

The Effectiveness of a Mindfulness-Based Psychoeducation Programme for Emotional Regulation in Individuals with Schizophrenia Spectrum Disorders: A Pilot Randomised Controlled Trial

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Background: Emotion dysregulation has emerged as a transdiagnostic factor that potentially exacerbates the risk of early-onset, maintenance, and relapse of psychosis. Mindfulness is described as the awareness that emerges from paying attention to the present moment without judgment. It gently pulls the mind out of the negative emotions induced by the disparity between expectation and reality by focusing on the present moment, instead of worrying about the future or regretting the past. However, only a few research has ever focused on the efficacy of using a mindfulness-based intervention to improve emotion regulation in schizophrenia spectrum disorders.

Purpose: The purpose of this study was to examine the effectiveness of a Mindfulness-Based Psychoeducation Programme (MBPP) on the emotion regulation of individuals with schizophrenia, in particular, to access emotion regulation strategies. The objective of this study was to find out whether MBPP is feasible for improving emotion regulation strategies, in terms of rumination, cognitive reappraisal, and expressive suppression, with a sustainable effect at a three-month follow-up.

Patients and Methods: A single-blinded pilot randomised controlled trial with repeated-measures designs was adopted. Forty-six participants diagnosed with schizophrenia and its subtypes were randomised in either the 8-week mindfulness-based psychoeducation programme or treatment-as-usual (control) group.

Results: The results of the Generalised Estimating Equations test indicated that the MBPP group showed a significant improvement in reappraisal at a three-month follow-up ($\beta = -6.59$, Wald's $\chi^2=4.55$, $p=0.033$), and a significant reduction in rumination across time. However, the Generalised Estimating Equations indicated no significant difference in rumination and expressive suppression in the MBPP group. Two participants reported having unwanted experiences, including feelings of terror and distress during the mindfulness practice.

Conclusion: The MBPP appeared to be effective for improving emotion regulation, which will contribute to future large-scale RCT to confirm the treatment effects in more diverse groups of schizophrenic patients.

Keywords: schizophrenia, mindfulness, emotion regulation, reappraisal, suppression, rumination

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Introduction

Schizophrenia is one of the top 25 leading causes of disability worldwide, it affects about 1.1% of the general population, i.e. more than 21 million people worldwide.^{1,2} It is highly associated with affective disturbance, psychiatric comorbidities, social

dysfunction, illness relapse and suicide.^{3–5} Antipsychotics are effective in reducing the psychotic symptoms associated with schizophrenia but are considered ineffective for improving the functioning and residual symptoms.^{6,7} Recent practice guideline has informed the importance of using psychosocial intervention in conjunction with pharmacotherapy to improve the symptoms control, functioning, and relapse prevention.^{8–10} The guideline suggests that cognitive behavioural therapy (CBT), family intervention and social skills training have been confirmed to provide short-term benefits in mental status, symptom management, and enhance medication adherence.¹¹ Unfortunately, these reports from CBT, social skills programme and family intervention are inconsistent with providing longer-term benefits, particularly in the mental status, functioning, and prevention of relapse.^{6,12–16} Besides, these interventions provide only limited empowerment of the patients' illness management and fail to develop their acceptance attitude towards the illness and life difficulties, hence, resulting in a general pattern of unsuccessful long-term management and persistent unsatisfactory functioning in schizophrenia.^{7,17}

Emotion regulation difficulty refers to the difficulty of a person to modulate their emotions in response to emotion-elicited stimuli.^{18,19} The model for the process of emotion regulation by Gross (1998) explained that emotion regulation starts by selecting, or avoiding situation (situation selection/modification) that needs to be attended to (attentional deployment), giving rise to an appraisal of the situation's valence and motivational relevance (cognitive appraisal), and expressing emotion in response to environmental demands (emotional modulation).²⁰ (Figure 1).

Attentional deployment refers to redirect one's attention toward or away from an emotional situation; it may include rumination, which refers to a perseverative focus on thoughts and feelings associated with an emotion-eliciting event.²¹ Cognitive change involves one imbuing the emotional situation with meaning.²² Reappraisal is a form of cognitive change, involving a reinterpretation of the meaning of an emotional situation.²¹ Response modulation occurs when one attempts to directly influence the experiential, behavioural, and physiological response after the emotion is generated.²² Example includes expressive suppression in which people use expressive suppression to inhibit their emotional expression.²¹

It has been discovered that people with schizophrenia have difficulty with emotion regulation process. Findings exhibit that they have substantial emotion awareness deficits, and initiates more emotion regulation strategies at a lower threshold of negative emotional intensity.^{23,24} Studies also showed that schizophrenia patients select more emotion regulation strategies which include rumination, reappraisal, suppression, and situation modification, than healthy subjects.²⁴ Besides, they become lost in the struggle of ruminations and attempts to confront negatively valenced experiences.^{24,25} Recent studies and meta-analysis suggested that compared to healthy controls, individuals with schizophrenia were associated with a greater use of rumination ($g = -0.67$, moderate to large effect size) and expressive suppression ($g = -0.44$), while an adaptive strategy, such as cognitive reappraisal ($g = 0.49$) was negatively associated with schizophrenia.^{24,26,27} Studies have discovered that the maladaptive use of rumination, reappraisal and suppression in schizophrenia is associated with negative

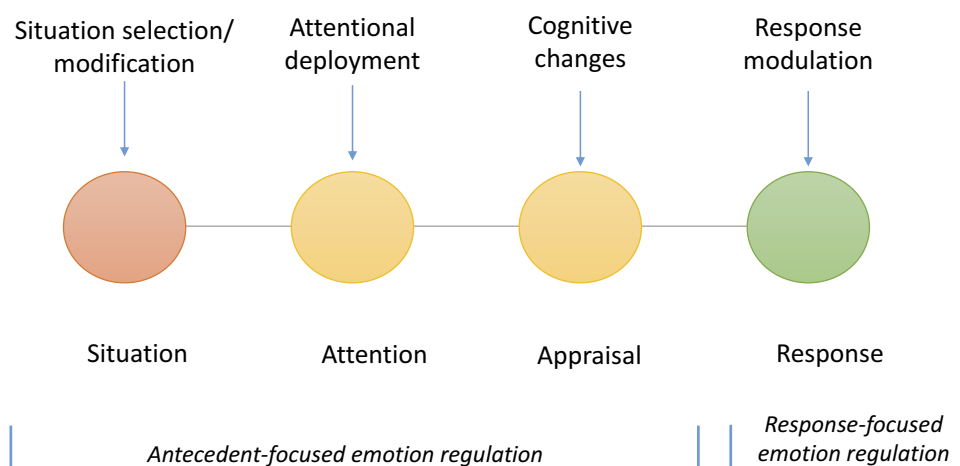


Figure 1 The process model of emotion regulation by Gross (1998).

Note: Gross JJ, The emerging field of emotion regulation: an integrative review, *Rev Gen Psychol*, 2(3), pp. 271-299, copyright © 1998 by SAGE Publications, Adapted with permission from SAGE Publications, Inc.²²

emotion, affective blunting, exacerbation of symptoms, and relapse.^{28–32} The increased use of suppression is closely associated with reduced emotional expressivity or blunted affect, alongside the normal or even stronger emotional experience and intensity.³³ Emotion regulation difficulties were also linked to the disruption of daily life and social function impairment.^{32,34–37}

Better use of adaptive emotion regulation strategies may improve the emotion regulation process in schizophrenia, thus, informing a new therapeutic direction to help patients cope with emotional experiences.²⁷ Studies have emerged to develop emotion regulation training in this population. There were a few pilot studies that investigated emotion regulation interventions involving third-wave CBT with integrated emotion regulation³⁸ and Acceptance and Commitment Therapy (ACT).^{39,40} However, there is insufficient evidence to demonstrate its promising effects due to the limited sample sizes, lack of vigorous study designs and huge differences across the study protocols.

Mindfulness is described as an awareness that emerges from paying attention to the present moment without judgment. It gently pulls the mind away from the negative emotions induced by the disparity between expectation and reality by focusing on the present moment, instead of worrying about the future or regretting the past.^{25,41} Mindfulness-based interventions (MBI) have demonstrated good effects in reducing psychological outcomes in people with depression,⁴² anxiety disorders,⁴³ substance use,⁴⁴ bipolar affective disorder,⁴⁵ and other chronic physical conditions.^{46,47} There is increasing evidence demonstrating the safety and effectiveness of MBI in schizophrenia. Our systematic review found that mindfulness-based intervention provides encouraging short-term benefits to people with schizophrenia; for instance improving depressive symptoms, functioning, and

psychotic symptoms. Possible longer-term benefits include the improvement of psychotic symptoms and functioning from 6 months up to 2 years.⁴⁸ Besides, mindfulness-based intervention integrated into psychoeducation has been confirmed to provide stronger and more desirable clinical outcomes in schizophrenia.^{48,49} Psychoeducation empowers patients with the knowledge, skills, strengths, and strategies, to overcome illness and its associated impairments.⁵⁰ Mindfulness, on the other hand, engages the participants to accept the experience without explicitly reinforcing illness management and treatment compliance. Recent randomised controlled trials demonstrated that mindfulness psychoeducation provided significant improvements in cognitive insight, psychiatric symptoms, and functioning.^{41,51–53} A single-blind, multi-site, pragmatic randomised controlled trial conducted in Hong Kong, Mainland China, and Taiwan with 300 participants consistently demonstrated significant improvement with regard to insight into illness, functioning, mental state, and the length of rehospitalisations when compared with conventional psychoeducation and control groups.⁴⁹ However, none of these studies identified mindfulness psychoeducation as a way to improve emotion regulation difficulty.

