Effectiveness of an age-modified mindfulness-based cognitive therapy (MBCT) in improving mental health in older people with depressive symptoms: a non-randomised controlled trial

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Abstract

Background Emerging evidence has shown that mindfulness-based cognitive therapy (MBCT) is effective in improving depressive symptoms in the older population. However, the accessibility to MBCT is limited by the shortage of psychotherapists or mindfulness teachers. One potential solution is to involve social workers, who have the knowledge and skills to promote individual and community well-being in various settings, in delivering modified MBCT to enhance its accessibility and sustainability. This study examined the effectiveness of an eight-week age-modified MBCT led by different mental health professionals (mindfulness teacher only vs. mindfulness teacher and social worker) in improving mental health outcomes as compared with a control group.

Methods Older adults ($N = 112$) were recruited through five community-based centres for older adults and mental wellness in Hong Kong. Participants were allocated to one of three groups: (1) mindfulness teacher-led modified MBCT, (2) social worker/teacher co-led modified MBCT (50% led by social workers and 50% led by mindfulness teacher), or (3) control (care as usual). The age-modified MBCT consisted of eight weekly sessions, with age-related modifications including more sitting meditation, shortened duration of each session, and the removal of the retreat. Outcome variables (i.e., depressive symptoms, anxiety symptoms, perceived stress, and mindfulness) were assessed at baseline (T0), after the intervention (T1), and four weeks after the intervention (T2), through self-reported questionnaires. Linear mixed models were performed while controlling for demographic variables to examine changes in outcome variables between the groups.

Results Participants from the age-modified MBCT intervention groups (teacher-led and social worker/teacher co-led) showed significantly greater reductions in depressive symptoms and stress, as well as greater increase in mindful non-reactivity, compared to the control group post-intervention. No significant interaction effect of time and group was found for anxiety and both overall mindfulness and its other facets. The improvements in mental health and

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mindfulness outcomes post-intervention were not significantly different between the teacher-led and social worker/teacher co-led MCBT groups.

Discussion Age-modified MBCT is beneficial in managing depressive and stress symptoms and in improving mindful non-reactivity among older adults at risk for depression. The findings support the feasibility and effectiveness of partial task-shifting in the delivery of MBCT to trained social workers. Future studies may explore the possibility for social workers in leading MBCTs independently to further improve its scalability and service accessibility for older adults in the community.

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Keywords Mindfulness-based cognitive therapy, Older adults, Depression, Anxiety, Stress, Mindfulness, Social workers

Background

The ageing process brings about various major changes, including physiological and cognitive decline, increased risks of disability, and loss of significant others [1, 2], that can compromise the well-being of older adults [3–5]. Depression is one of the most common geriatric psychiatric disorders in later life, with a global prevalence rate of 28.4%, [6] and is often comorbid with anxiety symptoms [7]. Not only is it one of the leading causes of the global burden of diseases [8], it is also significantly associated with reduced quality of life, elevated risk of morbidity (e.g., cardiovascular disease [9]), and mortality [10], and can create caregiver, economic, and societal burdens [11]. Particularly with the rapid growth of the older adult population worldwide, the prevention of depression and early intervention targeting those at risk for depression is thus critical [12], given the high prevalence of depressive symptoms experienced by older adults (24.8–40.4% globally as reported in recent meta-analyses [13, 14]).

A variety of pharmacological treatments are available for the management of depression. However, considering the adverse events and side effects associated with [2] pharmacological treatments in the older population [15–17], non-pharmacological interventions are often recommended and preferred by older adults, particularly in the management of mild-to-moderate depressive symptoms [18]. Cognitive-behavioural therapy (CBT) has been shown to be effective in reducing depressive symptoms and is recommended as the first-line intervention for depression [19]. CBT focuses on altering the content of maladaptive thoughts and emotions. However, attempting to control thoughts or feelings may intensify distress and perpetuate depression rather than resolve it. Furthermore, several studies have suggested that CBT may be less effective when applied to older adults as compared with younger populations, potentially because of age-related cognitive decline [20, 21], comorbidities such as generalised anxiety disorder [22–24], or general low perceived need or reluctance to seek for mental health treatment due to poor expectancies or stigma [25, 26].

An alternative approach is mindfulness-based cognitive behavioural therapy (MBCT), which is a program developed by Segal and colleagues [27, 28], designed for individuals with a history of depression. The program emphasizes an individual's awareness towards their thoughts, feelings, and bodily sensations, where one learns to take a decentered perspective on their patterns of thinking and cultivate a different attitude and ways of response [29]. MBCT is a group intervention that combines mindfulness meditation with CBT elements to reduce or prevent recurrent major depressive disorders [30]. The aim is to empower individuals to step out of their habitual (i.e., automatic) patterns of ruminative thinking, which makes them more vulnerable to experiencing a future episode of depression [29]. However, as opposed to modifications of thought contents, MBCT aims to enhance one's awareness of how feelings, thoughts, and bodily sensations relate to their thought processes [31, 32]. Through exercises such as body-scanning, mindful eating, mindful walking, as well as bringing awareness and attention to different parts of the body, mindfulness practices aim to shift people's awareness to the present moment in a nonjudgmental manner, and in turn develop the ability to disengage from maladaptive thinking patterns [33].

Increasingly MBCT has been applied to the older population, with modifications made to address cognitive and functional changes in old age [34] and increase its acceptability and feasibility [35]. These modifications include simplifying walking meditation, allowing sitting on a chair for exercises such as body scanning [34], removing the whole day retreat [28] and reducing the length of each session [34, 36]. Modified MBCT has been shown effective in reducing depressive symptoms, anxiety, and/or stress in older adults [1–4]. These studies were mainly conducted with clinical samples, such as those with cognitive or intellectual impairment and living in nursing homes rather than non-clinical, community-dwelling older adults [37–41]. Few studies have measured mindfulness as a change mechanism, and among them, results are inconclusive [32]. While some studies found no significant changes in overall mindfulness after the intervention [32], others found that specific facets, such as acting with awareness, non-judging, and non-reactivity,

if not overall mindfulness, improved after the intervention [37, 42] and are associated with improved emotional well-being and reduced depressive symptoms [42].

Despite its promising results, the accessibility of MBCT can be limited due to the shortage of psychotherapists or mindfulness teachers. Recent studies have suggested training other healthcare professionals to deliver MBCT or mindfulness-based interventions to older adults [37, 43]. This can increase the accessibility of MBCT to the rapidly growing ageing population in different settings and benefit their mental health. For example, in Guangdong province of China, mental health nurses who obtained national occupational qualifications as psychotherapists and completed MBCT training can provide MBCT to their patients, expanding access to MBCT in mental health facilities [43]. Aisenberg-Shafran and Harmataz also suggested training nursing home workers to deliver mindfulness-based interventions to older residents [37]. A recent study in Hong Kong examined the effectiveness of a modified mindfulness-based stress reduction therapy (MBSR) for community-dwelling older adults led by social workers, nurses, teachers, programme workers, and researchers, who received 74.5 h of training by an experienced mindfulness teacher [44]. The intervention was effective in reducing depressive symptoms and improving mental health. However, it did not improve mindfulness and was only compared against a wait-list control group. Therefore, it remains unclear whether its effectiveness is comparable to that being led by certified mindfulness teachers. Furthermore, there is yet study examining the potential of involving other healthcare professionals in delivering MBCT.

Social workers present a potential group of professionals to deliver MBCT for older adults. They receive academic and professional training that equips them the ability to "integrate and apply social work knowledge, values, skills, and cognitive and affective processes to practice situations in a culturally responsive, purposeful, intentional, and professional manner to promote human and community well-being" [45]. Social workers provide services to older adults in various settings, including community centres, nursing facilities, and hospitals. Some of them may have experience working with mental health issues and delivering therapeutic interventions for their clients, all of which help deliver MBCT. As in many other countries, the proportion of registered social workers working in the mental health sector in Hong Kong is considerably greater than other mental health professionals (e.g., psychiatrists and clinical psychologists [46]). Task-shifting the delivery of MBCT from mindfulness teachers to trained social workers who work in the community and other settings could improve the accessibility and scalability of the intervention by increasing the number of trained professionals who can deliver it. Moreover,

it could increase the sustainability of the intervention by building capacity within existing social work services.

The present study aimed to examine the effectiveness of an age-modified MBCT tailored for older adults at risk for depression led by MBCT teachers only or co-led by social workers and mindfulness teachers in improving mental health outcomes (i.e., depressive symptoms, anxiety symptoms, and perceived stress) and mindfulness, as compared with participants in the control group (who received usual service such as CBT and behavioural activation in their community centre). This study also aimed to compare the effectiveness between the teacher-led and social worker/teacher co-led MBCT groups in improving outcomes in older adults. We hypothesised that:

H1: Both age-modified MBCT groups (teacher-led group and social worker/teacher co-led group) will be significantly more effective in improving mental health outcomes (i.e., depressive symptoms, anxiety symptoms, perceived stress), and mindfulness in older adults with depressive symptoms as compared with the control group.

