A Pilot, Randomized Controlled Study of Tai Chi With Passive and Active Controls in the Treatment of Depressed Chinese Americans

Albert S. Yeung, MD, ScD[a,b,*]; Run Feng, BA, MPH[a,c]; Daniel Ju Hyung Kim, BA[a]; Peter M. Wayne, PhD[c]; Gloria Y. Yeh, MD, MPH[c]; Lee Baer, PhD[a]; Othelia E. Lee, PhD[d]; John W. Denninger, MD, PhD[b]; Herbert Benson, MD[b]; Gregory L. Fricchione, MD[b]; Jonathan Alpert, MD, PhD[a]; and Maurizio Fava, MD[a]

ABSTRACT

Objective: This pilot, randomized clinical trial investigates the effectiveness of tai chi as the primary treatment for Chinese Americans with major depressive disorder (MDD).

Methods: 67 Chinese Americans with *DSM-IV* MDD and no treatment for depression were recruited between March 2012 and April 2013 and randomized (1:1:1) into a tai chi intervention, an education program, or a waitlisted group for 12 weeks. The primary outcome measure was the 17-item Hamilton Depression Rating Scale ($HDRS_{17}$); positive response for this outcome was defined as a decrease in total score of 50% or more, and remission was defined as $HDRS_{17} \leq 7$.

Results: Participants (N = 67) were 72% female with a mean age of 54 ± 13 years. No serious adverse events were reported. After the end of the 12-week intervention, response rates were 25%, 21%, and 56%, and remission rates were 10%, 21%, and 50% for the waitlisted, education, and tai chi intervention groups, respectively. The tai chi group showed improved treatment response when compared to both the waitlisted group (odds ratio [OR] = 2.11; 95% CI, 1.01–4.46) and to the education group (OR = 8.90; 95% CI, 1.17–67.70). Tai chi intervention showed significantly improved remission rate over the waitlisted group (OR = 3.01; 95% CI, 1.25–7.10), and a trend of improved remission compared to the education group (OR = 4.40; 95% CI, 0.78–24.17).

Conclusions: As the primary treatment, tai chi improved treatment outcomes for Chinese Americans with MDD over both passive and active control groups.

Trial Registration: ClinicalTrials.gov identifier: NCT01619631

J Clin Psychiatry 2017;78(5):e522–e528
https://doi.org/10.4088/JCP.16m10772

[a]Depression Clinical and Research Program, Massachusetts General Hospital, Boston
[b]Benson Henry Institute for Mind Body Medicine, Massachusetts General Hospital, Boston
[c]Osher Center for Integrative Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts
[d]School of Social Work, University of North Carolina, Charlotte
**Corresponding author:* Albert S. Yeung, MD, ScD, MGH Depression Clinical and Research Program, One Bowdoin Sq, 6/F, Boston, MA 02114 (ayeung@mgh.harvard.edu).

In the United States, there are significant disparities of mental health care and access for ethnic minorities.[1] Chinese immigrants with major depressive disorder (MDD) frequently underutilize mental health services due to language barriers and strong cultural stigma against psychiatric disorders.[2–4] There is a serious need to investigate culturally sensitive mental health interventions for depressed Chinese immigrants.

Tai chi is a mind-body exercise comprising measured and intentional movements, focused breath, and the use of imagery and has been postulated to improve depression by alleviating the effects of stress on the body.[5–9] Recent studies have shown that tai chi reduces stress, anxiety, and depression.[10–15] However, these studies enrolled primarily patients with medical conditions, not patients with MDD. In this study, we examined the feasibility, safety, and effectiveness of tai chi as a primary treatment for Chinese Americans with MDD.

METHODS

Participants

Chinese Americans with MDD were recruited through advertisements between March 2012 and April 2013 from Boston's Chinese community. The inclusion criteria included (1) self-identified as being of Chinese ethnicity and fluent in Mandarin or Cantonese, (2) 18–70 years of age, (3) *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition (*DSM-IV*)[16] diagnosis of major depressive disorder, and (4) baseline score on the 17-item Hamilton Depression Rating Scale ($HDRS_{17}$)[17,18] ranging from 14 to 28, inclusive. The exclusion criteria included (1) primary psychiatric diagnosis other than MDD; (2) history of psychosis, mania, or severe cluster B personality disorder; (3) judged by the investigators to have unstable medical conditions; (4) current active suicidal or self-injurious potential necessitating immediate treatment; (5) regular practice of tai chi or other forms of mind-body intervention in the past 12 months; and (6) current or planned use of potentially confounding treatments during the study, including antidepressants, psychotherapy, and complementary and alternative treatments thought to have beneficial effects on mood, such as St. John's Wort, *S*-adenosyl methionine (SAMe), omega-3 fatty acids, light therapy, and other mind-body interventions (eg, Qigong, mindfulness training, muscle relaxation training, etc). The study was approved by the Institutional Review Board of Massachusetts General Hospital, written informed consent was obtained, and the study was registered at ClinicalTrials.gov (identifier: NCT01619631).

