was conducted using a questionnaire which assessed the participants’ satisfaction about the content and arrangement of the program. All interventions and assessments were performed by the investigator in an activity room in the HKSR.

Results

A convenience sample of 10 participants with PD completed the study. The mean age of the participants was 57.5 years; 70% of the participants were female. The majority of the participants were married and had completed at least secondary education. The characteristics of the participants are summarised in Table 2. Figure 1 shows the participants practicing mindfulness yoga in class.

Table 2. Characteristics of participants (n=10)

Variables	n (%)	Mean (S.D.)
Age, years		57.5 (7.1)
Female	70	
Marital status		
- Single	1 (10)	
- Married	7 (70)	
- Divorce/ Separation/ Widowed	2 (20)	
Number of children		1.8 (1.4)
Education level		
- Illiterate/Primary	3 (30)	
- Secondary	5 (50)	
- Tertiary	2 (20)	
The Hoehn and Yahr scale		
- 2	3 (30)	
- 3	7 (70)	
HADS		10.4 (4.5)
HADS – Anxiety		4.8 (2.5)
HADS – Depression		5.6 (2.5)
MDS UPDRS III		25.2 (9.6)
TUG		11.1 (1.4)
HWS – Affliction		3.0 (1.4)
HWS – Equanimity		7.0 (1.3)
PDQ-8		20.9 (12.8)



Figure 1. Photo of mindfulness yoga class

Feasibility and safety

The enrolment rate was 58.8%, and the class adherence rate was 97.5%. The preliminary findings are shown in Table 3. Significant improvements were observed in psychological distress, as measured by the HADS ($p = 0.006$) with a moderate effect size of 0.4, and spiritual well-being in terms of affliction, as measured by the HWS ($p = 0.007$).

Table 3. Outcomes between baseline and post-intervention assessment (n=10)

	Paired Differences (T0-T1)					t	Sig. (2-tailed)
	Mean	SD	SEM	95% CI of the difference			
				Lower	Upper		
HADS	4.70**	4.16	1.32	1.72	7.68	3.57	0.006
HADS – Anxiety	2.40*	2.46	0.78	0.64	4.16	3.09	0.013
HADS – Depression	2.30*	2.36	0.75	0.61	3.99	3.09	0.013
MDS UPDRS III	2.1	12.8	4.1	-7.1	11.3	0.52	0.617
TUG	1.11	2.06	0.65	-0.36	2.58	1.71	0.122
HWS – Affliction	0.87**	0.80	0.25	0.30	1.44	3.45	0.007
HWS – Equanimity	-0.07	1.11	0.35	-0.87	0.72	-0.20	0.843
PDQ-8	7.50	14.52	4.05	-11.27	7.07	1.63	0.137

Acceptability

The findings of the process evaluation are summarised in Table 4. All participants were satisfied with the program. Perceived benefits included improved flexibility, gait and balance and constipation; reduced back and shoulder pain; relaxed body and mind; ease of falling asleep; reduced levels of anxiety; and heightened calmness and mood. In addition, biweekly self-practice gatherings were self-initiated by the participants after the completion of the program. This result indicated their interest and motivation in continuing the yoga practice.

Table 4. Summary of process evaluation using satisfaction questionnaire (n=10)

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. The content of exercise program is appropriate.	6	3	1		
2. The total number of classes and duration of each class was appropriate. - too short for each class (n=1)	3	6		1	
3. The venue was appropriate.	3	7			
4. I think that the difficulty level of exercise being taught in classes is appropriate for me.	4	5	1		
5. I think that the breathing exercises is useful for me.	4	6			
6. I think the mindfulness meditation is useful for me.	3	6	1		
7. I think that the yoga poses are useful for me.	5	5			
8. The information being provided related to this exercise program is appropriate.	4	5	1		
9. I am satisfied with the teaching methods delivered by the instructor.	8	2			
10. I can remember the exercises learned from class.	3	5	1	1	
11. In daily living, I have time to practice the exercises learned from class.	3	6	1		
12. After the completion of exercise program, I am confident that I could continue the exercise practice in daily living.	3	4	2	1	
13. Overall speaking, I am satisfied with this exercise program.	5	5			

Modifications of the mindfulness yoga program

As part of the effort to address the feedback from the participants and instructors, a future protocol was proposed to increase the duration of each class from 60 min to 90 min. This extension ensured adequate time for teaching and learning in a stepwise approach amongst the participants with PD symptoms.