H2: There will be no significant difference in mental health outcomes, and mindfulness between the two age-modified MBCT groups (i.e., teacher-led group and social worker/teacher co-led group).

Method
Participants and study design
The present study is a three-arm non-randomised controlled trial as part of a large-scale collaborative stepped-care intervention program for older adults with mild-to-moderate depressive symptoms (JC JoyAge) [47]. The reason for implementing non-randomisation is due to feasibility considerations, including a high likelihood of interaction between intervention and control group participants (i.e., potential contamination), as well as the complex workflow between different aged care and mental health service units. Participants in this study were recruited from five of the community-based centres for older adults and mental wellness involved in the JC JoyAge project. Social workers identified potential older adults and referred them to the research team. Participants were included if they were: (1) aged 60 years or above, (2) had depressive symptoms of mild level or above (indicated by a score of 5 or higher on the PHQ-9) at T0 assessment, and (3) could give informed consent to participate. Participants were excluded if they had: (1) a known history of autism, intellectual disability, schizophrenia-spectrum disorder, bipolar disorder, Parkinson's disease, or dementia, (2) current abuse of drugs or alcohol, or (3) difficulty in communication. For participants allocated to the intervention group, a screening interview was conducted. Participants were further excluded if they had imminent suicidal risk, or if the training was deemed

unsuitable for the participant (e.g., unable to commit due to life events). The resulting sample consisted of 112 participants aged between 60 and 93 years. Participant demographics are provided in Table 1. A consort diagram showing the participant flow is provided in Fig. 1.

Older adults were allocated by social workers to one of the three groups: (1) 8-week age-modified MBCT led by a certified mindfulness teacher, henceforth *teacher-led group*; (2) 8-week age-modified MBCT facilitated by social workers (50%) and a mindfulness teacher (50%), henceforth *social worker/teacher co-led group*; or (3) usual services provided in the affiliated community centre of the participant (mainly CBT and behavioural activation), referred to as *control group* in the present study. There were three data collection timepoints: baseline (T0), after the intervention (T1), and four weeks after the intervention (T2). Each assessment took approximately 30 min to complete and were conducted by social workers with regular supervision from clinical psychologists of the project team. This study was approved by the Human Research Ethics Committee (HREC) of the University of Hong Kong, and all participants gave informed written consent. The present study was retrospectively registered on AsPredicted (#138042).

Screening interview

Prior to the start of the programme, participants who were allocated to the age-modified MBCT groups were required to attend an interview (approximately 45 to 50 min). The purpose of the interview was to determine whether they were in a suitable condition to take part in the intervention, understand whether participants have had any prior experience in learning mindfulness, and what motivates them to take part. Furthermore, participants were asked about their current mental/physical health status and their experience of living with depressive symptoms. Based on participants' responses, the interviewer (either the mindfulness teacher/social

worker) illustrated how their emotional experiences were related to their automatic cognitive responses, and how practicing mindfulness could help alleviate these unpleasant experiences. During this interview, participants were encouraged to ask any questions they have about the program and to discuss their expectations about the program. Finally, the interviewer invited the participant to do a 10-minute body scan to have a taste of what the training will involve (i.e., the experience of awareness and the present moment).

Measures

Patient health questionnaire

Depressive symptoms were assessed using the validated Chinese version of the Patient Health Questionnaire (PHQ-9) [48, 49]. The 9-item instrument incorporates depression diagnostic criteria with other leading major depressive symptoms and rates the frequency of the symptoms (e.g., "feeling tired or having little energy") on a four-point Likert scale ranging from 0 (*not at all*) to 3 (*nearly every day*). Higher scores indicate higher levels of depressive symptoms. The internal consistency of the test scores was acceptable ($\alpha = 0.69$ to 0.83) in the present study.

Generalised anxiety disorder scale

Anxiety symptoms were assessed by adopting the validated Chinese version of the Generalized Anxiety Disorder 7-item scale (GAD-7) [50, 51]. The instrument taps on the most prominent diagnostic features for generalised anxiety disorder. Participants rated the frequency of experiencing the symptoms over the past two weeks (e.g., "not being able to stop or control worrying") on a four-point Likert scale, ranging from 0 (*not at all*) to 3 (*nearly every day*). Higher scores indicate higher levels of anxiety symptoms, respectively. The internal consistency of the test scores was good ($\alpha = 0.89$ to 0.92) in the present study.

Table 1 Participant demographics

Variables	Control (n = 38)		Teacher-led (n = 39)		Social worker/teacher co-led (n = 35)	
Age	*M*	*SD*	*M*	*SD*	*M*	*SD*
	74.34	8.24	72.31	6.60	71.34	6.23
Gender	*n*	*%*	*n*	*%*	*n*	*%*
Male	10	26	4	10	1	3
Female	28	74	35	90	34	97
Highest education level						
Primary school or below	18	47	20	51	16	46
Secondary school	8	21	6	15	6	17
High school	11	29	7	18	10	29
Diploma or above	1	3	6	15	3	9
CSSA Recipient	4	11	6	15	4	11

Note. CSSA = Comprehensive Social Security Assistance Scheme, which provides financial assistance to low-income Hong Kong residents to meet basic needs

Consort Flow Diagram

Aged care/ mental health care units [a] recruited participants to MBCT intervention

Excluded [b] (*n* = 0)

Non-randomised (*n* = 116)

Enrollment

Allocation

| Teacher-Led Group (*n* = 40) | Social Worker /Teacher Co-Led Group (*n* = 38) | Control Group (*n* = 38) |

T0 Assessment

| **Baseline assessment & pre-group interview** (*n* = 39) PHQ-9 score <5 (*n* = 1) | **Baseline assessment & pre-group interview** (*n* = 35) Declined to participate (*n* = 3) | **Baseline assessment** (*n* = 38) |

Intervention

| Received intervention (*n* = 39) | Received intervention (*n* = 35) | Received intervention (*n* = 38) |

T1 Assessment

| Discontinued intervention (*n* = 1) Loss to follow-up (*n* = 1) | Discontinued intervention (*n* = 1) Loss to follow-up (*n* = 0) | Loss to follow-up (*n* =1) |

T2 Assessment

| Loss to follow-up (*n* = 1) | Loss to follow-up (*n* = 0) | Loss to follow-up (*n* = 1) |

Analysis

| Analysed (*n* = 36) | Analysed (*n* = 34) | Analysed (*n* = 36) |

a. Age care and mental health care units partnering with JC JoyAge: Holistic Support Project for Older Adults' Mental Wellness in Hong Kong
b. Exclusion Criteria: (1) known history of autism, intellectual disability, schizophrenia-spectrum disorder, bipolar disorder, Parkinson's disease, or dementia, (2) current abuse of drugs or alcohol, and (3) difficulty in communication (4) imminent suicidal risk, or (5) timing to participate or the training itself is deemed unsuitable

Fig. 1 Consort diagram

Table 2 Standardised and age-modified MBCT

	Standardised MBCT [30, 56]	Age-Modified MBCT for older adults
Program overview	8 sessions 1 full-day retreat 1 reunion session	8 sessions 1 reunion session
Session length	2.5 h per session	2 h per session
Session content	Formal mindfulness practice including stretching/yoga elements	Formal mindfulness practice (stretching/yoga substituted with a 20-minute sitting meditation) along with a selection of stories delivered at the end of each session
Change of wordings	Autopilot (in Session 1) Office (in Session 6, alternate thoughts exercise)	Automatic reactions Teahouse