To the best of our knowledge, this is the first pilot randomised controlled trial (RCT) to explore the effectiveness of using MBPP as an emotion regulation skill training in schizophrenia. The objective of this study was to find out whether the MBPP would be feasible for improving the emotion regulation of these patients, in terms of rumination, cognitive appraisal, and suppression, and whether the positive effects could be sustainable up to a three-month follow-up period. The hypotheses encompassed the core emotion regulation process regarding attentional deployment, cognitive appraisal, and response modulation²² (Figure 2).

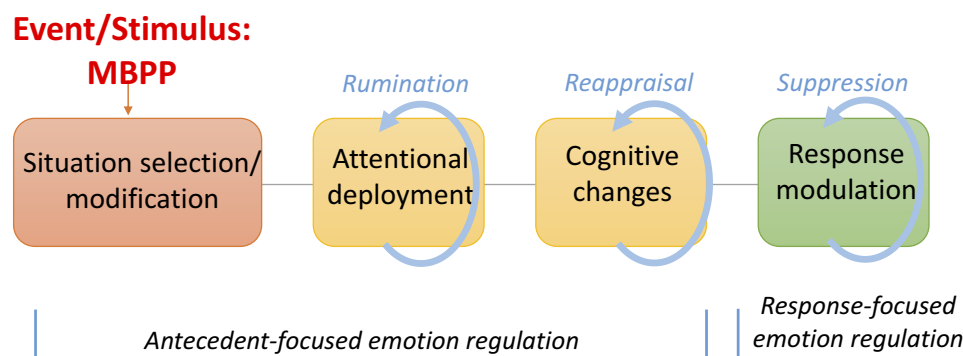


Figure 2 A proposed conceptual framework.

Methods

Trial Registration

This trial was registered at ClinicalTrials.gov (ClinicalTrials.gov Identifier: NCT03632278).

Study Design

The study was a single-blind, multi-centre RCT, using a repeated-measures design to examine the treatment outcomes for people with schizophrenia spectrum disorders in the community. A parallel-group randomised closely at 1:1 was chosen. The study was approved by the Human Subjects Research Ethics Committee at the Institutional Review Boards of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (UW18-004) and The Hong Kong Polytechnic University (HSEARS2018531001). All research methods followed the Declaration of Helsinki, and conformed to the principles of medical ethics.

Participants

Samples were recruited from two Integrated Community Centres for Mental Wellness (ICCMWs), and two Long Stay Care Homes (LSCHs) covering a large geographical region (New Territories and Kowloon) of Hong Kong. ICCMW is a community mental health centre providing accessible community support and social rehabilitation services to patients with various mental health problems, ranging from suspected mental disturbance to ex-mentally ill persons in all age groups. LSCH provides long-term residential care for all kinds of chronic psychiatric patients who are in stable mental condition but require assistance and support with activities of daily living. The inclusion criteria for participants in this study includes: aged 18–65 years old; diagnosed with schizophrenia-spectrum disorders according to the criteria of the Diagnostic and Statistical Manual for Mental Disorders DSM-IV-TR (and the latest DSM-V) or International Classification of Diseases (ICD-10) – Classification of Mental Disorders; able to communicate in Chinese/Cantonese and give informed consent; and able to understand/follow the study and instructions for mindfulness training. Exclusion criteria include; individuals with comorbid organic brain disorders or substance abuse; recently participating in any forms of cognitive therapy, mind-body therapy, or mindfulness training (in forms of Tai Chi, Qi Gong or mind-body yoga) during the previous 3 months.

Whitehead et al (2016) determined that the optimal sample size of a pilot study was 20 per treatment arm for

a small standardised effect size (0.2), and this rule of thumb was used to determine the sample size in the main trial designed with 80% power and two-sided 5% significance.^{54–56} The target number of recruitments in this study was therefore set at 50 with consideration of a 20% attrition rate.

Randomisation and Masking

The patients who applied to participate in the study were assessed by a trained research nurse in a face-to-face visit. The research nurse assessed these patients with the inclusion and exclusion criteria; explained to them the study's aim, procedures, and the use of data. Participants then signed the full consent form if they agreed to participate. The trained research nurse administered the baseline measures after obtaining their informed written consent. This trained research nurse was blinded to treatment allocation.

The consenting participants were randomised into either the intervention or control group by an independent research assistant. This independent research assistant generated a randomised list, in which the eligible participants were assigned a unique number using a computer program for the randomisation.⁵⁷ Block randomisation was adopted. Randomly mixed block sizes (from 2 to 10) were used to ensure the concealment of the allocation using a computer program.⁵⁸ This sequence of randomisation was repeated until all patients were recruited. To minimise assessor bias, the outcome assessor was blinded to the treatment allocation. Participants were asked not to discuss their study participation with other patients throughout the study period to minimise potential contamination.

Intervention

The mindfulness-based psychoeducation programme (MBPP) was conducted for 90 mins in each session, once a week for 8 weeks, with 6–8 participants per group. The protocol was developed based on the model of mindfulness-based stress reduction proposed by Kabat-Zinn (1992)⁵⁹ and Chien and Lee (2013).⁴¹ The treatment protocol and its main contents are shown in Table 1. There are four-key components in the programme:

- Engagement and empowerment;
- Mindfulness in daily living and problem solving;
- Mindfulness in illness management; and
- Equip and prepare for the future.

Table 1 Treatment Protocol of Mindfulness-Based Psychoeducation Programme (MBPP)

Session	Theme	Component and Goals of Each Session	Contents
1	Orientation & engagement	<ul style="list-style-type: none"> • Introduction • Establishment of mutual trust and respect • Identify the goals, objectives, clients role and responsibility in the program • Identify the basic concepts of mindfulness 	<ul style="list-style-type: none"> • Introduction of facilitators, participants. • Give participants an Overview of the program • Group discussion about role and responsibility <ul style="list-style-type: none"> ◦ Contracting for later on sessions (e.g. attendance, respect for others, silent when practicing). ◦ The importance of regular practice, and set realistic expectations. • Introduce participants with the basic concepts of mindfulness • Body scan and mindful eating • Reflections on the mindfulness exercise. • Homework: Body scan and mindful eating
2	Awareness & Acceptance	<ul style="list-style-type: none"> • Awareness on auto-pilot, breathing, bodily sensation • Focused attention on body sensation with acceptance attitude 	<ul style="list-style-type: none"> • Body scan & Mindful-walking • Reflection, discussion and inquires: <ul style="list-style-type: none"> ◦ Noticing sensation, Describing bare sensation and thoughts ◦ Recognized recurring experience, allowing, awareness and accepting attitude towards experience • How to manage schizophrenia: the basic information • Sharing on Cause, signs and symptoms, stage of illness, importance of management • Homework: Body scan and Mindful-walking
3	Non-judgement	<ul style="list-style-type: none"> • Explore present moment experience • Focused attention on breathing with acceptance and non-judgmental attitude • Understand the basic information of schizophrenia 	<ul style="list-style-type: none"> • Mindful-stretching • Reflection, discussion and inquires: <ul style="list-style-type: none"> ◦ Noticing sensation, feelings and thoughts (auto-pilots) ◦ Observe from moment to moment with non-judgmental • How to manage schizophrenia <ul style="list-style-type: none"> ◦ Sharing and discussion on Medication and drug compliance • Homework: Mindful- stretching and drug compliance sheet
4	Stay present & Let go	<ul style="list-style-type: none"> • Mindful attitude: stay present and let go • Increase acceptance and compliance of medication 	<ul style="list-style-type: none"> • Mindful sitting (with breathing) • Reflection, discussion and inquires: <ul style="list-style-type: none"> ◦ Sustained focus to observe body sensation, feelings and thoughts ◦ Observe experience with stay present attitude and letting go attitude • How to manage schizophrenia <ul style="list-style-type: none"> ◦ Expand Social networking & social skill • Homework: Mindful sitting (with breathing) & mindful stretching
5	Response without reacting	<ul style="list-style-type: none"> • A Mindful Difference: Respond vs React • Recognising recurring thoughts and standing back from them, without questioning them • Advocate social networking 	<ul style="list-style-type: none"> • Three-minute breathing space & Mindful sitting (with difficulties) • Reflection, discussion and inquires: <ul style="list-style-type: none"> ◦ Difference between react and response ◦ Alternative options and response for negative thoughts/sensation: mindful, response without react • How to manage schizophrenia <ul style="list-style-type: none"> ◦ Stigma • Homework: Three-minute breathing space & mindful walking

(Continued)

Table I (Continued).