For a 90 min mindfulness yoga session, the proposed time distributed to each component was reviewed as follows.

- (i) Breathing exercises = 15 min
- (ii) Warm-up exercises = 15 min
- (iii) Flow sequence of sun salutations = 30 min
- (iv) Cool-down exercises = 15 min
- (v) Meditation = 15 min

Conclusion

The mindfulness yoga intervention and study procedures were found to be feasible for people with mild-to-moderate PD. Improvements in psychological distress, symptom perceptions and well-being merit powered and controlled studies on mindfulness yoga for the PD population in the future.

Summary

This online supplemental file discussed how the experiences and observations obtained from the previous review and the mixed methods study contributed to the development of the mindfulness yoga program for this vulnerable group. Living with chronic illnesses such as PD is distressing physically and psychologically. The major reason behind the development of this program is that the current treatment and rehabilitation practice overlooks the psychological impacts of the illness.

The mindfulness yoga program covers three core components, namely, mindfulness of movement, breathing exercises and meditation. These components are aimed at not only strengthening the body but also healing the mind. By cultivating mindfulness, one learns to observe thoughts and experiences without emotional judgement, thereby realising the impermanent nature of things and cultivating openness in accepting changes as they happen. The program is expected to facilitate the dynamic readjustment process towards changes brought by PD. It is also aimed at enhancing the psychological, physical and spiritual well-being and HRQOL of people with PD.

eMethods 2. Theory of Self-transcendence

Overview of the theory

In the current study, the theory of self-transcendence is adopted to explain the process and outcomes of PD patients in adapting to the illness experience. It also offers direction to guide the selection of appropriate interventions for promoting improved health outcomes amongst PD patients. The theory of self-transcendence (1-3) aims to ‘provide a framework for inquiry and practice related to the promotion of well-being in the midst of difficult situations, particularly where individuals and families face loss or life-limiting illness’ (p.1). This mid-range nursing theory elucidates how a person moves from vulnerability to self-transcendence, with the outcome pointing towards well-being. The term self-transcendence has been widely used to describe the process whereby individuals compel a vivid change in self-perception and attain an improved sense of well-being and acceptance, as well as an expanded view of lives, whilst confronting vulnerable health experiences.

The theory of self-transcendence proposes that when individuals encounter vulnerable health experiences, such as life-altering illness or life-threatening disease, they may expand or transcend their self-boundary to integrate those changes for attaining a sense of well-being. Individuals often expand their self-boundary by themselves, but patients may fail to ‘self-transcend’ naturally and suffer from enduring emotional disturbances and existential distress in times of difficulty, such as facing vulnerable health experiences. The focus of this theory for nursing practice is on facilitating self-transcendence for the purpose of enhancing well-being, particularly the well-being of the whole person in the context of health experiences. Three major concepts, namely, self-transcendence, well-being and vulnerability, are involved in the theory (Figure 1) and would be discussed subsequently.

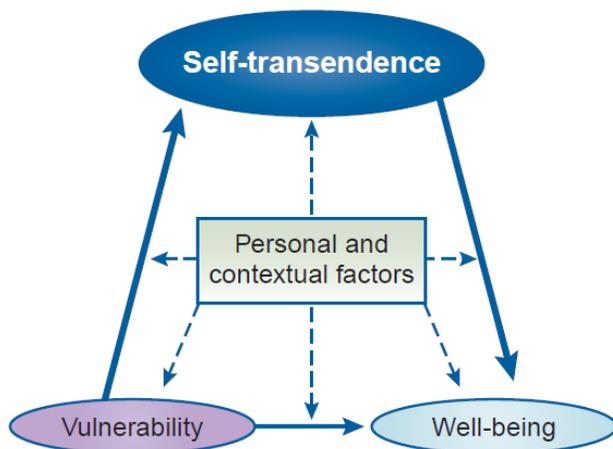


Figure 1. Model of Reed's self-transcendence nursing theory.