Perceived stress scale

Stress was measured by the Chinese validated Perceived Stress Scale (PSS) [52]. The 10-item instrument measures the degree to which an individual's life situations are perceived as stressful. Respondents rated the frequency of how they felt in a certain way (e.g., "unable to control the important things in your life") during the last month on a Likert scale ranging from 0 (*never*) to 4 (*very often*). Higher scores indicate higher perceived stress. The internal consistency of the test scores was acceptable ($\alpha = 0.54$ to 0.67) in the present study.
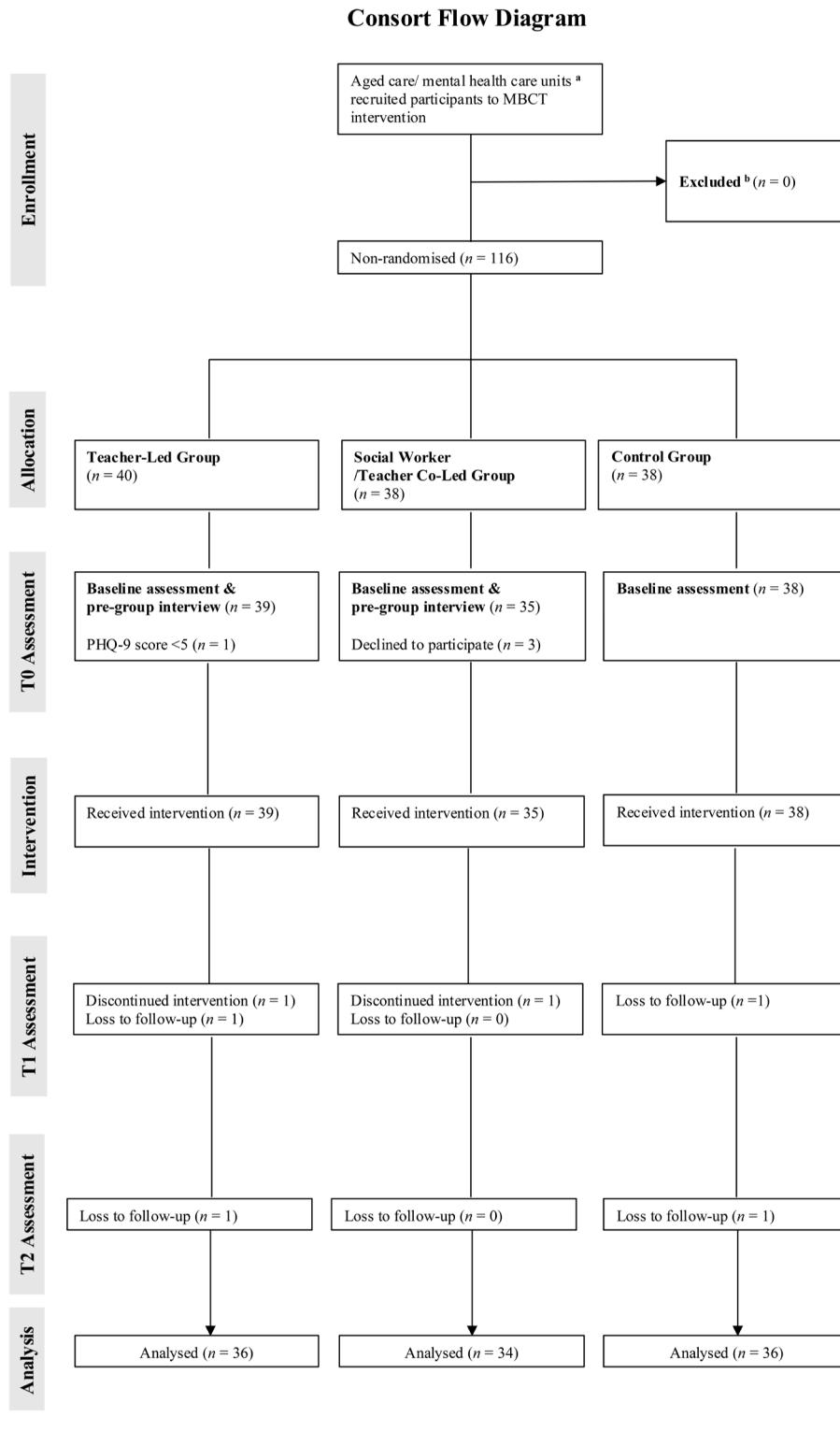
Five Facet Mindfulness questionnaire – short form

Mindfulness was assessed using the Chinese validated Five Facet Mindfulness Questionnaire Short Form (FFMQ-SF) [53]. The 20-item instrument measures mindfulness by five domains: observe, describe, acting with awareness, non-judging, and non-reactivity. Respondents rated how much each statement reflects their lives (e.g., "I tell myself that I shouldn't be feeling the way I'm feeling") on a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*). Higher scores indicate higher mindfulness. In the current study, the internal consistency of the test scores for the overall scale ($\alpha = 0.75$ to 0.83) and across different subscales was acceptable ($\alpha = 0.65$ to 0.90).

Interventions

Age-modified MBCT for older adults

Based on previous research [34, 35], participant feedback, and clinical observations from a pilot study conducted by the research team, several modifications were made to the standard MBCT to reduce demands for older adults. The age-modified MBCT consisted of eight weekly sessions, with each session lasting for two hours instead of three hours. The full-day retreat was removed. Besides, we replaced the mindfulness stretching exercise with mindfulness sitting meditation. Handouts and recordings were provided to participants so that they could perform daily home practice after each session. Participants were encouraged to record any feelings, thoughts, or challenges they encountered as they did the practice. A

Table 3 Session outline for the age-modified MBCT delivered in the present study

Session	Topic
1	Awareness and automatic reactions
2	Living in our heads
3	Gathering the scattered mind
4	Recognising aversion
5	Allowing/letting be
6	Thoughts are not facts
7	How can I best take care of myself
8	Maintaining and extending learning
Reunion (1 month later)	Meditation/home practice review/relapse prevention

group reunion session was held four weeks following the completion of the programme. The differences between the standardised and current age-modified MBCT are provided in Table 2.

Apart from translating the content to Cantonese, we made some adaptations to the wordings and examples in the standard MBCT to ensure that the intervention content was culturally/contextually relevant and easy to understand by older adults with low education, For example, the term "autopilot" was used to describe a state of mind where one acts without conscious intention or being fully aware of their current behaviours. However, the term was not commonly understood or used among older adults. Therefore, we replaced it with "automatic reactions" for a more direct description. Moreover, one of the stories was set in an office environment, which may not have resonated with older adults who were retired and no longer work. To make the story more relatable, we decided to reframe it in a teahouse setting, which is a common breakfast and gathering place for older adults to socialise with others in the morning.

The age-modified MBCT was conducted in Cantonese (see Table 3 for the session outline). The intervention was either led by a mindfulness teacher (*teacher-led group*) or co-led by a mindfulness teacher and a social worker (*social worker/teacher co-led group*). In the *social worker/teacher co-led group*, the mindfulness teacher introduced new mindfulness practices to the participants and

responded to participants' inquiries about their practice experiences. Under the certified teacher's supervision, social workers facilitated 50% of each session, including leading formal mindfulness practices. The mindfulness teacher received formal training organised by the Oxford Mindfulness Centre and the Hong Kong Centre for Mindfulness. He was certified to deliver MBCT and had extensive experience working with older adults. The social workers were from the JC JoyAge project, where they were trained to deliver cognitive behavioural therapy to older adults as the primary intervention modality. To co-lead MBCT, the social workers attended an 8-week MBCT course and received a one-day mindfulness training from the mindfulness teacher. The training included demonstration and role play of leading various mindfulness practices, such as body scan and sitting meditation, and leading practice-related discussions with participants. This provided social workers with the opportunity to gain personal experience in practising mindfulness meditation and to understand the group dynamics of the age-modified MBCT. They also received ongoing supervision from the mindfulness teacher when delivering the groups.

To encourage full adherence to the age-modified MBCT programme, all participants allocated to the age-modified MBCT groups were assigned to a trained peer supporter who: (1) sat in the mindfulness programme with their participants, (2) assisted participants in attending the programme (e.g., accompanying those with limited physical mobility when travelling to and from the centre), (3) maintained contact with the participant outside the sessions and encouraged them to complete their homework, and (4) provided support, if needed, during breakout sessions and encouraged participants to share their experiences and feelings.

Procedure

All participants provided informed consent prior to taking part in the study. Older adults' suitability for joining the study was assessed through the screening process by first assessing their inclusion and exclusion criteria and followed by a clinical pre-group interview to evaluate one's suitability in terms of one's current mental condition, expectations, and experiences toward mindfulness. Eligible participants were allocated to different intervention groups based on the clinical judgment of the mindfulness teacher and social workers.

At baseline (T0), participants completed demographic questions and self-report questionnaires (i.e., PHQ-9, GAD-7, PSS, FFMQ-SF). Eight weeks (T1; also called post-intervention for intervention groups) and one month later (i.e., 12 weeks after baseline; T2), participants once again completed all self-report questionnaires.

Care as usual

Participants in the care as usual group received evidence-based psychological and supportive interventions regularly delivered by trained social services staff in age care units and mental health care units partnering with JC JoyAge in Hong Kong [47]. Based on the primary concerns of our participants, older adults received 8-week high-intensity CBT, CBT for insomnia, behavioural activation, and/or person-centred therapy (PCT).

Power analysis

Based on previous literature on the effectiveness of MBIs [54, 55], assuming a small-to-medium effect size (Cohen's $d = 0.40/f = 0.20$), 80% power, and 5% significance level, a minimum of 84 participants is needed to elicit changes for three arms over three timepoints. To account for 10% attrition, at least 32 participants (rounded up) are needed for each arm. The current study fulfilled the criteria ($n = 38$ for control, $n = 39$ for teacher-led group, and $n = 35$ for social worker/teacher co-led group).

Data analysis

Baseline group differences were tested using ANOVAs. To examine the efficacy of the age-modified MBCT in improving mental health symptoms (i.e., depressive symptoms, anxiety symptoms, and stress) and mindfulness (five facets including observe, describe, acting with awareness, non-judging, and non-reactivity), separate linear mixed models (LMMs) were conducted using restricted likelihood estimation (REML). Although LMMs are relatively robust to assumption violation [56], we checked assumptions of linearity, normality of residuals, homoscedasticity, and no autocorrelation by plots and ensured they were met before applying the analyses. Each mental health symptom outcome and mindfulness facet was included as the outcome variable. Demographic variables (i.e., age, gender, education, and socioeconomic status as indicated by the need of financial support, see Table 1), time point (T1 and T2), group (two age-modified MBCT groups and control group), and interaction terms for time and group were included as fixed effects. Participant was included as a random effect. All analyses were conducted using R Studio software version 3.3.0, using the lme4 package [57]. For comparison, ANOVA results are included in the Supplementary Materials.