Session	Theme	Component and Goals of Each Session	Contents
6	Our thoughts are not real	<ul style="list-style-type: none"> Thoughts are not facts – alternative perspectives of seeing your thoughts and sensations Integrate mindfulness in managing stress and daily difficulties 	<ul style="list-style-type: none"> Mindful walking & Three-minute breathing space (expand) Reflection, discussion and inquires: <ul style="list-style-type: none"> Alternative perspectives of seeing your thoughts and sensations Recognising recurring thoughts and standing back from them, without questioning them How to manage schizophrenia <ul style="list-style-type: none"> Discussion on stress management Homework: Mindful walking & Three-minute breathing space (expand)
7	Empowerment of self-control	<ul style="list-style-type: none"> Advocate problem-solving and communication with mindful attitude 	<ul style="list-style-type: none"> Mindful stretching & Three-minute breathing space (expand) Reflection, discussion and inquires: <ul style="list-style-type: none"> Integration of mindfulness in daily living How to manage schizophrenia <ul style="list-style-type: none"> Discussion on daily difficulties Discussion and role play on problem-solving skill with mindful attitude Homework: Mindful stretching & Three-minute breathing space (expand), communication worksheet
8	Relapse prevention and Care in community	<ul style="list-style-type: none"> Identify strategies for relapse prevention Consolidation and develop future plan on disease management with the use of mindfulness 	<ul style="list-style-type: none"> Body scan and Mindful sitting Reflection and discussion: <ul style="list-style-type: none"> Compare the difference How to manage schizophrenia: Relapse prevention <ul style="list-style-type: none"> Identifying signs of relapse and associated factors Checking each person's community support resources/mechanisms Identify strategies to prevent and handle relapse Planning continuing mindfulness practice and other meaningful daily activities in the future Invitation to outcome assessment

All sessions comprised the mindfulness practice (at least 20 mins) and group discussion. The programme is focused on cultivating in the participants an awareness of the present moment with an accepting, non-judgmental and letting go attitude. It also explored mindfulness approaches in illness management, problem-solving and daily living, and equipped the participants with future plans of relapse prevention and mindful living. There were two interventionists; one is a mindfulness instructor, an experienced mindfulness interventionist in psychosis. The other is a psychiatric nurse who has experience in psychoeducation group facilitation and assisting mindfulness-based interventions.

The participants were all encouraged to engage in a daily mindfulness practice guided by mindfulness audio-tracks on an MP3 player distributed to them. They were

encouraged to practice mindfulness for at least 5 mins per day according to the practice manual, and submit their logbook records of daily self-practice each week to the researchers.

The treatment-as-usual group received routine psychiatric outpatient services. To minimise the inflated intervention effect due to awareness of no additional intervention received, the participants in the control group received a brief telephone contact once a week for 5 mins to discuss their illness condition and daily issues during the intervention period (i.e. weekly telephone contacts for 8 weeks).

Outcomes

Outcome assessments were conducted at recruitment, and immediately after and three-month post-intervention by the research nurse who was blind to the group/intervention

assignment. The primary outcomes were reappraisal and suppression, which are measured by the Chinese version of the Emotion regulation questionnaire (ERQ),^{60,61} and rumination which was measured using the Short Ruminative Response Scale (SRRS).^{62,63} Secondary outcomes included affective symptoms, psychotic symptoms and ability of mindfulness, which were measured using the Chinese version of Depression Anxiety Stress Scale (DASS-21),^{64,65} Chinese version of Psychotic Symptom Rating Scale (C-PSYRATS),^{66,67} and the Five Facet Mindfulness Questionnaire – Short form (FFMQ-SF),^{68,69} respectively.

Patients' demographic and clinical data were also collected at the baseline. The negative symptoms were measured by the Self-Assessment of Negative Symptoms (SANS)⁷⁰ as a covariate in the outcome analysis. Dosages of antipsychotics were converted into chlorpromazine equivalents for comparison.⁷¹

Statistical Analyses

The quantitative data were analysed using IBM, SPSS for Windows version 19. The homogeneity of the demographic characteristics and baseline scores between the two study groups were examined using the independent sample *t*-test (two-tailed), or the Pearson Chi-square test, according to their level of measurement.

The statistical data analyses comparing the clinical outcomes between the MBPP and TAU were based on the intention-to-treat analysis (ITT), which included all randomised patients regardless of their adherence to the intervention.⁷² A generalised estimating equations (GEE) test was used to investigate the interactive (group × time) effect to compare the changes in all individual outcome variables between the two study groups across time (or measurements), and the effects of time on each of the outcome variables. AutoRegressive Order 1 (AR(1)) model was applied in the GEE model to consider the time dependence of outcome variables in the working correlation matrix.⁷³ Pairwise comparison was used to examine the group differences on each of the outcome variables at each time of measurement. Potential covariates should be considered based on the anticipated prognostic variables rather than the significant baseline differences.^{56,73} Therefore, the results of this study presented the adjusted model of GEE to compare the difference after the adjustment of the covariant of emotion regulation, which includes age, gender, duration of illness, the dosage of antipsychotic medication, and negative symptoms. The statistical significance of all statistical tests was set at 0.05.

Results

Seventy-one patients were referred to the MBPP during the subject recruitment period between April and October 2018. Nineteen of them were excluded, 13 of which did not meet the inclusion criteria and six refused to participate due to lack of interest or time (Figure 3).

Fifty-two participants were randomly assigned into either the intervention (n=26) or control (n=26) group. After the allocation, one of the participants died of an acute medical problem; and three participants disagreed to be in the intervention allocation group and withdrew from the study. Meanwhile, two participants from the control group repeatedly expressed a “strong preference” to the MBPP. They participated in the intervention group according to their preference but their results were omitted from the analysis. Finally, there were 46 participants used for the final data analysis. The majority of the participants were female (76.1%), aged over 45 years (80.4%), married (73.9%), and had a long duration of illness (ie, 93.5% had >10 years of illness). There were no statistically significant differences in all of these characteristics or in the mean scores of all outcome measures at the baseline (see Table 2).

The average number of attendances for each session on average in the MBPP was 6.88 (SD=1.39, range 3–8). Chien et al (2017) defined participants' attendance of more than or equal to six sessions as satisfactory, while the attendance of fewer than six sessions was defined as low.⁴⁹ Accordingly, 20 participants (84.6%) attended six sessions or above and were defined as satisfactory attendees, and four participants (8.33%) attended below six sessions and were defined as low attendees. Fourteen out of 24 (58.3%) participants engaged in the homework during the active intervention period, i.e. self-practice at home according to the audio mindfulness guidance. The average duration of the practice was 31 min per week (SD= 17.34, range 0–86.4 mins per week). There was no homework assignment after the active intervention period. Therefore, the self-mindfulness practice after the intervention period was not measured.

The attritions over the intervention and three-month follow-up periods were relatively low. At post-intervention follow-up, one participant from the intervention group was out of contact due to temporarily being out of town, and thus did not receive the first post-test; however, the patient participated at the three-month follow-up. Two participants in the control group did not