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Self-transcendence

Reed (2012) defined self-transcendence as an inherent, gradual and non-linear developmental process that results in increased awareness of dimensions greater than the self and expansions of personal boundaries within four domains, namely, (i) intra-personal: towards great awareness of one's philosophy, values and dreams and great self-acceptance; (ii) inter-personal: to reach out and relate to others, nature and the environment; (iii) temporal: to integrate one's past and future so as to make sense of the present; and (iv) trans-personal: to connect with dimensions beyond the typically discernible world and the openness to a higher entity or purpose which is also known as 'spiritual consciousness'. Coward (4), a student of Reed, conducted a qualitative phenomenological study with advanced breast cancer patients and identified four themes as basis for the transcendent experience: (i) an incident that generates intense negative feelings and emotions, such as physical and emotional pain, fear of death, anger and despair over personal losses, all of which encourage one to look for ways to find new meaning and purpose for living; (ii) great effort to acquire new skills to

overcome and confront one's fear; (iii) emotional sense of healing and well-being, a sense of physical lightness and relief of burden; (iv) helping others and accepting help from others, as well as a sense of receiving more than what has been given.

Self-transcendence is evident in psychosocial and spiritual perspectives. It provides the flexibility to expand one's self-boundary beyond the immediate and constricted views of the self and the world and to attain meaning of life even amidst complex and adverse health conditions. Self-transcendence is an effective coping strategy for individuals experiencing a range of chronic illnesses, such as rheumatic arthritis (5), human immunodeficiency virus (6), cancer (4) and conditions related to liver transplant (7).

Vulnerability

Vulnerability refers to a person's awareness of mortality or experience of difficult life events. Health experiences are major sources of increased vulnerability because they confront individuals and their families with concerns and problems about mortality or immortality.

Reed theorised that self-transcendence is a development capacity that emerges naturally in adverse health experiences. A crisis event, such as life-altering illness, can be perceived as a catalyst for self-awareness. The positive or negative response of a person to difficult life situations affects the developmental progress of self-transcendence. If the response is positive, then people can go beyond themselves and self-transcend to attain a state of physical, psychosocial and spiritual well-being. Otherwise, the difficult life situations crush one's inner boundary and result in emotional distress and suffering. At times of vulnerability, nurses can intervene and help a person explore one's inner boundaries, transform loss into growth or healing experience and contribute to health and well-being.

Well-being

Well-being is defined broadly as a sense of feeling whole and healthy in accordance with one's own criteria of wholeness and health (3). The indicators of well-being vary from one individual to another as human perceptions of health and wellness and developmental processes may be affected by cultural diversity, complexities in ways of living, social dogma and other factors. Reed theorised that self-transcendence, as a nursing process, is linked to positive health-promoting experiences, with the outcome pointing towards well-being.

Well-being is a concept about the positive aspects of a person's life, with several variations in the way this concept is defined. Longo, Coyne (8) revealed the six most widely used theoretical perspectives on well-being and identified fourteen distinct and recurring constructs, namely, happiness, vitality, calmness, optimism, involvement, self-awareness, self-acceptance, self-worth, competence, development, purpose, significance, self-congruence and connection.

eMethods 3. Definition of Spiritual Wellbeing

Spiritual well-being in terms of perceived affliction and equanimity

The recent development of the concept of spiritual well-being has adopted a merged perspective from the East and the West, with growing emphasis on the interconnectedness of the body, mind and spirit (1). Spiritual well-being is being viewed as embodying fundamental values, beliefs and meanings of life, with the dual goals of alleviating suffering (that is, affliction), and achieving enduring happiness (that is, equanimity).

The concept of affliction is similar to that of depression, but it is qualitatively distinct, with components such as resentment, jealousy and bitterness. Affliction is believed to manifest somatically as irritability and nervousness. Spiritually is also related to the inability to let go of material and immaterial obsessions, resulting in a loss of direction and an impaired sense of meaning that resembles an existential threat. Equanimity is characterised by a sense of unflappability and resilience whilst facing changes and challenges. It is reflected by factors that indicate a sense of vitality, an alert and empathetic mind for the self and others, an accepting attitude to changes and a willingness to take care of one's spiritual well-being. In this study, holistic well-being is measured by the Holistic Well-being Scale (HWS) which measures the absence of affliction in terms of bodily irritability, emotional vulnerability and spiritual disorientation; and the presence of equanimity in terms of general vitality, mindful awareness, non-attachment and spiritual self-care.