Results

The descriptive statistics of all variables assessed can be found in Table 4. There were no significant between group differences in baseline age [$F(2,109) = 1.970$, $p = .19$], levels of depressive symptoms [$F(2, 109) = 1.69$, $p = .19$], anxiety symptoms [$F(2, 108) = 0.35$, $p = .71$], stress [$F(2,107) = 1.92$, $p = .15$], or mindfulness [$F(2,105) = 0.57$, $p = .57$].

Table 4 Descriptive statistics

| Timepoint | T0 | | | | | | T1 | | | | | | T2 | | | | | |
| Group | Control | | Teacher-led | | Co-led | | Control | | Teacher-led | | Co-led | | Control | | Teacher-led | | Co-led | |
Variable	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
PHQ-9	8.58	4.06	10.23	4.23	9.71	3.75	6.49	4.37	6.38	4.80	5.65	3.88	4.69	4.06	5.00	3.64	5.29	3.78
GAD-7	7.45	5.63	8.42	5.35	8.20	4.90	5.89	5.31	6.03	4.44	4.59	3.66	3.89	4.09	4.97	3.87	4.85	3.92
PSS	19.89	7.62	22.97	7.07	21.32	5.57	18.95	6.48	19.11	6.22	17.22	5.70	18.39	6.13	18.14	5.94	17.76	6.81
FFMQ-SF	64.14	8.88	62.42	8.75	61.94	9.97	64.97	9.78	64.24	9.43	66.47	9.54	65.26	7.55	67.17	8.57	67.03	8.95
Observation	14.50	3.31	13.64	3.41	14.00	3.96	14.24	3.52	14.76	3.12	14.50	3.77	14.08	3.64	15.00	3.03	14.32	3.58
Description	13.55	3.87	13.85	2.69	13.34	3.34	13.70	3.26	13.38	2.65	14.50	3.49	13.42	3.28	13.92	3.03	14.47	3.39
Awareness	11.53	4.09	11.26	3.93	11.80	3.27	13.00	3.69	11.86	3.74	13.24	3.03	13.22	3.05	13.08	3.11	13.82	3.19
Non-judging	11.62	3.61	11.36	3.43	10.41	2.66	11.97	3.06	11.78	1.60	10.53	2.81	11.83	2.65	12.00	2.48	11.06	2.74
Non-reactivity	12.97	2.98	12.05	2.45	11.97	2.83	12.22	2.75	12.46	2.78	13.71	2.76	12.53	2.13	12.86	2.45	13.35	2.63
CompAct-8	24.32	4.44	22.77	5.91	23.74	4.31	26.68	5.20	26.28	6.39	24.85	5.67	27.22	5.24	26.06	6.70	26.26	6.07

Note. T0 = Baseline; T1 = 8 weeks after baseline/post intervention for intervention groups; T2 = 12 weeks after baseline; Co-led = Social worker/teacher co-led; PHQ-9 = Patient Health Questionnaire; GAD-7 = Generalized Anxiety Disorder scale; PSS = Perceived Stress Scale; FFMQ-SF = Five Facet Mindfulness Questionnaire Short Form; CompAct-8 = Comprehensive Assessment of Acceptance and Commitment Therapy Processes

Linear mixed models

H1: examining the efficacy of the age-modified MBCT in improving mental health outcomes and mindfulness

The model statistics showing the efficacy of the two age-modified MBCT groups as compared with the control group are summarised in Table 5 (mental health outcomes) and Table 6 (mindfulness outcomes). For depressive symptoms, significant main effects of time [Time (T1): $t(211)$ = -3.09, p = .002; Time (T2): $t(212)$ = -5.69, $p < .001$] and group [$t(190)$ = 1.93, p = .05] were found. The interaction effect between Time 1*Group was also significant, suggesting that differences in depression reduction from the age-modified MBCT groups versus control group were pronounced at Time 1 [$t(211)$ = -2.35, p = .02] (see Fig. 2a). None of the demographic variables had a significant effect on depressive symptoms.

For anxiety symptoms, only a significant main effect of time [Time (T2): $t(211)$ = -4.72, $p < .001$] was found (Fig. 2b). No other variable in the model showed a significant effect.

For perceived stress, a significant interaction effect of Time 1*Group [$t(211)$ = -2.13, p = .03] was found, suggesting that differences in stress reduction from the age-modified MBCT groups versus control group were more pronounced at Time 1 (see Fig. 2c). No other variable showed a significant effect on perceived stress.

For overall levels of mindfulness, only a significant main effect of education [$t(103)$ = 2.80, p = .006] was found. No other variables in the model showed a significant effect (Table 6).

For the individual mindfulness facets, a significant interaction between time and group was found only in the non-reactivity dimension [Time 1*Group = $t(211)$ = 2.84, p = .005; Time 2*Group = $t(211)$ = 2.33, p = .02]. Differences in the improvements in mindful non-reactivity between the age-modified MBCT groups and control group were more pronounced at Time 1 and Time 2 (see Fig. 3).

None of the variables had a significant effect on the dimensions of observe and non-judging (Table 6). For the describe model, education was the only variable that had a significant effect, $t(103)$ = 3.47, $p < .001$. Education also had a significant effect on acting with awareness dimension, $t(105)$ = 2.84, p = .005. In addition, there were significant main effects of time [Time (T1): $t(213)$ = 2.78, p = .006; Time (T2): $t(214)$ = 3.11, p = .002] on the acting with awareness model.

H2: Comparing the efficacy of the two age-modified MBCT groups in improving mental health outcomes and mindfulness

The model statistics are summarised in Table 7 (mental health outcomes) and Table 8 (mindfulness outcomes). Among all mental health outcomes, there was

Table 5 Models predicting mental health outcomes among the age-modified MBCT groups and the control group

Model	Depressive symptoms		Anxiety symptoms		Perceived stress	
Fixed effects	*b*(SE)	95% CI	*b*(SE)	95% CI	*b*(SE)	95% CI
Age	0.001 (0.05)	-0.10, 0.10	-0.08 (0.05)	-0.19, 0.03	-0.11 (0.07)	-0.25, 0.04
Gender	-1.17 (1.03)	-3.20, 0.86	-0.25 (1.15)	-2.53, 2.03	-0.70 (1.52)	-3.69, 2.28
Education	-0.31 (0.27)	-0.84, 0.23	0.10 (0.36)	-0.50, 0.70	0.34 (0.39)	-0.44, 1.12
SES	0.62 (1.05)	-1.45, 2.69	0.99 (1.17)	-1.33, 3.31	2.44 (1.55)	-0.60, 5.49
Time (T1)	-2.02** (0.65)	-3.30, -0.73	-1.38 (0.76)	-2.89, 0.12	-1.02 (1.13)	-3.25, 1.20
Time (T2)	-3.75*** (0.66)	-5.05, -2.46	-3.60* (0.76)	-5.10, -2.10	-1.70 (1.14)	-3.95, 0.55
Group	1.64* (0.85)	-0.03, 3.31	0.65 (0.96)	-1.24, 2.55	2.08 (1.32)	-0.52, 4.67
Time 1*Group	-1.89* (0.80)	-3.47, -0.31	-1.58 (0.94)	-3.43, 0.26	-2.98* (1.40)	-5.75, -0.23
Time 2*Group	-0.97 (0.81)	-2.56, 0.63	0.30 (0.94)	-1.55, 2.14	-2.50 (1.41)	-5.27, 0.27
Random effects	σ²	SD	σ²	SD	σ²	SD
Participant	8.89	2.98	10.9	3.31	16.7	4.09
Residual	7.94	2.82	10.6	3.26	23.9	4.89

Note. SES = Socioeconomic Status. * *p* < .05, ** *p* < .01, *** *p* < .001

a nonsignificant main effect of group on depressive symptoms [$t(122) = 0.37$, $p = .71$], anxiety [$t(140) = -0.04$, $p = .97$], and stress [$t(165) = -1.03$, $p = .31$]. In addition, there was a nonsignificant interaction between group and time for all mental health outcomes. The results suggest that the effectiveness of the two age-modified MBCT groups did not differ in improving mental health outcomes. There was a significant main effect of time on depressive symptoms [Time (T1): $t(138) = -2.40$, $p = .02$; Time (T2): $t(138) = -3.86$, $p < .001$], and perceived stress [Time (T2): $t(137) = -2.13$, $p = .04$].

For mindfulness and all its dimensions, the main effect of group was not statistically significant [overall mindfulness: $t(145) = -0.40$, $p = .69$; observe: $t(130) = 0.05$, $p = .96$; non-judging: $t(166) = -1.50$, $p = .13$; describe: $t(153) = -0.76$, $p = .45$; acting with awareness: $t(129) = 0.72$, $p = .47$; non-reactivity [$t(176) = -0.20$, $p = .84$] (Table 8). In addition, there was a nonsignificant interaction between group and time for all mindfulness dimensions, except for the describe dimension at Time 1 [$t(136) = 2.00$, $p = .04$]. The overall results suggest that the effect of the two age-modified MBCT groups in promoting different mindfulness facets did not differ significantly. The social worker/teacher co-led group ($M = 14.50$, $SD = 3.49$) had greater improvements in the describe facet compared with the teacher-led group ($M = 13.38$, $SD = 2.65$) at Time 1.