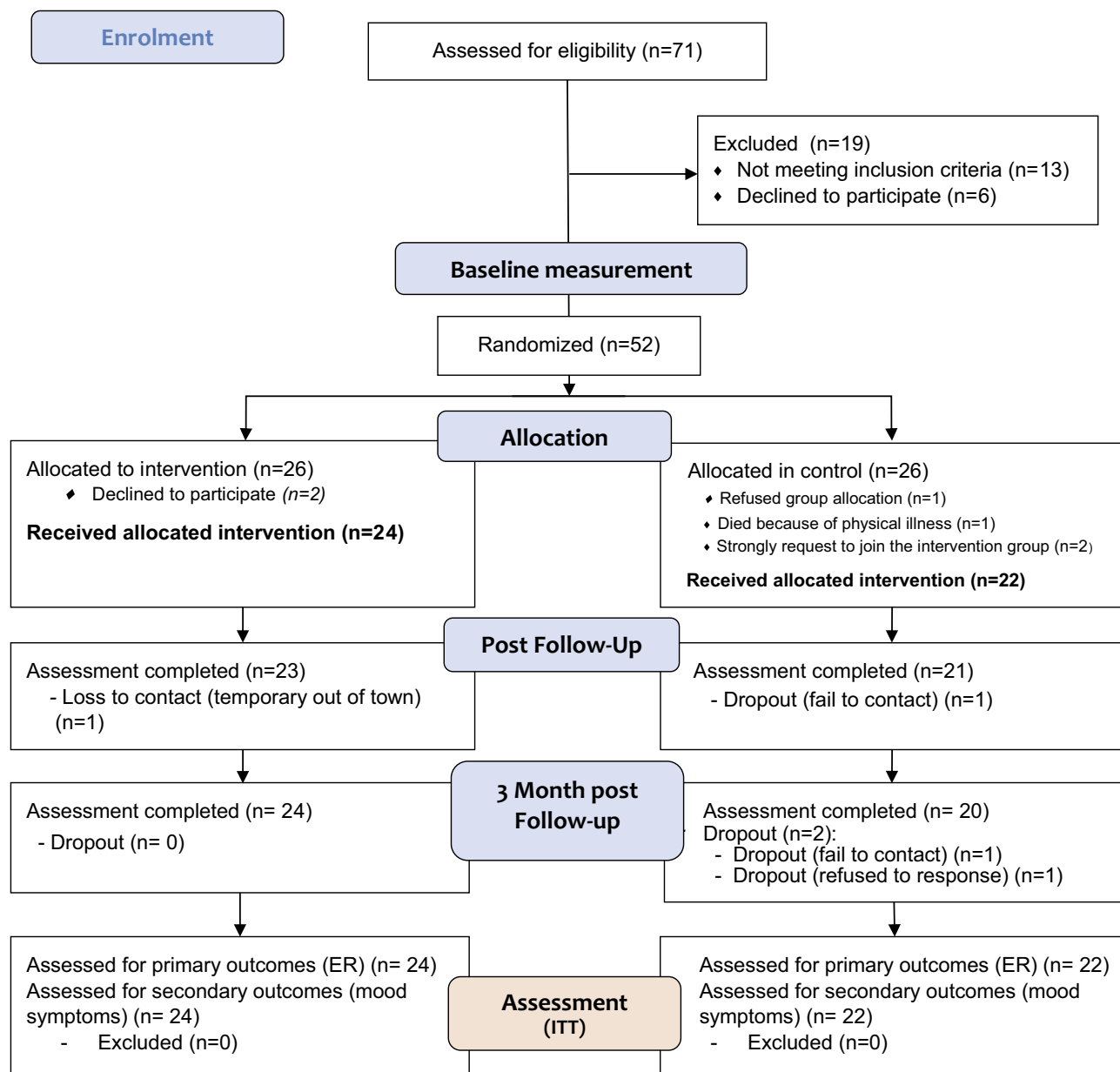


Figure 3 Flow through trial of MBPP (The CONSORT diagram).

complete the three-month post-assessment and were treated as dropouts, contributing to the attrition rate of 4.3%.

One participant reported a subjective feeling of terror when practising mindfulness at night-time during the intervention period. She said she avoided practising mindfulness at night-time, and thus all her mindfulness practice was done during the daytime. Another participant had a poor relationship with her family and expressed that her felt irritable when practising mindfulness and thus stopped self-practice over the follow-up period. These psychological discomforts were treated as mild adverse events and were reported to the Institutional Review Board.

Mean (and SD) values of baseline outcome scores and two post-tests for the participants are presented in [Table 3](#). There were no significant differences on the baseline mean scores of all outcomes between groups ($P=0.06-0.89$).

Primary Outcomes – Emotion Regulation Group X Time Interaction

GEE indicated that there was a statistically significant group X time interaction in the reappraisal at T3 ($\beta = -6.59$, 95% Confidence Interval (CI) = $-12.63- -0.54$, Wald's $\chi^2=4.55$, $p=0.033$) of the crude model, with a moderate effect size ($d=0.47$) ([Table 4](#)). There was no group X time

Table 2 Demographic and Clinical Characteristics of the Participants

	Total (n=46)		Intervention Group (n=24)		Control Group (n=22)		t-Test/ Chi-Square Test	
	n	%	n	%	n	%	Test Value	p-value
Gender							0.330	0.857
Male	11	23.9%	6	25%	5	23%		
Female	35	76.1%	18	75%	17	77%		
Age							2.589	0.460
25–34	4	8.7%	1	4.2%	3	14%		
35–44	5	10.9%	2	8.3%	3	14%		
45–54	20	43.5%	10	41.7%	10	45%		
55+	17	36.9%	11	45.8%	6	27%		
Education							7.840	0.098
University/ College	7	15.2%	2	8.3%	5	13%		
Secondary	25	54.4%	16	66.7%	9	41%		
Primary	6	13%	3	12.5%	3	23%		
No qualifications	2	4.4%	2	8.3%	0	-		
Others	6	13%	1	4.2%	5	23%		
Marital status							1.534	0.464
Single	4	8.7%	1	4.2%	3	14%		
Married	34	73.9%	18	75%	16	73%		
Divorced/ widowed	8	17.4%	5	20.8%	3	13%		
Working status							4.280	0.233
Employed FT	6	13%	2	8.3%	4	18%		
Employed PT	2	4.4%	2	8.3%	0	-		
Unemployed	25	54.3%	15	62.5%	10	46%		
Others	13	28.3%	5	20.8%	8	36%		
Income							1.649	0.648
No income	35	76.1%	19	79.2%	16	73%		
Less than \$8K	7	15.2%	4	16.7%	3	14%		
\$8 - 14.9K	3	6.5%	1	4.2%	2	9%		
\$15 – 24.9K	1	2.2%	0	-	1	4%		
Accommodation							2.348	0.672
Private housing	5	10.8%	2	8.3%	3	14%		
Public housing	13	28.3%	6	25%	7	32%		
Half way home	1	2.2%	1	4.2%	0	-		
Long stay care home	26	56.5%	14	58.3%	12	54%		
Others	1	2.2%	1	4.2%	0	-		
Living condition							2.143	0.543
Alone	5	10.8%	3	12.5%	2	9%		
With family	13	28.3%	5	20.8%	8	36%		
In residential hostel	27	58.7%	15	62.5%	12	55%		
Others	1	2.2%	1	4.2%	0	-		
Duration of illness							-0.889	0.374
Less than 10 years	3	6.5%	1	4%	2	9%		
10 – 19 years	11	23.9%	10	38%	1	4%		
20 – 29 years	20	43.5%	8	30%	14	64%		
30–39 years	10	21.7%	7	28%	3	14%		
40 years or above	2	4.4%	0	-	2	9%		

(Continued)

Table 2 (Continued).

	Total (n=46)		Intervention Group (n=24)		Control Group (n=22)		t-Test/ Chi-Square Test	
	n	%	n	%	n	%	Test Value	p-value
Psychiatric diagnosis							1.607	0.448
Schizophrenia	38	84.5%	19	79.2%	19	90%		
Paranoid schizophrenia	2	4.4%	1	4.2%	1	5%		
Brief psychotic disorder	5	11.1%	4	16.7%	1	5%		
CPZE							3.061	0.382
Less than 500	20	43.5%	12	50%	8	35%		
500 – 999	17	37%	7	29.2%	10	45%		
1000–1499	5	10.8%	3	12.5%	2	10%		
1500+	4	8.7%	2	8.3%	2	10%		

Table 3 Mean Scores (Standard Deviation) at Baseline, Post-Assessment (T2) and 3-Month Post-Assessment (T3)