eTable 1. Overview of the Stretching and Resistance Exercise Intervention

Week	Warm up	Resistance training	Stretching and cool down
1-2	Seated: <ul style="list-style-type: none"> - Straight arm forward rotation¹ - Straight arm backward rotation¹ - Straight arm up and down flapping¹ - Seated forward and backward stepping¹ - Seated hip abduction and adduction stepping¹ - Seated knee raise¹ 	Seated: <ul style="list-style-type: none"> - Seated forward leg extension¹ - Seated backward leg curl¹ Standing*: <ul style="list-style-type: none"> - Single leg knee raise² - Alternate knee raise¹ - Mini squat (30 degree)¹ 	Seated: <ul style="list-style-type: none"> - Seated hamstring stretch²
3-4	Seated: <ul style="list-style-type: none"> - Straight arm forward rotation¹ - Straight arm backward rotation¹ - Straight arm up and down flapping¹ - Straight arm horizontal abduction and adduction¹ - Trunk rotation and hold¹ Standing*: <ul style="list-style-type: none"> - Straight leg forward kick¹ - Straight leg backward kick¹ - Straight leg hip adduction and abduction¹ - Alternate knee raise¹ 	Seated: <ul style="list-style-type: none"> - Straight leg forward kick² - Straight leg circling² Standing*: <ul style="list-style-type: none"> - Calf raise² - Mini squat (45 degree)² 	Standing*: <ul style="list-style-type: none"> - Hamstring stretch² - Calf stretch²
5-6	Seated: <ul style="list-style-type: none"> - Straight arm forward rotation¹ - Straight arm backward rotation¹ - Straight arm up and down flapping¹ - Straight arm horizontal abduction and adduction¹ - Trunk rotation and hold¹ Standing*: <ul style="list-style-type: none"> - Straight leg forward kick¹ - Straight leg backward kick¹ - Straight leg hip adduction and abduction¹ - Alternate knee raise¹ 	Seated: <ul style="list-style-type: none"> - Straight leg circling² - Straight leg alternate crossover² Standing*: <ul style="list-style-type: none"> - Single leg standing² - Single leg calf raise² - Wall squat² 	Standing*: <ul style="list-style-type: none"> - Hamstring stretch² - Calf stretch² - Upper trapezius stretch²
7-8	Seated: <ul style="list-style-type: none"> - Straight arm forward rotation¹ - Straight arm backward rotation¹ - Straight arm up and down flapping¹ - Straight arm horizontal abduction and adduction¹ - Trunk rotation and hold¹ Standing*: <ul style="list-style-type: none"> - Straight leg forward kick¹ - Straight leg backward kick¹ - Straight leg hip adduction and abduction¹ - Alternate knee raise¹ 	Standing*: <ul style="list-style-type: none"> - Single leg standing² - Single leg calf raise² - Side lunges² - Wall squat² 	Standing*: <ul style="list-style-type: none"> - Hamstring stretch² - Calf stretch² - Upper trapezius stretch² - Side trunk flexion stretch² - Forearm stretch²
*Standing with hands rest on chair back; ¹ 10 seconds, 2 cycles, with 10 seconds rest; ² 20 seconds, 2 cycles, with 10 seconds rest.			

eTable 2. Characteristics of Drop-out and Nondrop-out Cases

Characteristics	Non-drop-out (n=108)	Drop-out (n=30)	χ^2/t	<i>p</i>
Age, years ²	63.6(8.4)	63.6(9.9)	-0.03	0.98
Female ¹	58(53.7%)	15(50%)	0.129	0.719
Marital status ¹				
- Single/separated/divorced/widowed	24(22.2%)	6(20%)	0.068	0.794
- Married	84(77.8%)	24(80%)		
Number of children ²	1.7(1.0)	1.7(1.2)	0.06	0.95
Education ¹				
- Illiterate/Primary	19(17.6%)	6(20%)		
- Secondary	62(57.4%)	16(53.3%)	0.170	0.919
- Tertiary	27(25%)	8(26.7%)		
Living status ¹				
- Living alone	11(10.2)	3(10%)	0.001	0.976
- Living with spouses/ families/friends	97(89.8%)	27(90%)		
Social security allowance ¹	81(75%)	21(70%)	0.304	0.581
The Hoehn and Yahr scale ¹				
- 1/2	33(30.6%)	11(36.7%)	0.404	0.525
- 3	75(69.4%)	19(63.3%)		
LEED ²	2064 (5455.8)	4599.3 (11356.4)	2.964	0.087
HADS ²	12.4(6.9)	12.5(6.0)	-0.09	0.93
- Anxiety subscale	6.0(3.9)	6.1(3.5)	-0.22	0.83
- Depression subscale	6.4(3.6)	6.4(3.1)	0.06	0.95
MDS UPDRS III ²	32.3(14.2)	37.1(18.3)	-1.54	0.13
TUG ²	15.0(11.1)	18.8(15.7)	-1.52	0.13
HWS ²				
- Perceived affliction	3.9(1.6)	4.4(1.7)	-1.52	0.13
- Perceived equanimity	6.7(1.3)	6.3(1.1)	1.61	0.11
PDQ-8 SI ²	29.4(16.2)	30.8(15.6)	-0.43	0.67
PDQ-8 – Mobility ²	39.6(24.7)	46.7(29.2)	-1.34	0.18
PDQ-8 – ADL ²	28.2(24.2)	35.8(26.0)	-1.50	0.14
PDQ-8 – Emotions ²	24.5(21.8)	25.8 (24.1)	-0.28	0.78
PDQ-8 – Social support ²	23.1(23.6)	25.8(27.5)	-0.49	0.63
PDQ-8 – Cognitions ²	26.6(23.0)	26.7(27.8)	-0.01	0.99
PDQ-8 – Communications ²	23.1(24.3)	20.8(23.7)	0.43	0.64
PDQ-8 – Bodily discomforts ²	38.2(23.8)	38.3(24.3)	-0.03	0.98
PDQ-8 – Stigma ²	31.7(24.8)	26.7(22.7)	1.00	0.32