Discussion

The present study examined the effectiveness of an age-modified MBCT in improving mental health outcomes (i.e., depressive symptoms, anxiety symptoms, and perceived stress) and mindfulness in community-dwelling older adults with mild-to-moderate levels of depressive symptoms. In addition, this study examined whether there were differences in the effectiveness of the age-modified MBCT when being delivered by a certified mindfulness teacher versus social workers in conjunction with a mindfulness teacher.

Our findings partially supported our first hypothesis in showing that both age-modified MBCT groups were significantly more effective than the active control group in improving outcomes, specifically in terms of depressive symptoms, perceived stress, and mindful non-reactivity. Furthermore, although not statistically significant, participants also reported lower levels of anxiety post-MBCT. Consistent with our second hypothesis, we found that the intervention effects did not significantly differ between teacher-led and social worker/teacher co-led MCBT groups. With rapid population ageing across societies and the ongoing challenge of insufficient manpower and resources [58], our findings suggest that enhancing training for social workers in delivering adapted versions of MBCT may be a possible means of partial task-shifting and may help increase access to mental health intervention and reduce healthcare burden among at-risk community members in the long run. While further refinements to the current age-modified MBCT may

Table 6 Models predicting mindfulness and its dimensions among the age-modified MBCT groups and the control group

Model	Overall Mindfulness (FFMQ-SF)		Individual Mindfulness Facets									
			Observe		Non-judging		Describe		Acting with Awareness		Non-reactivity	
Fixed effects	*b*(SE)	95% CI	*b*(SE)	95% CI	*b*(SE)	95% CI	*b*(SE)	95% CI	*b*(SE)	95% CI	*b*(SE)	95% CI
Age	0.06 (0.10)	-0.14, 0.27	-0.02 (0.04)	-0.10, 0.06	0.00 (0.03)	-0.06, 0.06	0.01 (0.04)	-0.06, 0.08	0.06 (0.04)	-0.02, 0.15	0.02 (0.03)	-0.04, 0.08
Gender	2.77 (2.09)	-1.34, 6.87	1.10 (0.84)	-0.55, 2.74	-0.90 (0.66)	-2.20, 0.40	0.99 (0.72)	0.43, 2.41	0.88 (0.86)	-0.82, 2.58	0.67 (0.59)	-0.49, 1.83
Education	1.54 * (0.55)	0.46, 2.62	0.17 (0.22)	-0.26, 0.60	0.02 (0.17)	-0.32, 0.37	0.66* (0.19)	0.28, 1.03	0.64* (0.23)	0.20, 1.09	0.04 (0.15)	-0.26, 0.35
SES	-2.20 (2.11)	-6.36, 1.96	-1.08 (0.85)	-2.75, 0.59	-0.94 (0.67)	-2.26, 0.37	-0.06 (0.73)	-1.50, 1.37	-0.24 (0.88)	-1.97, 1.49	0.23 (0.60)	-0.94, 1.41
Time (T1)	0.99 (1.64)	-2.25, 4.22	-0.27 (0.61)	-1.48, 0.93	0.36 (0.55)	-0.71, 1.44	0.17 (0.59)	-1.00, 1.34	1.53* (0.23)	0.45, 2.61	-0.79 (0.53)	-1.82, 0.25
Time (T2)	1.31 (1.66)	-1.96, 4.57	-0.41 (0.62)	-1.62, 0.81	0.22 (0.55)	-0.87, 1.30	-0.14 (0.60)	-1.32, 1.04	1.73 * (0.88)	0.64, 2.82	-0.44 (0.53)	-1.48, 0.61
Group	-2.45 (1.85)	-6.09, 1.19	-0.93 (0.72)	-2.34, 0.49	-0.52 (0.59)	-1.69, 0.65	-0.17 (0.65)	-1.44, 1.11	-0.08 (0.71)	-1.47, 1.32	-1.06 (0.55)	-2.15, 0.02
Time 1*Group	2.27 (2.02)	-1.71, 6.25	1.11 (0.75)	-0.37, 2.59	-0.04 (0.67)	-1.36, 1.28	0.09 (0.73)	-1.35, 1.53	-0.50 (0.68)	-1.83, 0.84	1.84** (0.65)	0.57, 3.12
Time 2*Group	3.51 (2.04)	-0.51, 7.53	1.24 (0.76)	-0.26, 2.73	0.48 (0.38)	-0.85, 1.81	0.67 (0.74)	-0.78, 2.12	0.15 (0.68)	-1.19, 1.49	1.52* (0.65)	0.23, 2.80
Random effects	σ^2	SD	σ^2	SD	σ^2	SD	σ^2	SD	σ^2	SD	σ^2	SD
Participant	30.27	5.50	5.20	2.28	2.84	1.69	3.38	1.84	6.20	2.49	2.00	1.42
Residual	48.61	6.97	6.97	2.64	5.39	2.32	6.59	2.57	5.63	2.37	5.15	2.27

Note. FFMQ-SF = Five Facet Mindfulness Questionnaire Short Form; SES = Socioeconomic status. * $p < .05$, ** $p < .01$, *** $p < .001$
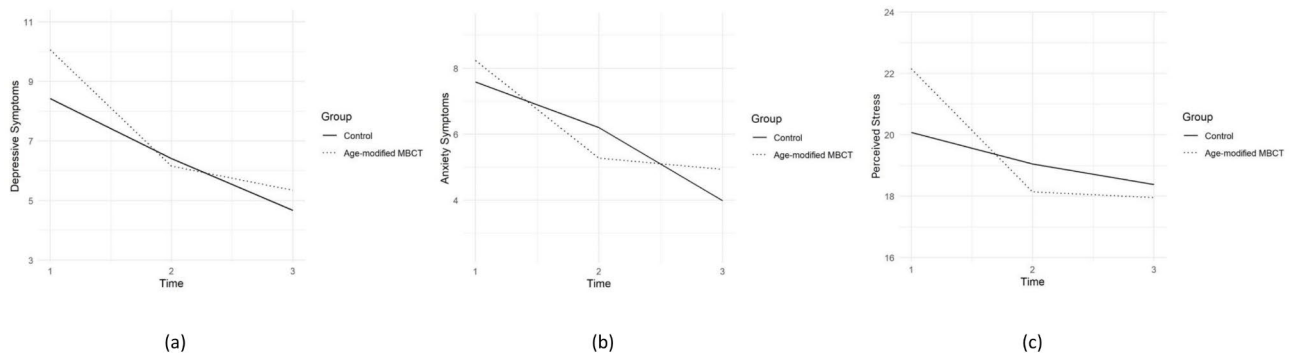
Fig. 2 Predicted values of mental health outcomes by time and group. *Note*. Predicted values of (**a**) depressive symptoms, (**b**) anxiety symptoms, and (**c**) perceived stress by time and group are shown. 0 = Control; 1 = Age-modified MBCT groups (teacher-led and social worker/teacher co-led groups combined)
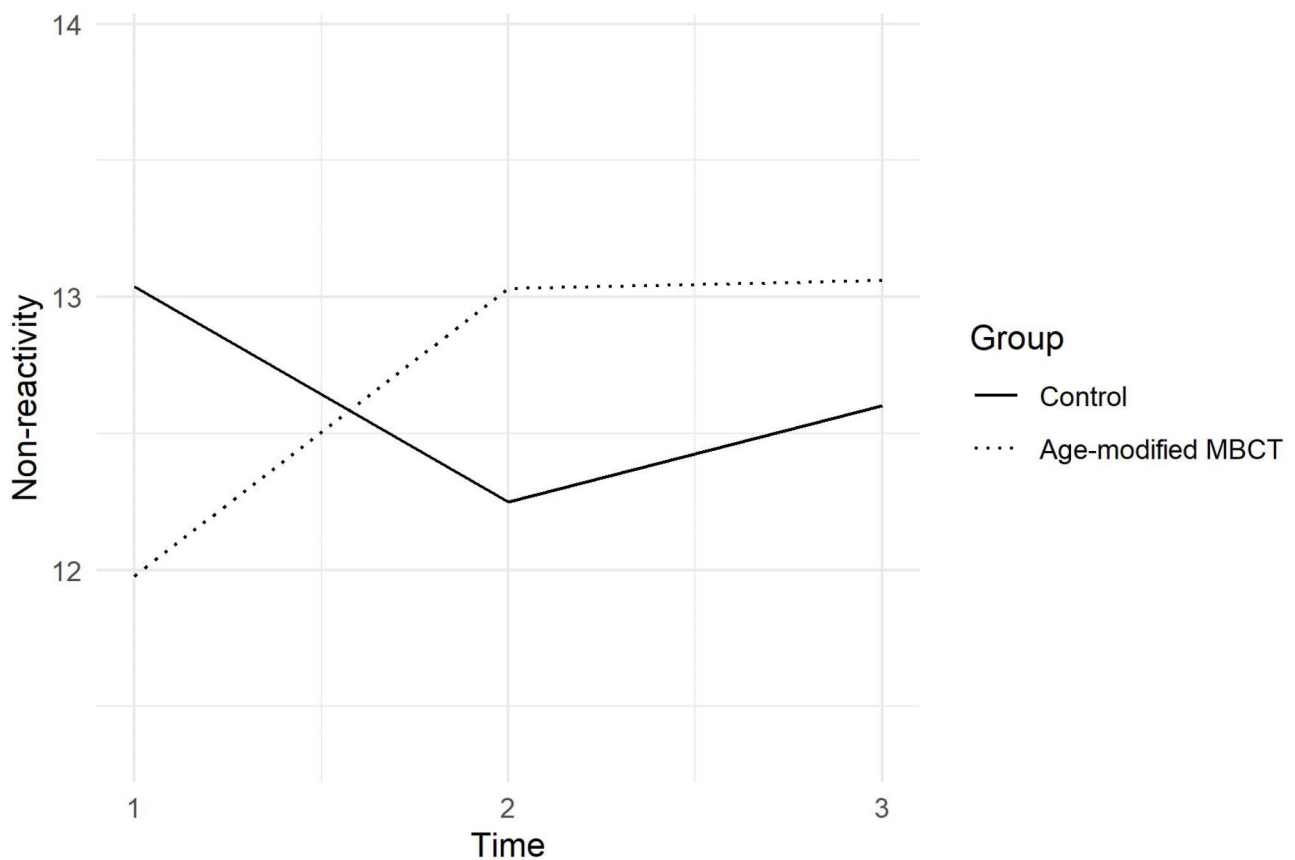