Mean (SD)	Baseline					p-value	T2				T3			
	Intervention Group		Control Group		Mean Diff.		Intervention Group		Control Group		Intervention Group		Control Group	
Primary Outcome														
1) SRRS														
Total score	16.83	(4.59)	17.00	(3.84)	-0.17	0.89	14.78	(5.65)	14.19	(3.37)	14.83	(5.25)	15.55	(4.49)
Brooding	9.17	(2.58)	9.00	(2.78)	0.17	0.83	7.83	(3.34)	7.19	(2.25)	7.96	(3.21)	8.35	(1.98)
Reflection	7.67	(2.43)	8.00	(2.00)	-0.33	0.62	6.96	(2.704)	7.00	(2.26)	6.88	(2.31)	7.20	(3.22)
2) ERQ														
Reappraisal	18.88	(9.21)	22.64	(7.79)	-3.76	0.14	24.17	(7.36)	25.81	(8.16)	26.71	(5.23)	23.85	(6.86)
Suppression	11.96	(5.88)	14.50	(4.62)	-2.54	0.11	13.78	(6.84)	12.14	(6.55)	13.08	(4.54)	13.50	(4.93)
Secondary outcome														
3) DASS														
Total score	16.96	(9.54)	17.59	(11.28)	-0.63	0.84	14.17	(11.98)	10.38	(7.07)	13.50	(9.97)	14.40	(11.17)
Depression	5.58	(3.86)	4.82	(3.81)	0.77	0.50	3.87	(4.34)	1.67	(2.22)	3.96	(3.50)	3.45	(3.82)
Anxiety	4.98	(3.08)	6.82	(4.75)	-2.28	0.06	4.74	(4.28)	4.43	(3.28)	4.21	(2.84)	5.20	(4.49)
Stress	6.83	(4.12)	5.95	(4.41)	0.88	0.49	5.57	(4.95)	4.29	(3.35)	5.33	(4.91)	5.75	(4.67)
4) FFMQ														
Total score	56.20	(7.16)	59.32	(10.55)	-3.12	0.24	58.56	(7.31)	58.74	(7.33)	60.79	(5.18)	58.86	(7.96)
Observing	9.21	(2.87)	10.41	(3.20)	-1.20	0.19	10.12	(2.58)	9.54	(3.42)	11.00	(2.36)	9.20	(3.22)
Describing	9.42	(3.52)	10.91	(3.85)	-1.49	0.17	9.67	(3.52)	9.98	(3.57)	10.79	(3.66)	11.13	(3.14)
Awareness	13.54	(4.51)	14.18	(5.38)	-0.64	0.66	12.73	(3.97)	13.47	(4.27)	13.13	(3.44)	13.85	(3.41)
Non-judging	13.79	(4.14)	13.14	(3.72)	0.66	0.58	14.16	(2.58)	14.35	(2.97)	14.04	(2.69)	13.90	(2.92)
Non-reacting	10.23	(3.36)	10.69	(3.16)	-0.45	0.65	11.87	(3.15)	11.40	(2.06)	11.83	(2.06)	10.77	(3.26)
5) PSYRAT														
Total score	8.33	(13.25)	11.50	(15.59)	-3.17	0.46	5.38	(10.05)	7.45	(11.84)	3.21	(6.88)	8.10	(14.50)
Total H score	5.96	(11.56)	9.00	(11.84)	-3.04	0.38	4.42	(9.10)	5.14	(8.93)	2.00	(5.56)	5.43	(10.41)
Emotion H	2.04	(4.69)	3.05	(4.46)	-1.00	0.46	1.54	(3.61)	1.55	(2.94)	0.42	(1.67)	2.19	(4.27)
Physical H	1.04	(1.92)	1.73	(2.41)	-0.69	0.29	0.79	(1.614)	1.05	(1.89)	0.54	(1.53)	1.05	(2.04)
Control H	1.50	(2.776)	2.45	(3.14)	-0.95	0.28	1.04	(2.33)	1.27	(2.25)	0.50	(1.35)	1.19	(2.34)
Cognitive H	1.38	(2.62)	1.77	(2.51)	-0.407	0.60	1.04	(2.24)	1.27	(2.29)	0.54	(1.53)	1.00	(1.90)
Total D score	2.38	(4.80)	2.50	(5.83)	-0.13	0.94	0.96	(3.33)	2.32	(4.90)	1.21	(3.48)	2.67	(5.74)
Cognitive D	1.38	(2.79)	1.32	(3.06)	0.06	0.95	0.58	(2.00)	1.09	(2.45)	0.71	(2.05)	1.38	(2.97)
Emotion D	1.00	(2.04)	1.18	(2.81)	-0.18	0.80	0.38	(1.35)	1.23	(2.49)	0.50	(1.44)	1.29	(2.78)
SANS	56.13	(24.99)	59.59	(22.82)	-3.47	0.63								

Table 4 Results of the Generalised Linear Model Regarding the Effects of MBPP on Emotion Regulation Outcomes

Dependent Variable		Crude Model					Adjusted Model					ES Cohen's d	
		B	CI		χ^2	p-value	B	CI		χ^2	p-value		
			Upper	Lower				Upper	Lower				
SRRS	(intercept)	16.83	14.98	18.68	317.59	0.000	17.43	15.31	19.54	260.67	0.000	0.13 -0.15 0.22 -0.14 -0.02 -0.12	
	Total score	0.17	-2.51	2.84	0.01	0.903	-0.97	-4.39	2.45	0.31	0.580		
	Group	-2.06	-4.19	0.07	3.58	0.058	-2.81	-5.10	-0.52	5.77	0.016*		
	Time (T2)	-2.00	-4.45	0.45	2.56	0.110	-2.86	-5.58	-0.13	4.22	0.040*		
	Time (T3)	-0.83	-3.92	2.26	0.28	0.597	0.73	-2.97	4.44	0.15	0.698		
	Group x Time (T2)	0.52	-3.07	4.11	0.08	0.778	3.55	-0.86	7.96	2.49	0.114		
	Group x Time (T3)	9.17	8.06	10.27	265.18	0.000	9.52	8.29	10.75	230.06	0.000		
	Brooding	Group	-0.17	-1.76	1.43	0.04	0.838	-0.83	-2.82	1.16	0.67		0.413
	Time (T2)	-1.32	-2.59	-0.04	4.11	0.043*	-1.86	-3.20	-0.51	7.34	0.007**		
	Time (T3)	-1.21	-2.67	0.25	2.63	0.105	-1.71	-3.31	-0.12	4.46	0.035*		
	Group x Time (T2)	-0.53	-2.37	1.31	0.32	0.574	0.24	-1.93	2.41	0.05	0.827		
	Group x Time (T3)	0.58	-1.56	2.72	0.28	0.596	2.02	-0.55	4.60	2.37	0.124		
Reflection	(intercept)	7.67	6.67	8.67	225.09	0.000	7.90	6.76	9.05	184.34	0.000		
	Group	0.33	-1.11	1.78	0.20	0.652	-0.14	-1.98	1.71	0.02	0.886		
	Time (T2)	-0.74	-1.95	0.48	1.42	0.233	-0.95	-2.27	0.37	2.00	0.157		
	Time (T3)	-0.79	-2.15	0.57	1.30	0.253	-1.14	-2.67	0.38	2.16	0.141		
	Group x Time (T2)	-0.30	-2.06	1.46	0.11	0.737	0.49	-1.64	2.63	0.20	0.652		
	Group x Time (T3)	-0.05	-2.04	1.94	0.00	0.962	1.53	-0.94	3.99	1.48	0.224		
	ERQ	Reappraisal	(intercept)	18.88	15.86	21.89	150.46	0.000	19.43	16.03	22.83	125.37	0.000
		Group	3.76	-0.60	8.12	2.86	0.091	3.26	-2.24	8.76	1.35	0.245	
Time (T2)		5.27	1.53	9.01	7.64	0.006**	4.43	0.50	8.36	4.88	0.027*		
Time (T3)		7.83	3.70	11.96	13.83	0.000***	7.14	2.61	11.68	9.53	0.002**		
Group x Time (T2)		-2.02	-7.43	3.39	0.54	0.464	-3.04	-9.40	3.31	0.88	0.348		
Group x Time (T3)		-6.59	-12.63	-0.54	4.55	0.033*	-6.30	-13.63	1.04	2.83	0.093		
Suppression		(intercept)	11.96	9.66	14.26	103.61	0.000	12.19	9.76	14.62	96.72	0.000	
Group		2.54	-0.43	5.52	2.80	0.094	2.96	-0.97	6.89	2.19	0.139		
Time (T2)		1.81	-1.63	5.26	1.06	0.302	0.86	-1.99	3.71	0.35	0.555		
Time (T3)		1.13	-1.53	3.78	0.69	0.406	0.43	-2.84	3.69	0.07	0.797		
Group x Time (T2)	-4.21	-9.23	0.83	2.68	0.102	-3.24	-7.85	1.37	1.90	0.168			
Group x Time (T3)	-2.12	-5.93	1.69	1.20	0.274	-1.35	-6.63	3.93	0.25	0.616			

Notes: Cohen's d: 0.2 = Small effect size; 0.5 = Medium effect size; 0.8 = Large effect size (Cohen, 1988). *p < 0.05. **p < 0.01. ***p < 0.001. Bold values denote statistical significance at the p < 0.05 level.

Abbreviations: SRRS, Short rumination response scale; ERQ, Emotion regulation questionnaire; ES, Effect size.

interaction in other primary outcomes (rumination and suppression).

Effect for Time

There was statistically significant effects of time in the total SRRS at the post-assessment (T2) ($\beta = -2.81$, 95% CI = -5.1-0.52, Wald's $\chi^2 = 5.77$, $p = 0.016$) and three-month post-assessment (T3) ($\beta = -2.86$, 95% CI = -5.58,-0.13, Wald's $\chi^2 = 4.22$, $p = 0.40$) in the adjusted GEE model (Table 4). There were also statistically significant effects of time in the Brooding sub-scale at T2 ($\beta = -1.86$, 95% CI = -3.20,-0.51, Wald's $\chi^2 = 7.34$, $p = 0.007$) and T3 ($\beta = -1.71$, 95% CI = -3.31,-0.12, Wald's $\chi^2 = 4.46$, $p = 0.035$) in the intervention group and in the adjusted model (Table 4). There was a significant effect of

time on the reappraisal at T2 ($\beta = 4.43$, 95% CI = 0.50-8.36, Wald's $\chi^2 = 4.88$, $p = 0.027$) and T3 ($\beta = 7.14$, 95% CI = 2.61-11.68, Wald's $\chi^2 = 9.53$, $p = 0.002$) in the intervention group. There were no significant effects of time on the suppression and subscale reflection rumination.