¹Categorical and ²continuous variables were compared between the two groups using the Chi-square test (χ^2) and Independent t-test (*t*), respectively. Data are presented as mean (standard deviation), n (%), or median (interquartile range).
Abbreviation: HADS, Hospital Anxiety and Depression Scale; HWS, Holistic Well-being Scale; LEED, Levodopa equivalent dose; MDS UPDRS III, Movement Disorders Society United Parkinson's Disease Rating Scale Part III; PDQ-8, Parkinson's Disease Questionnaire-8; TUG, Timed Up and Go Test.

eReferences

1. Kwok JYY, Auyeung M, Chan CHY. Examining Factors Related to Health-Related Quality of Life in People With Parkinson's Disease. *Rehabil Nurs*. 2018.
2. Kwok JY, Choi KC, Chan HY. Effects of mind-body exercises on the physiological and psychosocial well-being of individuals with Parkinson's disease: A systematic review and meta-analysis. *Complement Ther Med*. 2016;29:121-31.
3. Kwok JYY, Auyeung M, Chan CHY. The illness experience of people with Parkinson's Disease: A Qualitative study. Manuscript submitted for publication. 2018.
4. Reed PG. Demystifying self-transcendence for mental health nursing practice and research. *Arch Psychiatr Nurs*. 2009;23(5):397-400.
5. Reed PG. Toward a nursing theory of self-transcendence: Deductive reformulation using developmental theories. *Advances in Nursing Science*. 1991.
6. Chopra D. *AARP The Seven Spiritual Laws of Yoga: A Practical Guide to Healing Body, Mind, and Spirit*; Wiley; 2012.
7. Baer RA. *Mindfulness-Based Treatment Approaches: Clinician's Guide to Evidence Base and Applications*; Elsevier Science; 2015.
8. Cramer H, Lauche R, Langhorst J, Dobos G. Yoga for depression: a systematic review and meta-analysis. *Depress Anxiety*. 2013;30(11):1068-83.
9. Kabat-Zinn J, Hanh TN. *Full Catastrophe Living (Revised Edition): Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness*; Random House Publishing Group; 2013.
10. Chiesa A, Serretti A. Mindfulness-based stress reduction for stress management in healthy people: a review and meta-analysis. *J Altern Complement Med*. 2009;15(5):593-600.
11. Fjorback LO, Arendt M, Ornbol E, Fink P, Walach H. Mindfulness-based stress reduction and mindfulness-based cognitive therapy: a systematic review of randomized controlled trials. *Acta Psychiatr Scand*. 2011;124(2):102-19.
12. Miller JJ, Fletcher K, Kabat-Zinn J. Three-year follow-up and clinical implications of a mindfulness meditation-based stress reduction intervention in the treatment of anxiety disorders. *Gen Hosp Psychiatry*. 1995;17(3):192-200.
13. Haug T, Nordgreen T, Ost LG, Havik OE. Self-help treatment of anxiety disorders: a meta-analysis and meta-regression of effects and potential moderators. *Clin Psychol Rev*. 2012;32(5):425-45.
14. Polit DF, Beck CT. *Nursing research: Principles and methods*; Lippincott Williams & Wilkins; 2004.