Fig. 3 Predicted values of the mindful non-reactivity facet by time and group. *Note*. 0 = Control; 1 = Age-modified MBCT groups (teacher-led and social worker/teacher co-led groups combined)

be needed to enhance its efficacy in promoting mental health, the involvement of social workers in delivering mindfulness interventions is promising.

Our findings are generally in line with the literature suggesting that mindfulness-based interventions can improve depressive symptoms and perceived stress in older adults [35]. However, the current age-modified MBCT did not show significant effects on anxiety symptoms, which has been observed in another study on

mindfulness-based intervention for older adults [59]. Across all groups, we found reductions in depression at T1 and reductions in anxiety at T2. One possible reason is that the age-modified MBCT was compared to an active control group, where participants received other evidence-based interventions, such as CBT, behavioural activation, or PCT. Given that all groups received some form of cognitive therapy, the unique benefits of MBCT may have been compromised to a certain extent. The

Table 7 Models predicting mental health outcomes among the two age-modified MBCT groups

Model	Depressive symptoms		Anxiety symptoms		Perceived stress	
Fixed effects	*b*(SE)	95% CI	*b*(SE)	95% CI	*b*(SE)	95% CI
Age	0.02 (0.07)	-0.12, 0.16	-0.03 (0.08)	-0.18, 0.13	-0.04 (1.00)	-0.23, 0.16
Gender	-0.79 (1.71)	-4.15, 2.58	-2.21 (1.78)	-5.72, 1.30	-1.06 (2.35)	-5.68, 3.57
Education	-0.25 (0.34)	-0.92, 0.42	0.10 (0.35)	-0.59, 0.79	0.34 (0.46)	-0.58, 1.25
SES	0.69 (1.26)	-1.78, 3.17	0.12 (1.31)	-2.45, 2.70	0.79 (1.72)	-2.61, 4.19
Time (T1)	-3.46** (1.45)	-6.31, -0.61	-1.03 (1.72)	-4.43, 2.37	-3.67 (2.76)	-9.11, 1.77
Time (T2)	-5.58*** (1.45)	-8.43, -2.73	-3.10 (1.72)	-6.50, 0.30	-5.85* (2.75)	-11.26, -0.43
Group	-0.36* (0.97)	-2.28, 1.56	-0.05 (1.06)	-2.14, 2.04	-1.55 (1.51)	-4.52, 1.42
Time 1*Group	-0.30 (0.93)	-2.13, 1.53	-1.30 (1.10)	-3.48, 0.87	-0.24 (1.78)	-3.75, 3.27
Time 2*Group	0.59 (0.93)	-1.24, 2.41	-0.13 (1.10)	-2.31, 2.04	1.12 (1.76)	-2.36, 4.59
Random effects	σ^2	SD	σ^2	SD	σ^2	SD
Participant	9.18	3.03	9.07	3.01	12.50	3.54
Residual	7.68	2.77	10.81	3.29	27.40	5.24

Note. SES = Socioeconomic status. * $p < .05$, ** $p < .01$, *** $p < .001$

observed reduction in depressive symptoms and anxiety may also be due to common non-specific factors shared across intervention modalities, such as social engagement and support. The findings also corroborate with previous research that showed a lack of effect or modest effect of MBCT in improving psychological outcomes when an active control group (e.g., psychoeducation, social support, or nutrition education) was employed [34, 35]. Nevertheless, the present findings suggest that the age-modified MBCT and care as usual are both effective in promoting positive mental health outcomes in older adults.

Another possible reason is that the improvement in the non-reactivity facet of mindfulness was not sufficient to reduce anxiety. Despite a non-significant change in overall mindfulness like in some studies [32], the age-modified MBCT significantly improved the non-reactivity facet of mindfulness for older adults. Previous studies have found that non-reactivity plays a more specific role in reducing stress and improving cognitive flexibility after mindfulness-based interventions [28, 60, 61]. Interestingly, a randomised wait-list control trial among outpatients with diabetes has shown that the *non-reactivity* facet of mindfulness mediated the effects of MBCT on depressed mood, whereas the *observing* facet mediated the effects on anxiety symptoms [62]. The absence of significant change in the observing facet of mindfulness after the intervention may account for the non-significant change in anxiety. These findings might suggest that MBCT, particularly in older adults, may have a stronger

effect specifically on the non-reactivity facet of mindfulness; however, it may also imply that the age-modified MBCT requires further adjustments to address all five facets of mindfulness.

In the current study, the FFMQ score across groups was around 63, which is comparable to the scores in a previous study that also found a null effect among older adults (a score of around 65) [59]. Lee et al. pointed out that the FFMQ may be less sensitive to capturing changes among those with lower education [44], which also applies to our sample characteristics, where the majority of participants had an education level of primary school or below. In addition to using a self-report measure to assess mindfulness, future research could consider incorporating behavioural tasks to assess mindfulness or mind wandering [63], which may also be helpful in evaluating whether mindfulness skills improve over the course of mindfulness-based interventions.

Strengths and limitations
Given the scarcity of studies exploring the effectiveness of MBCT on older adults with depressive symptoms and with none having been conducted to explore the effectiveness of a social worker and teacher co-led MBCT, our study added new insights into the possibilities of modifying MBCT to target this age group and partially task shifting to social workers for improving service access.

To ensure the current MBCT could be most optimally understood by the older adults sample, age-related modifications were made to the standardised MBCT

Table 8 Models predicting mindfulness and its dimensions among the two age-modified MBCT groups

Model	Overall Mindfulness (FFMQ-SF)		Individual Mindfulness Facets									
			Observe		Non-judging		Describe		Acting with Awareness		Non-reactivity	
	b(SE)	95% CI	b(SE)	95% CI	b(SE)	95% CI	b(SE)	95% CI	b(SE)	95% CI	b(SE)	95% CI
Fixed effects												
Age	0.00 (0.15)	-0.30, 0.30	0.00 (0.06)	-0.12, 0.12	-0.05 (0.04)	-0.14, 0.03	-0.01 (0.05)	-0.11, 0.09	0.04 (0.06)	-0.08, 0.15	0.03 (0.04)	-0.05, 0.11
Gender	1.93 (3.52)	-5.02, 8.88	2.80* (1.41)	0.02, 5.58	-0.76 (0.99)	-2.72, 1.19	-0.80 (1.15)	-3.07, 1.47	-0.08 (1.36)	-2.76, 2.60	0.72 (0.96)	-1.17, 2.62
Education	1.83* (0.70)	0.45, 3.20	0.36 (0.28)	-0.19, 0.91	0.12 (0.19)	-0.26, 0.51	0.51* (0.23)	0.06, 0.95	0.74* (0.27)	0.21, 1.27	0.07 (0.19)	-0.31, 0.44
SES	-0.64 (2.58)	-5.73, 4.45	-1.06 (1.04)	-3.10, 0.98	-0.14 (0.72)	-1.56, 1.28	-0.34 (0.84)	-2.00, 1.31	0.96 (1.00)	-1.00, 2.93	0.04 (0.70)	-1.34, 1.41
Time (T1)	-0.66 (3.59)	-7.74, 6.42	1.52 (1.31)	-1.06, 4.10	0.86 (1.17)	-1.44, 3.17	-2.10 (1.25)	-4.57, 0.37	-0.07 (1.21)	-2.46, 2.31	-0.95 (1.21)	-3.34, 1.43
Time (T2)	3.71 (3.64)	-3.47, 10.90	1.99 (1.31)	-0.59, 4.57	0.80 (1.18)	-1.53, 3.12	-1.00 (1.26)	-3.49, 1.49	1.50 (1.21)	-0.88, 3.89	0.16 (1.21)	-2.23, 2.55
Group	-0.85 (2.15)	-5.10, 3.39	0.04 (0.83)	-1.59, 1.67	-0.96 (0.64)	-2.22, 0.30	-0.54 (0.71)	-1.94, 0.87	0.56 (0.79)	-0.98, 2.11	-0.13 (0.64)	-1.39, 1.13
Time 1*Group	2.67 (2.31)	-1.88, 7.23	-0.47 (0.84)	-2.12, 1.19	-0.37 (0.75)	-1.85, 1.12	1.61* (0.80)	0.02, 3.19	0.75 (0.78)	-0.78, 2.28	1.36 (0.78)	-0.17, 2.89
Time 2*Group	0.77 (2.33)	-3.83, 5.36	-0.49 (0.84)	-2.45, -0.86	-0.07 (0.75)	-1.56, 1.42	1.04 (0.80)	-0.55, 2.64	0.26 (0.78)	-1.27, 1.79	0.63 (0.78)	-0.91, 2.16
Random effects	σ^2	SD	σ^2	SD	σ^2	SD	σ^2	SD	σ^2	SD	σ^2	SD
Participant	33.91	5.82	5.88	2.42	2.18	1.48	3.31	1.82	5.61	2.37	1.84	1.36
Residual	46.48	6.82	6.31	2.51	5.03	2.24	5.81	2.41	5.39	2.32	5.34	2.31