Secondary Outcomes

Group X Time Interaction

The GEE model indicated that there was a statistically significant group X time interaction in FFMQ-Observe at T2 ($\beta = -2.58$, 95% CI = -4.99- -0.16, Wald's $\chi^2 = 4.37$, $p = 0.037$), and T3 ($\beta = -2.81$, 95% CI = -5.56- -0.06, Wald's $\chi^2 = 4.00$, $p = 0.045$), with a small to moderate effect

size ($d=0.19$ at T2 and 0.64 at T3) (Table 5). GEE model indicated no significant group X time interaction in mood symptoms, mindfulness level, and psychotic symptoms.

Effect for Time

There were statistically significant effects of time on depression subscale, overall mindfulness level, mindfulness subscales, overall psychotic symptoms, and hallucination.

There was a statistically significant reduction in the depression subscale at T2 in the intervention group ($\beta = -2.19$, 95% CI = -4.07 – -0.31 , Wald's $\chi^2 = 5.21$, $p = 0.022$) and in the adjusted model. Surprisingly, there was also a statistically significant reduction in depression subscale at T2 in the control group (MD = -3.00 , 95% CI = 0.61 – 5.39 , $P = 0.014$). This indicates that there was a significant within-group improvement in depressive symptoms at T2 both in the intervention and control groups. There were no significant effects of time on the total DASS and other DASS subscale (anxiety and stress).

In the intervention group, there was a statistically significant effect of time on total FFMQ at T3 ($\beta = 5.23$, 95% CI = 0.43 – 10.02 , Wald's $\chi^2 = 4.57$, $p = 0.033$), which was consistent in both adjust and crude model. Besides, There was statistically significant effect of time on mindfulness subscale – observed at T3 ($\beta = 1.81$, 95% CI = 0.11 – 3.51 , Wald's $\chi^2 = 4.34$, $p = 0.037$) in the adjust model, and a marginal significant effect of time on mindfulness subscale – non-reacting at T3 ($\beta = 1.59$, 95% CI = -0.03 – 3.22 , Wald's $\chi^2 = 3.7$, $p = 0.049$) in the crude model. There were no statistically significant effects of time on other FFMQ subscale (describing, awareness and non-judging).

Besides, there were statistical significant effects of time on the overall psychotic symptoms ($\beta = -6.86$, 95% CI = -13.02 – -0.70 , Wald's $\chi^2 = 4.76$, $p = 0.029$), overall hallucinations ($\beta = -5.38$, 95% CI = -10.01 – -0.75 , Wald's $\chi^2 = 5.19$, $p = 0.023$), physical characteristics ($\beta = -0.86$, 95% CI = -1.69 – -0.02 , Wald's $\chi^2 = 4.06$, $p = 0.044$), controllability ($\beta = -1.33$, 95% CI = -2.42 – -0.25 , Wald's $\chi^2 = 5.81$, $p = 0.016$) and cognitive interpretation of hallucinations ($\beta = -1.24$, 95% CI = -2.32 – -0.15 , Wald's $\chi^2 = 4.99$, $p = 0.026$) at T3 in the intervention group (Table 5). There were no significant effects of time on the emotion characteristics of hallucination, and delusion scale.

Pairwise Comparison

The pairwise comparison indicated that the participants in the MBPP group underwent statistically significant improvement in FFMQ-observe at T3 (MD = -1.80 ,

95% CI = -3.50 – -0.09 , $p = 0.039$), compared with the control group.

The pairwise comparison also indicated that there was a marginal between-group difference in the overall psychotic symptoms at T3 (MD = 8.3 , 95% CI = 0.14 – 16.70 , $p = 0.51$), with a moderate effect size ($d = -0.44$ at T3), indicating a marginal difference in the severity of overall psychotic symptoms at T3 in the MBPP group compared to control group. There were no significant differences in the mood symptoms, overall mindfulness level, and psychotic symptoms between the MBPP group and the control group.

Discussion

The current study demonstrates that MBPP is feasible for improving emotion regulation of adult schizophrenic patients in the community setting. The study was feasible, given the low dropout rate (4.3%) and good compliance in the intervention (84.6% attendance ≥ 6 sessions). Meanwhile, the main difficulty appeared in the recruitment phase. Clients with schizophrenia are difficult to reach in the community because of the social stigma, time constraints and lack of motivation.^{74–76} Hence the potential candidates for the study were, therefore, less than expected.

The finding indicates that MBPP produced significantly greater improvements in some processes of emotion regulation, such as cognitive reappraisal and rumination, for up to three-month of follow-up. The results also suggested that MBPP might improve mindfulness ability and reduce the symptoms of depression, and the perceived disturbance of hallucinations. Furthermore, it shows that mindfulness psychoeducation might improve a certain degree of emotion regulation ability in schizophrenia. These results are consistent with a non-controlled study that demonstrated that combined compassion, acceptance and mindfulness (CAM) could significantly improve emotional self-regulation, which includes rumination, self-blaming and mood symptoms in people with psychosis at 3 months follow-up.⁷⁷ The results also echo the findings of Chien et al's studies,^{41,49,53} which demonstrated that mindfulness-based intervention promotes significant psychotic reduction. It was however noted that the results might not be able to rule out the improvement in emotion regulation likely contributing by their improvements in symptoms. Further longitudinal studies are needed to confirm the benefits of the MBPP in modulating emotion regulation in schizophrenia.

Table 5 Results of the Generalised Linear Model Regarding the Effects of MBPP on Secondary Outcomes (Mood Symptoms, Level of Mindfulness, Psychotic Symptoms)