Participant Enrollment and Randomization

After the participant gave consent, a psychiatrist administered the Chinese Bilingual version of the Structured Clinical Interview for *DSM-IV* Axis I Disorders (CB-SCID-I)[19] to assess the diagnosis of MDD and, in addition, completed the 17-item Hamilton Depression

Clinical Points

- Tai chi was found to be effective in alleviating anxiety and depression symptoms for patients who suffered from medical conditions and as an augmentative treatment for depressed patients. It is unclear whether tai chi is effective as a primary treatment for patients with depression.
- Findings of this study suggest that for patients with mild or moderate depression, tai chi shows promise to be an effective first-line treatment.
- For depressed Chinese Americans who avoid mental health services because of stigma, tai chi could be a culturally acceptable treatment.

Rating Scale ($HDRS_{17}$)[17,18] to determine eligibility. Eligible participants were randomized 1:1:1 with an online program (www.graphpad.com/quickcalcs/randomize1.cfm) into 1 of 3 groups: (1) tai chi intervention, (2) education (active control), and (3) waitlist (passive control). Randomization was performed at the beginning of the study by a statistician (L.B.). Each time we recruited a new subject to the study, we obtained the randomization assignment from the statistician. Participants received $20 for each outcomes assessment interview at weeks 6, 12, 18, and 24, but they were not remunerated for attending the tai chi or education training. Participants in the education and the waitlist groups were offered free tai chi classes after they completed the 24-week study period.

Intervention

The tai chi intervention consisted of 1-hour group classes twice a week for 12 weeks. During the study period, 3 cohorts of tai chi groups were formed, about 1 group every 4 months. We employed 2 instructors; the first instructor taught the first 2 groups, and the second instructor led the third group. Each instructor had over 20 years of prior experience teaching tai chi in a community setting. The instructors followed a standard protocol, which included the first section of the traditional 108 movements of Yang-style tai chi and comprises 24 basic tai chi movements.[20] In addition, the instructors coached the participants through a set of traditional warm-up exercises that involved arm swinging; gentle stretches of the neck, shoulders, spine, arms, and legs; and traditional breathing methods. Participants in the intervention group were encouraged to practice at home at least 3 times per week and to record how often they practiced. Classes were conducted in Chinese (both Cantonese and Mandarin). To facilitate social interaction and mutual support, peer learning and discussion were encouraged and considered an important therapeutic element of the tai chi class.

Participants in the education group received didactic training and discussed stress, mental health, depression, and its treatment for 1 hour twice per week for 12 weeks. Participants in the waitlisted group were contacted for assessment at weeks 6, 12, 18 and 24 weeks but received no other interventions during their waiting and follow-up periods.

Outcome Assessments

Outcomes were assessed at baseline and weeks 6, 12, 18, and 24. At each assessment, participants in all 3 groups completed the following quantitative instruments: (1) the $HDRS_{17}$,[17,18] (2) the Clinical Global Impressions Severity (CGI-S)[21] and Improvement (CGI-I) scales,[21] (3) the 36-item Short Form Health Survey (SF-36),[22,23] (4) the Mindful Attention Awareness Scale (MAAS)[24,25] for mindfulness awareness, and (5) the Multidimensional Scale of Perceived Social Support (MSPSS).[26,27] At week 12, subjects in the tai chi group were interviewed using a semistructured questionnaire to obtain qualitative information about their tai chi experience (O. E. Lee, PhD; K. Meade, BA; G. Y. Yeh, MD, MPH; et al. Manuscript submitted, 2016). Following are detailed descriptions of the quantitative instruments:

17-item Hamilton Depression Rating Scale: The $HDRS_{17}$[17,18] is a 17-item clinician-rated scale for depression. The Chinese translated version of the $HDRS_{17}$ has been shown to have adequate reliability and validity.[28]

Clinical Global Impressions Severity and Improvement scales: These 2 clinician-rated scales[21] assess patients' global improvement. The CGI-S (severity) measures the current condition of the patient, and the CGI-I (improvement) measures the degree of improvement since the start of treatment.