Note. FFMQ-SF = Five Facet Mindfulness Questionnaire Short Form; SES = Socioeconomic status. * $p < .05$, ** $p < .01$, *** $p < .001$

programme as suggested by the literature to increase feasibility and acceptability [31]. For example, we shortened the session length and replaced mindfulness stretching exercise with mindfulness mediation, with the aim of reducing cognitive and physical challenges associated with increased age. The acceptability and feasibility of the current age-modified MBCT is supported by the low attrition rate observed, with only 3% of participants who dropped out from the teacher-led and social worker/teacher co-led groups.

Nonetheless, the study has several limitations. First, due to feasibility considerations (e.g., workflow between different service units), no randomisation was applied in this study. Second, it is also possible that modifications made to the MBCT could have compromised its effects in targeting other mindfulness facets, and possibly also anxiety symptoms. Some studies have suggested that adapting treatments to fit service needs in the community may reduce its effectiveness [46, 64]. Moreover, the current modifications were based on top-down decisions and may not reflect the needs of the older population. For example, although participants were satisfied with the two-hour session duration, they preferred having more informal practices, such as mindful eating and walking, over formal practices like sitting meditation. They also reflected that some wordings in the intervention, such as "emotions arise", were still uncommon in daily use and took longer to comprehend. More research is needed to explore ways to optimise intervention outcomes while ensuring the training is feasible for the population of interest. Finally, although social workers had extensive experience delivering CBT to older adults, they had less experience with mindfulness and were not qualified to lead MBCT on their own. This may limit the exploration of their potential involvement in delivering the age-modified MBCT. Future studies and practice could consider developing mindfulness-based interventions that can be delivered by social workers on their own or examining the possibility of incorporating mindfulness teacher training in social worker training to expand the workforce.

Future research

While social workers are capable of facilitating most of the age-modified MBCT, including leading mindfulness exercises, we examined the possibility of partial task-shifting in this study, with the trained social workers and the certified MBCT teacher delivering half of the MBCT groups, respectively. Building on our work, future research should further test the feasibility of developing a low-intensity mindfulness-based intervention that could be led solely by trained social workers without the support of a mindfulness teacher to further lower its costs and improve sustainability. To further enhance the current age-modified MBCT, future research should also seek to develop more tailored age-friendly materials and incorporating culturally relevant examples with the involvement of service users, social workers, and certified MBCT teachers in the design process. Given that mindfulness-based interventions have also been found to improve physical health outcomes in older adults (e.g., pain, memory) [33], future research could examine whether social worker-led age-modified MBCTs could also promote physical health outcomes in older adults and how this might be associated with the improvements observed in mental health outcomes.

Conclusions

Age-modified MBCT appears to be effective in improving mental health outcomes of depression and stress, as well as mindful non-reactivity, in older adults with depressive symptoms compared to those receiving care as usual. Future research should seek to investigate whether social workers, with adequate training, may have the potential to facilitate mindfulness-based interventions in the community setting with comparable standards to a certified mindfulness teacher alone. To increase access to mental healthcare, policymakers may consider training social workers to deliver low-intensity mental health interventions to promote mental well-being and prevent mental illness.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12906-025-04781-6.

> Supplementary Material 1

Declarations

Ethics approval and consent to participate
The study was approved by the Human Research Ethics Committee (HREC) of the University of Hong Kong (Number: EA220105) on March 17, 2022. Written informed consent was obtained from all participants in the study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References
1. Barberger-Gateau PFC. Disability and cognitive impairment in the elderly. Disabil Rehabil. 1997;19:175–93.
2. Naef RWR, Mahrer-Imhof R, Grande G. Characteristics of the bereavement experience of older persons after spousal loss: an integrative review. Int J Nurs Stud. 2013;50:1108–21.
3. Charles STPJ, Mogle J, Sliwinski MJ, Almeida DM. The wear and tear of Daily stressors on Mental Health. Psychol Sci. 2013;24:733–41.
4. de Frias CMWE. Stress on health-related quality of life in older adults: the protective nature of mindfulness. Aging Ment Health. 2015;19:201–6.
5. Fiocco AJMS. The importance of cultivating mindfulness for cognitive and emotional well-being in late life. J Evidence-based Complement Altern Med. 2015;20:35–40.
6. Hu T, Zhao X, Wu M, Li Z, Luo L, Yang C, Yang F. Prevalence of depression in older adults: a systematic review and meta-analysis. Psychiatry Res. 2022;311:114511. https://doi.org/10.1016/j.psychres.2022.114511.
7. Gum AMCJ. Psychiatric comorbidity and depression in older adults. Curr Psychiatry Rep. 2008;10:23–9.
8. Abate KH, Abebe Z, Abil OZ, Afshin A, Ahmed MB, Alahdab F, Alam K, Alavian SM, Alkerwi A, Alla F, Amoako YA, Anber NH, Animut MD, Armoon B, Badali H, Baune BT, Cercy KM, Chaiah Y, Charlson FJ, Zucker I. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories. Lancet (British Edition). 2018;392:1789–858. https://doi.org/10.1016/S0140-6736(18)32279-7.
9. Williams SAKS, Heiat A, Abramson JL, Krumholz HM, Vaccarino V. Depression and Risk of Heart failure among the Elderly: a prospective community-based study. Psychosom Med. 2002;64:6–12.
10. B DG. Depression in Late Life: Review and Commentary. Journals Gerontol Ser Biol Sci Med Sci. 2003;58:M249–65.
11. Zivin KPWT, Rostant OP. The Economic, Public Health, and Caregiver Burden of late-life Depression. Psychiatr Clin North Am. 2013;36:631–49.
12. Reynolds CFCP, Lotrich F, Albert SM, Patel V, Cohen A, et al. Early intervention to reduce the global health and economic burden of major depression in older adults. Annu Rev Public Health. 2012;33:123–35.
13. Tang TJJ, Tang X. Prevalence of depressive symptoms among older adults in mainland China: a systematic review and meta-analysis. J Affect Disord. 2021;293:379–90.
14. Badrasawi MZS. Prevalence and correlates of depressive symptoms in older people in the West Bank, Palestine: cross-sectional study. East Mediterr Health J. 2021;27:260–8.
15. WD T. Should antidepressant medication be used in the elderly? Expert Rev Neurother. 2015;15:961–3.
16. Tham AJU, Andersson G, Söderlund A, Allard P, Bertilsson G. Efficacy and tolerability of antidepressants in people aged 65 years or older with major depressive disorder – a systematic review and a meta-analysis. J Affect Disord. 2016;205:1–12.
17. Woolcott JCRK, Wiens MO, Patel B, Marin J, Khan KM, et al. Meta-analysis of the impact of 9 medication classes on Falls in Elderly persons. Archives Intern Med (1960). 2009;169:1952–60.
18. Kok RMRC. Management of Depression in older adults: a review. JAMA: J Am Med Association. 2017;317:2114–22.
19. Excellence NIfHaC. Depression in adults: Treatment and management. https://www.nice.org.uk/guidance/ng222/chapter/Recommendations (2022).
20. Hall JDCKS, Berrios RPD, Bains MKDC, Scott SDC. Efficacy of cognitive behavioral therapy for generalized anxiety disorder in older adults: systematic review, Meta-analysis, and Meta-Regression. Am J Geriatric Psychiatry. 2016;24:1063–73.
21. Executive skills in older adults with GAD: Relations with clinical variables and CBT outcome. M J. J Anxiety Disord. 2013;27:131–9.
22. Gould RLCM, Howard RJ. Cognitive behavioral therapy for Depression in Older people: a Meta-analysis and Meta-regression of Randomized controlled trials. J Am Geriatr Soc (JAGS). 2012;60:1817–30.
23. Hundt NEAA, Kraus-Schuman C, Cully JA, Rhoades H, Kunik ME, et al. Predictors of CBT outcome in older adults with GAD. J Anxiety Disord. 2014;28:845–50.
24. Stanley MAGBJ, Novy DM, Averill PM, Swann AC, Diefenbach GJ, et al. Cognitive-behavioral treatment of late-life generalized anxiety disorder. J Consult Clin Psychol. 2003;71:309–19.
25. Conner KOPDLSWMPHCV, Grote NKPD, Koeske GPD, Rosen DPD, Reynolds CFMD, et al. Mental Health Treatment seeking among older adults with Depression: the impact of Stigma and Race. Mental Health Treat Seeking among Older Adults Depression: Impact Stigma Race. 2010;18:531–43.
26. Karlin BEDM, Gleaves DH. Patterns and Predictors of Mental Health Service Use and Mental Illness among older and younger adults in the United States. Psychol Serv. 2008;5:275–94.
27. Segal ZVWJ, Teasdale JD. Mindfulness-based cognitive therapy for depression: a new approach to preventing relapse. New York: Guilford Press; 2002.
28. Segal ZV, Williams JMG, Teasdale JD. Mindfulness-based cognitive therapy for depression. Guilford Press; 2013.
29. Segal Z, Williams M, Teasdale J, Crane R, Dimidian S, Ma H, Woods S, Kuyken W. 2016/10/MBCT-Training-Pathway-Version-11_Jan Mindfulness-based cognitive therapy: Training pathway (Version 2.0). https://www.oxfordmindfulness.org/wp-content/uploads/ 2018.pdf (2018).
30. J K-Z. Full catastrophe living: using the wisdom of your body and mind to face stress, pain, and illness. Revised and updated edition ed. New York: Bantam Books trade paperback, 2013.
31. Foulk MA, Ingersoll-Dayton B, Kavanagh J, et al. Mindfulness-based cognitive therapy with older adults: an exploratory study. J Gerontol Soc Work. 2014;57:498–520.
32. Geiger PJ, Boggero IA, Brake CA, et al. Mindfulness-based interventions for older adults: a review of the effects on Physical and Emotional Well-Being. Mindfulness. 2016;7:296–307. https://doi.org/10.1007/s12671-015-0444-1.
33. O'Connor M, Piet J, Hougaard E. The effects of mindfulness-based cognitive therapy on depressive symptoms in elderly bereaved people with loss-related distress: a controlled pilot study. Mindfulness. 2014;5:400–9.
34. Johansson P, Høglend P. Identifying mechanisms of change in psychotherapy: mediators of treatment outcome. Clin Psychol Psychother. 2007;14:1–9.
35. Kangaslampi S, Peltonen K. Mechanisms of change in psychological interventions for posttraumatic stress symptoms: a systematic review with recommendations. Curr Psychol. 2022;41:258–75.
36. Chiesa A, Serretti A. Mindfulness based cognitive therapy for psychiatric disorders: a systematic review and meta-analysis. Psychiatry Res. 2011;187:441–53.
37. Aisenberg-Shafran D, Harmatz M. Improving depressive symptoms and maintaining cognitive abilities of seniors within the nursing homes: a pilot study of brief mindfulness-based interventions for seniors in a semi-randomized trial. Front Psychol. 2023;13. https://doi.org/10.3389/fpsyg.2022.994336. Original Research.