Dependent Variable		Crude Model					Adjusted Model					ES Cohen's d
		B	CI		χ^2	p-value	B	CI		χ^2	p-value	
			Upper	Lower				Upper	Lower			
DASS Total score Depression Anxiety Stress	(intercept)	16.96	12.84	21.08	65.06	0.000	17.86	13.26	22.45	58.03	0.000	0.38 -0.09 0.63 0.14 0.08 -0.27 0.3 -0.09
	Group	0.63	-5.33	6.59	0.04	0.835	0.07	-7.36	7.50	0.00	0.986	
	Time (T2)	-2.85	-7.37	1.67	1.53	0.216	-4.29	-9.15	0.57	2.99	0.084	
	Time (T3)	-3.46	-8.76	1.85	1.63	0.201	-5.00	-10.83	0.83	2.82	0.093	
	Group x Time (T2)	-4.66	-11.21	1.88	1.95	0.163	-2.79	-10.65	5.07	0.48	0.486	
	Group x Time (T3)	0.22	-7.56	7.99	0.00	0.957	4.62	-4.82	14.05	0.92	0.338	
	(intercept)	5.58	4.12	7.05	55.73	0.000	5.90	4.26	7.55	49.51	0.000	
	Group	-0.77	-2.88	1.35	0.50	0.479	-0.90	-3.56	1.76	0.44	0.505	
	Time (T2)	-1.69	-3.41	0.02	3.75	0.053	-2.19	-4.07	-0.31	5.21	0.022*	
	Time (T3)	-1.63	-3.58	0.33	2.65	0.103	-2.05	-4.23	0.13	3.38	0.066	
	Group x Time (T2)	-1.53	-4.02	0.95	1.46	0.227	-0.81	-3.85	2.23	0.27	0.602	
	Group x Time (T3)	0.27	-2.60	3.14	0.03	0.853	1.66	-1.87	5.19	0.85	0.356	
	(intercept)	4.54	3.01	6.07	33.73	0.000	4.76	3.14	6.38	33.15	0.000	
	Group	2.28	0.06	4.49	4.05	0.051	2.01	-0.61	4.63	2.25	0.133	
	Time (T2)	0.10	-1.60	1.79	0.01	0.912	-0.38	-2.09	1.33	0.19	0.662	
	Time (T3)	-0.33	-2.31	1.65	0.11	0.742	-0.67	-2.72	1.39	0.41	0.524	
	Group x Time (T2)	-2.60	-5.76	0.582	2.56	0.110	-1.62	-4.38	1.14	1.32	0.250	
	Group x Time (T3)	-1.32	-4.22	1.59	0.79	0.374	0.05	-3.27	3.37	0.00	0.976	
(intercept)	6.83	5.05	8.61	56.62	0.000	7.19	5.16	9.22	48.36	0.000		
Group	-0.88	-3.45	1.69	0.45	0.503	-1.04	-4.31	2.24	0.38	0.535		
Time (T2)	-1.25	-3.17	0.66	1.65	0.199	-1.71	-3.79	0.37	2.61	0.106		
Time (T3)	-1.50	-3.77	0.77	1.68	0.194	-2.29	-4.81	0.24	3.15	0.076		
Group x Time (T2)	-0.52	-3.29	2.26	0.13	0.715	-0.36	-3.73	3.00	0.04	0.833		
Group x Time (T3)	1.27	-2.06	4.59	0.56	0.455	2.90	-1.18	6.98	1.94	0.164		
FFMQ Total score Observing Describing Awareness	(intercept)	56.20	53.12	59.28	1278.75	0.000	56.15	52.67	59.64	995.53	0.000	-0.02 0.29 0.19 0.64 -0.09 -0.1 -0.18 -0.21
	Group	3.12	-1.33	7.58	1.89	0.169	2.08	-3.56	7.72	0.52	0.469	
	Time (T2)	2.36	-1.37	6.10	1.54	0.215	2.71	-1.60	7.02	1.52	0.218	
	Time (T3)	4.59	0.39	8.79	4.60	0.032*	5.23	0.43	10.02	4.57	0.033*	
	Group x Time (T2)	-2.94	-8.34	2.46	1.14	0.286	-2.86	-9.83	4.10	0.65	0.421	
	Group x Time (T3)	-5.06	-11.13	1.02	2.66	0.103	-4.02	-11.77	3.73	1.04	0.309	
	(intercept)	9.21	8.03	10.39	233.69	0.000	9.10	7.83	10.36	199.36	0.000	
	Group	1.20	-0.51	2.91	1.90	0.168	0.75	-1.29	2.79	0.52	0.471	
	Time (T2)	0.92	-0.49	2.32	1.64	0.201	1.19	-0.30	2.68	2.44	0.118	
	Time (T3)	1.79	0.20	3.39	4.84	0.028*	1.81	0.11	3.51	4.34	0.037*	
	Group x Time (T2)	-1.78	-3.81	0.25	2.96	0.085	-2.58	-4.99	-0.16	4.37	0.037*	
	Group x Time (T3)	-3.00	-5.30	-0.69	6.48	0.011*	-2.81	-5.56	-0.06	4.00	0.045*	
	(intercept)	9.42	8.00	10.84	168.75	0.000	9.60	8.01	11.18	140.80	0.000	
	Group	1.49	-0.56	3.55	2.03	0.155	0.10	-2.47	2.66	0.01	0.941	
	Time (T2)	0.25	-1.40	1.91	0.09	0.763	-0.07	-1.83	1.69	0.01	0.937	
	Time (T3)	1.38	-0.53	3.28	2.01	0.156	1.26	-0.81	3.33	1.43	0.232	
	Group x Time (T2)	-1.18	-3.57	1.21	0.94	0.332	-0.28	-3.13	2.57	0.04	0.850	
	Group x Time (T3)	-1.15	-3.90	1.60	0.67	0.411	0.33	-3.02	3.68	0.04	0.846	
	(intercept)	13.54	11.86	15.22	248.61	0.000	13.38	11.53	15.23	201.10	0.000	
	Group	0.64	-1.79	3.07	0.27	0.606	1.08	-1.91	4.07	0.50	0.479	
	Time (T2)	-0.81	-2.69	1.07	0.71	0.401	-0.43	-2.41	1.55	0.18	0.672	
	Time (T3)	-0.42	-2.62	1.79	0.14	0.711	0.19	-2.18	2.56	0.02	0.875	
	Group x Time (T2)	0.09	-2.63	2.81	0.00	0.948	-0.53	-3.73	2.68	0.10	0.748	
	Group x Time (T3)	0.09	-3.10	3.28	0.00	0.958	-0.50	-4.32	3.33	0.07	0.799	

(Continued)

Table 5 (Continued).

Dependent Variable		Crude Model					Adjusted Model					ES Cohen's d	
		B	CI		χ^2	p-value	B	CI		χ^2	p-value		
			Upper	Lower				Upper	Lower				
Non judging	(intercept)	13.79	12.50	15.08	440.31	0.000	13.62	12.18	15.05	346.45	0.000	-0.06 0.05	
	Group	-0.66	-2.52	1.21	0.48	0.491	0.07	-2.25	2.39	0.00	0.951		
	Time (T2)	0.37	-1.11	1.84	0.24	0.626	0.81	-0.88	2.49	0.89	0.346		
	Time (T3)	0.25	-1.46	1.96	0.08	0.774	0.67	-1.26	2.60	0.46	0.498		
	Group x Time (T2)	0.85	-1.28	2.98	0.61	0.434	0.58	-2.15	3.30	0.17	0.679		
	Group x Time (T3)	0.51	-1.96	2.99	0.17	0.683	0.10	-3.02	3.22	0.00	0.949		
	Non reacting	(intercept)	10.24	9.08	11.40	300.44	0.00	10.46	9.14	11.78	241.38		0.00
		Group	0.45	-1.23	2.12	0.27	0.601	0.08	-2.05	2.22	0.01		0.941
		Time (T2)	1.63	-0.10	3.37	3.39	0.052	1.21	-0.74	3.16	1.47		0.225
		Time (T3)	1.59	-0.03	3.22	3.70	0.049	1.30	-0.56	3.16	1.87		0.171
Group x Time (T2)		-0.92	-3.43	1.59	0.51	0.474	-0.06	-3.22	3.09	0.00	0.970		
Group x Time (T3)		-1.51	-3.86	0.84	1.58	0.209	-1.15	-4.16	1.86	0.56	0.453		
PSYRAT	Total score	(intercept)	8.33	3.44	13.23	11.13	0.001	8.95	3.75	14.15	11.39	0.001	-0.19 -0.44 -0.08 -0.42 0 -0.56 -0.15 -0.28 -0.1 -0.37 -0.1 -0.27
		Group	3.17	-3.91	10.25	0.77	0.381	3.59	-4.82	11.99	0.70	0.403	
		Time (T2)	-2.96	-8.03	2.11	1.31	0.253	-4.57	-9.53	0.38	3.27	0.071	
		Time (T3)	-5.13	-11.26	1.01	2.68	0.102	-6.86	-13.02	-0.70	4.76	0.029*	
		Group x Time (T2)	-1.09	-8.42	6.25	0.08	0.771	4.65	-3.37	12.66	1.29	0.256	
	Group x Time (T3)	1.35	-7.52	10.22	0.09	0.765	4.70	-5.26	14.67	0.86	0.355		
	Total H score	(intercept)	5.96	2.05	9.86	8.95	0.003	6.81	2.59	11.03	10.00	0.002	
		Group	3.04	-2.60	8.69	1.12	0.291	2.96	-3.87	9.79	0.72	0.395	
		Time (T2)	-1.54	-5.26	2.18	0.66	0.417	-3.10	-6.72	0.53	2.80	0.094	
		Time (T3)	-3.96	-8.58	0.67	2.81	0.094	-5.38	-10.01	-0.75	5.19	0.023*	
		Group x Time (T2)	-2.32	-7.70	3.06	0.72	0.398	2.02	-3.84	7.88	0.46	0.500	
	Group x Time (T3)	0.25	-6.48	6.98	0.01	0.941	2.92	-4.57	10.41	0.58	0.445		
	Emotion H	(intercept)	2.04	0.55	3.54	7.15	0.007	2.33	0.71	3.96	7.91	0.005	
		Group	1.00	-1.16	3.17	0.83	0.363	0.90	-1.73	3.53	0.45	0.504	
		Time (T2)	-0.50	-2.12	1.12	0.37	0.546	-1.14	-2.75	0.46	1.95	0.163	
		Time (T3)	-1.63	-3.55	0.30	2.73	0.098	-1.95	-3.93	0.02	3.76	0.053	
		Group x Time (T2)	-1.00	-3.34	1.34	0.70	0.403	0.53	-2.07	3.12	0.16	0.691	
	Physical H	Group x Time (T3)	0.74	-2.06	3.54	0.27	0.605	1.65	-1.55	4.84	1.02	0.313	
		(intercept)	1.04	0.28	1.81	7.12	0.008	1.19	0.36	2.02	7.90	0.005	
		Group	0.69	-0.42	1.79	1.48	0.225	0.81	-0.53	2.15	1.40	0.237	
Time (T2)		-0.25	-0.91	0.41	0.55	0.458	-0.48	-1.12	0.16	2.13	0.144		
Time (T3)		-0.50	-1.34	0.34	1.35	0.245	-0.86	-1.69	-0.02	4.06	0.044*		
Control H	Group x Time (T2)	-0.43	-1.39	0.52	0.79	0.375	0.25	-0.79	1.28	0.22	0.642		
	Group x Time (T3)	-0.21	-1.44	1.01	0.11	0.736	0.24	-1.11	1.59	0.12	0.725		
	(intercept)	1.50	0.53	2.47	9.23	0.002	1.71	0.66	2.76	10.25	0.001		
	Group	0.95	-0.44	2.35	1.79	0.181	0.75	-0.95	2.44	0.74	0.388		
	Time (T2)	-0.46	-1.36	0.44	0.99	0.319	-0.76	-1.60	0.07	3.19	0.074		
Cognitive H	Time (T3)	-1.00	-2.13	0.13	3.02	0.082	-1.33	-2.42	-0.25	5.81	0.016*		
	Group x Time (T2)	-0.72	-2.03	0.58	1.18	0.277	0.45	-0.90	1.81	0.43	0.510		
	Group x Time (T3)	-0.30	-1.94	1.34	0.13	0.722	0.56	-1.19	2.32	0.40	0.528		
	(intercept)	1.38	0.49	2.26	9.28	0.002	1.57	0.61	2.53	10.33	0.001		
	Group	0.40	-0.88	1.68	0.37	0.542	0.51	-1.04	2.05	0.41	0.523		
Cognitive H	Time (T2)	-0.33	-1.17	0.50	0.61	0.433	-0.71	-1.57	0.15	2.65	0.103		
	Time (T3)	-0.83	-1.87	0.21	2.47	0.116	-1.24	-2.32	-0.15	4.99	0.026*		
	Group x Time (T2)	-0.17	-1.37	1.04	0.07	0.786	0.79	-0.60	2.18	1.24	0.265		
	Group x Time (T3)	0.03	-1.49	1.54	0.00	0.972	0.47	-1.29	2.23	0.27	0.601		