36-item Short Form Health Survey: The SF-36[22] is a generic health-related quality-of-life instrument. There are 36 items that assess health across 8 domains: bodily pain, general health perceptions, mental health, physical functioning, role limitations due to emotional health problems, physical health problems, social functioning, and vitality. The Chinese translated version of the SF-36 was validated by Yang et al.[23]

Mindful Attention Awareness Scale: The MAAS[24] consists of 9 items to measure mindfulness. It has been shown to have good reliability and convergent/discriminant validity among a Chinese population.[25]

Multidimensional Scale of Perceived Social Support: The MSPSS[26,27] is a self-administered, 12-item scale to assess perceptions of social support from family members, friends, and a significant other, with higher scores indicating greater levels of perceived support. The Chinese translated version was found to have good internal consistency.[27]

Beliefs and Expectations of Tai Chi: This is a 4-point Likert scale (0 = no, 1 = maybe, 2 = yes, 3 = definitely) for the participants to report their baseline beliefs on the effectiveness of tai chi as treatment for depression.[29]

Feasibility and Safety Measures: At each class, participants were asked to complete an attendance sheet, the Adverse Events Log, and the Adherence to Tai Chi Practice Log to report how many times and how long they practiced tai chi in the previous week.

Table 1. Demographic Characteristics of Participants in the 3 Intervention Groups

	Waitlist (n = 22)		Education (n = 22)		Tai Chi (n = 23)			
Characteristic	n	%	n	%	n	%	Fisher Exact Test	*P* Value
Sex (female)	15	68	16	73	17	74	0.0497	.8904
Beliefs in tai chi intervention							0.0038	.8568
Maybe	12	55	10	45	13	57		
Yes	8	36	8	36	10	43		
Definitely	2	9	3	14	1	4		
Marriage status							0.0006	.9678
Married	13	59	12	55	17	74		
Widowed	3	14	3	14	2	9		
Separated/divorced	3	14	4	18	3	13		
Never married	3	14	2	9	2	9		
Education							0.0356	.7477
High school or less	10	45	8	36	12	52		
Some college or above	12	55	13	59	12	52		
Employment status							0.0027	.0506
Employed	13	59	17	77	11	48		
Unemployed	9	41	4	18	13	57		
	Mean	SD	Mean	SD	Mean	SD	Kruskal-Wallis χ^2_2	*P* Value
Age, y	55	15	55	9	53	14	0.6893	.7085

Data Analyses

Preliminary analyses: The 3 groups were compared, using nonparametric statistical tests, with respect to participants' demographics, beliefs in the effectiveness of tai chi for depression, and severity of depression at the beginning of the study. Chi-square tests were utilized for categorical variables and analysis of variance (ANOVA) tests were used for continuous variables (see Table 1).

Primary outcome analyses: The primary outcome variables were the response and remission rates for depression. Response was defined by a ≥ 50% improvement in $HDRS_{17}$ score at the last assessment, compared to baseline, and remission was defined by a $HDRS_{17}$ score ≤ 7 at the last measurement.[30] Multivariate logistic regression analyses were performed to examine whether patients randomized to the tai chi group exhibited improved treatment outcomes compared to the control groups. A modified intent-to-treat analysis (to include patients with ≥ 1 visit after their initial screening visits) and last-observations-carried-forward approach was used for data analyses. In the multivariate logistic regression analyses, response and remission status were the outcome variables of interest. The type of intervention (tai chi vs education; tai chi vs waitlist; and education vs waitlist) was the primary predictor of interest, and the baseline $HDRS_{17}$ score, age, and sex were entered as default confounders.

Secondary outcome analyses: For continuous outcomes including the $HDRS_{17,}$ CGI, SF-36, MAAS, and the MSPSS, ANOVA tests with pair-wise comparisons were used to examine differences between the intervention and the control groups.

Statistical analyses were conducted using SPSS software, version 20.0.[31]

RESULTS

We consented and interviewed 93 people who met criteria and showed interest in the study and enrolled 67 (72% female, mean ± SD age = 54 ± 13 years). The participants overall enjoyed good health with no medically unstable conditions or apparent limitations on physical activities. They were receiving no antidepressants, psychotherapy, or complementary and alternative treatments thought to have beneficial effects on mood. Enrolled participants were randomly assigned into 1 of the 3 groups: (1) tai chi (n = 23), (2) education (n = 22), and (3) waitlisted (n = 22). The 3 groups were similar in their demographics and outcome measurements at baseline (Table 1).