38. Han A. Mindfulness-based interventions for older adults with dementia or mild cognitive impairment: a meta-analysis. Clin Gerontologist. 2022;45:763–76.

39. Leow Y, Rashid NLBA, Klainin-Yobas P, et al. Effectiveness of mindfulness-based interventions on mental, cognitive outcomes and neuroplastic changes in older adults with mild cognitive impairment: a systematic review and meta-analysis. J Adv Nurs. 2023;79:4489–505. https://doi.org/10.1111/jan.15720.

40. Nagaoka M, Hashimoto Z, Takeuchi H, et al. Effectiveness of mindfulness-based interventions for people with dementia and mild cognitive impairment: a meta-analysis and implications for future research. PLoS ONE. 2021;16:e0255128–0255128. https://doi.org/10.1371/journal.pone.0255128.

41. Wang FL, Tang QY, Zhang LL, et al. Effects of Mindfulness-based interventions on Dementia patients: a Meta-analysis. West J Nurs Res. 2020;42:1163–73. https://doi.org/10.1177/0193945920916750.

42. Splevins K, Smith A, Simpson J. Do improvements in emotional distress correlate with becoming more mindful? A study of older adults. Aging Ment Health. 2009;13:328–35. https://doi.org/10.1080/13607860802459807.

43. Ye J, Pan Y, Wu C, et al. Effects of Mindfulness-based cognitive therapy on depression and anxiety in late life: a Meta-analysis. Alpha Psychiatry. 2024;25:1–8. https://doi.org/10.5152/alphapsychiatry.2024.231379.

44. Lee EK-P, Wong B, Chan PHS, et al. Effectiveness of a mindfulness intervention for older adults to improve emotional well-being and cognitive function in a Chinese population: a randomized waitlist-controlled trial. Int J Geriatr Psychiatry. 2022;37. https://doi.org/10.1002/gps.5616.

45. Council on Social Work Education. 2022 Educational Policy and Accreditation Standards. 2022.

46. Tickell A, Ball S, Bernard P, et al. The effectiveness of mindfulness-based cognitive therapy (MBCT) in real-world healthcare services. Mindfulness. 2020;11:279–90.

47. Liu TLD, Wong D, Tse S, Wong P, Ng SM et al. Effectiveness of collaborative mental health and aged care with peer support in reducing depressive symptoms, anxiety, and loneliness in older people with risk factors or subsyndromal symptoms: A pragmatic district-based non-randomised controlled trial (JoyAge study). [Manuscript in preparation].

48. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16:606–13.

49. Wang W, Bian Q, Zhao Y, et al. Reliability and validity of the Chinese version of the Patient Health Questionnaire (PHQ-9) in the general population. Gen Hosp Psychiatry. 2014;36:539–44.

50. Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med. 2006;166:1092–7.

51. Tong X, An D, McGonigal A, et al. Validation of the generalized anxiety Disorder-7 (GAD-7) among Chinese people with epilepsy. Epilepsy Res. 2016;120:31–6. https://doi.org/10.1016/j.eplepsyres.2015.11.019.

52. Ng S-m. Validation of the 10-item Chinese perceived stress scale in elderly service workers: one-factor versus two-factor structure. BMC Psychol. 2013;1:1–8.

53. Hou J, Wong SY-S, Lo HH-M, et al. Validation of a Chinese version of the five Facet Mindfulness Questionnaire in Hong Kong and development of a short form. Assessment. 2014;21:363–71.

54. Shih VW, Chan W-C, Tai O-K, et al. Mindfulness-based cognitive therapy for late-life depression: a randomised controlled trial. East Asian Archives Psychiatry. 2021;31:27–35.

55. Zhang J-x, Liu X-h, Xie X-h, et al. Mindfulness-based stress reduction for chronic insomnia in adults older than 75 years: a randomized, controlled, single-blind clinical trial. Explore. 2015;11:180–5.

56. Schielzeth H, Dingemanse NJ, Nakagawa S, et al. Robustness of linear mixed-effects models to violations of distributional assumptions. Methods Ecol Evol. 2020;11:1141–52.

57. Bates D, Mächler M, Bolker B et al. Fitting linear mixed-effects models using lme4. arXiv preprint arXiv:14065823 2014.

58. Wainberg ML, Scorza P, Shultz JM, et al. Challenges and opportunities in global mental health: a research-to-practice perspective. Curr Psychiatry Rep. 2017;19:1–10.

59. Aisenberg-Shafran D, Shturm L. The effects of mindfulness meditation versus CBT for anxiety on emotional distress and attitudes toward seeking mental health treatment: a semi-randomized trial. Sci Rep. 2022;12:19711.

60. Benzo RP, Anderson PM, Bronars C, et al. Mindfulness for healthcare providers: the role of non-reactivity in reducing stress. Explore. 2018;14:453–6.

61. Zou Y, Li P, Hofmann SG, et al. The mediating role of non-reactivity to mindfulness training and cognitive flexibility: a randomized controlled trial. Front Psychol. 2020;11:1053.

62. Haenen S, Nyklíček I, van Son J, et al. Mindfulness facets as differential mediators of short and long-term effects of mindfulness-based cognitive therapy in diabetes outpatients: findings from the DiaMind randomized trial. J Psychosom Res. 2016;85:44–50.

63. Levinson DB, Smallwood J, Davidson RJ. The persistence of thought: evidence for a role of working memory in the maintenance of task-unrelated thinking. Psychol Sci. 2012;23:375–80.

64. Curtis NM, Ronan KR, Borduin CM. Multisystemic treatment: a meta-analysis of outcome studies. J Fam Psychol. 2004;18:411.

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