(Continued)

Table 5 (Continued).

Dependent Variable		Crude Model					Adjusted Model					ES Cohen's d
		B	CI		χ^2	p-value	B	CI		χ^2	p-value	
			Upper	Lower				Upper	Lower			
Total D score	(intercept)	2.38	0.48	4.27	6.03	0.014	2.14	0.06	4.22	4.08	0.043	
	Group	0.13	-2.62	2.87	0.01	0.929	0.63	-2.74	3.99	0.13	0.715	
	Time (T2)	-1.42	-3.76	0.93	1.41	0.236	-1.48	-4.10	1.15	1.21	0.271	
	Time (T3)	-1.17	-3.77	1.44	0.77	0.380	-1.48	-4.36	1.40	1.01	0.315	
	Group x Time (T2)	1.23	-2.15	4.62	0.51	0.475	2.63	-1.62	6.88	1.47	0.225	-0.33
	Group x Time (T3)	1.31	-2.48	5.10	0.46	0.499	1.78	-2.87	6.44	0.56	0.453	-0.31
Cognitive D	(intercept)	1.38	0.35	2.40	6.85	0.009	1.24	0.13	2.35	4.76	0.029	
	Group	-0.06	-1.55	1.43	0.01	0.940	0.15	-1.65	1.95	0.03	0.873	
	Time (T2)	-0.79	-2.06	0.48	1.49	0.222	-0.86	-2.29	0.58	1.37	0.241	
	Time (T3)	-0.67	-2.08	0.75	0.85	0.356	-0.86	-2.41	0.69	1.17	0.279	
	Group x Time (T2)	0.56	-1.27	2.40	0.36	0.547	1.32	-1.00	3.64	1.24	0.265	-0.23
	Group x Time (T3)	0.72	-1.34	2.78	0.47	0.495	1.09	-1.42	3.60	0.72	0.395	-0.26
Emotion D	(intercept)	1.00	0.12	1.88	4.95	0.026	0.90	-0.07	1.88	3.29	0.070	
	Group	0.18	-1.09	1.46	0.08	0.780	0.48	-1.10	2.06	0.35	0.552	
	Time (T2)	-0.63	-1.71	0.46	1.28	0.258	-0.62	-1.82	0.58	1.02	0.313	
	Time (T3)	-0.50	-1.71	0.71	0.66	0.417	-0.62	-1.96	0.72	0.82	0.366	
	Group x Time (T2)	0.67	-0.89	2.24	0.70	0.401	1.31	-0.63	3.26	1.75	0.186	-0.43
	Group x Time (T3)	0.59	-1.17	2.35	0.43	0.511	0.70	-1.47	2.86	0.40	0.529	-0.36

Notes: Cohen's d = 0.2 = Small effect size; 0.5 = Medium effect size; 0.8 = Large effect size (Cohen, 1988). *p < 0.05. Bold values denote statistical significance at the p < 0.05 level.

Abbreviations: DASS, Depression Anxiety Stress Scales; FFMQ, Five Facet Mindfulness Questionnaire; PSYRAT, Psychotic Symptoms Rating Scale; Total H score, Total hallucination score; Emotion H, hallucination; Physical H, physical hallucination; Control H, control hallucination; Cognitive H, cognitive hallucination; Total D score, total delusion score; Cognitive D, cognitive delusion; Emotion D, emotion delusion.

Contradictory to our hypothesis, MBPP did not effectively improve suppression in the participants. The study suggested that suppression appeared to be the ineffective emotion regulation strategy as individuals had a rebound in target thoughts, which heightened their emotionality after a designated suppression period.⁷⁸ Mindfulness, which cultivates the acceptance of unwanted experience and thoughts, is suggested to be antithetical to expression suppression.⁷⁹ Nevertheless, this study result was contradictory to previous studies which demonstrated that mindfulness training reduced expressive suppression in clinical and non-clinical populations.⁸⁰⁻⁸² Meanwhile, recent studies have suggested that emotion regulation practices and the associated psychological impacts are culturally specific.⁸¹ Contradictory to the Western context which values emotional expression, the Asian culture considers the expression of the inner self as ego-focused, and a disturbance of social harmony.⁸³ Suppression may function as adaptive self-restraint and interpersonal harmony in the Asian contexts.⁸³⁻⁸⁶ Our study revealed that the suppression score was in the unexpected direction, it slightly increased after the MBPP and 3 months follow-up. The use of suppression in emotion regulation may serve the

purpose of self-restraint and social attachment in traditional Chinese culture. Meanwhile, Western studies have consistently found that greater use of suppression in patients with schizophrenia is associated with depression, anxiety, and affective blunting, which has been associated with poorer clinical outcomes in psychosis.^{27,34,37,87} More studies are needed to examine the role of suppression in Chinese patients with schizophrenia, and the effectiveness of mindfulness in modulating the use of suppression and associated emotional response in this population.

In our study, two participants (7.7% of the MBPP participants) reported experiencing unwanted events during the mindfulness practice, which is substantially lower than the occurrence of unwanted events (25.4%) reported by general mindfulness practitioners.⁸⁸ The common unwanted effects that mindfulness practitioners have experienced include transient anxiety and fear (13.8%), emotional lability (2.3%), and depressive symptoms (2.3%).⁸⁸ The incidence in this study was lower than that of general practitioners reported by Cebolla et al (2017); and the unwanted effects were mild without the need for medical assistance. Nevertheless, the result informed the consideration of further study for the possible unwanted effects of mindfulness in this population.

This trial has several limitations. First, convenience sampling was adopted for subject recruitment leading to self-selection bias. Secondly, patients were recruited from four mental health centres in two geographical regions (Kowloon and New Territories), which are associated with a high poverty rate, low household income and low social class compared to the overall demographic structure in Hong Kong.⁸⁹ Thirdly, the participants in this study were dominated by females, aged over 45, married, and with a long duration of illness. The sample bias might limit the generalisation of the findings. Fourth, both participants and clinicians in the ICCMW and LSCH were not blinded, which might produce an expectation, response bias and Hawthorne effect. Fifthly, this study adopts self-reported measurements to measure the outcomes which may induce self-reported/response bias and learning effects. The statistically significant improvement in the reported emotion regulation may not be linked to the clinical improvement and the change of emotional valence in response to the illness experience. Psychophysiological measurements such as neuroimaging or neurobiological responses should be employed in future studies to develop an understanding of the psychophysiological impact of MBPP on the emotion regulation process, and the emotional response for schizophrenia.

Conclusion

This study achieved positive results that strengthened the body of knowledge on the impacts of mindfulness psychoeducation on emotion regulation. The findings suggest that MBPP can be both feasible and acceptable by schizophrenic patients in community settings and improve emotion regulation, in terms of cognitive reappraisal, rumination, reduced depressive symptoms, and hallucination severity. These encouraging results urge further multi-centre randomised controlled trials to examine the treatment effects of using MBPP as an emotion regulation intervention in more diverse patient groups of schizophrenia. It is also important to investigate the comparative effectiveness of other psychosocial interventions and their longer-term effects on schizophrenia.

Data Sharing Statement

The research team could not share the data because both the research team and community centres share held the access right of the data. The community centres had concerns about the confidentiality of identity and data of this sensitive patient population.

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Disclosure

The authors report no conflicts of interest in this work.

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