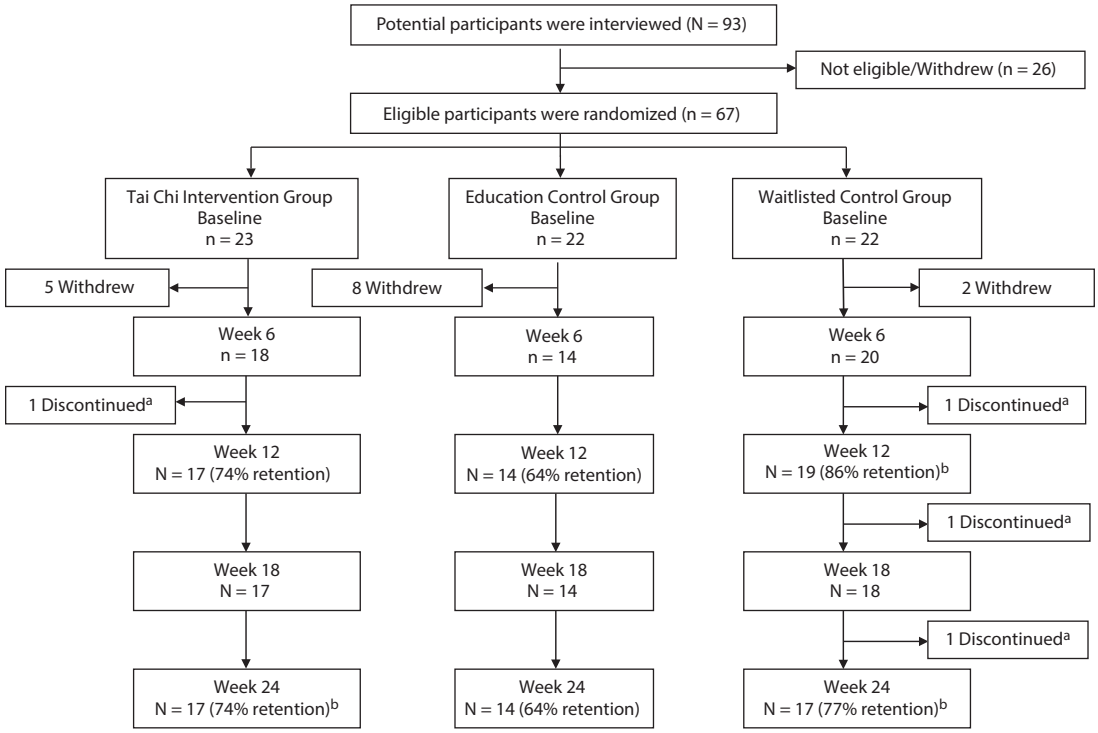
At baseline, all participants had positive expectations that tai chi would help their depression ("not helpful": 0%, "maybe": 52%, "yes": 39%, and "definitely": 9%).

After randomization, 15 participants dropped out of the trial before their first outcome assessment at week 6 (5 from the tai chi group, 8 from the education group, and 2 from the waitlisted group) owing to reasons including having no means of transportation because their friends were randomized to a different intervention group, unanticipated trips to China due to family emergencies, and loss of interest after knowing that they were randomized to a control group. Between weeks 6 and 24, 4 participants showed significant worsening of symptoms based on predetermined criteria (CGI-I ≥ 6); they were discontinued from the study and referred to conventional treatment for depression (Figure 1). Patients in the tai chi group reported few, nonspecific side effects that may or may not be related to the exercise. Effects included 3 (17%) of the participants reporting GI discomfort, 2 (11%) reporting knee pain, and 1 (6%) reporting each of the following: back pain, diarrhea, ear nerve pain, fatigue, finger pain, foot pain, memory loss, and poor appetite. No serious adverse events related to tai chi were reported.

On the basis of the intent-to-treat method, 52 respondents were included in subsequent analyses with 18 in the tai chi group, 14 in the education group, and 20 in the waitlisted group at week 6. Fifty participants (75% of the randomized participants) completed the 12-week intervention.

At week 12, response rates were 25%, 21%, and 56% and remission rates were 10%, 21%, and 50% for the waitlisted

Figure 1. Flowchart of Subject Recruitment, Intervention, and Follow-Up of Tai Chi Treatment for Depressed Chinese Americans



[a]For safety concerns, patients were discontinued and referred to clinical treatment if their depression showed significant worsening during the study.
[b]The numbers used for statistical analyses may differ since intent-to-treat analyses were used with last observation carried forward.

Table 2. Primary Outcomes[a]

	Waitlist		Education		Tai Chi		Tai Chi vs Education	Tai Chi vs Waitlist	Education vs Waitlist
Outcome	n/Total	%	n/Total	%	n/Total	%	OR (95% CI)	OR (95% CI)	OR (95% CI)
Week 12 Postintervention									
Positive response	5/20	25	3/14	21	10/18	56	**8.90 (1.17–67.70)**	**2.11 (1.01–4.46)**	1.10 (0.18–6.75)
Positive remission	2/20	10	3/14	21	9/18	50	4.40 (0.78–24.17)	**3.01 (1.25–7.10)**	4.10 (0.40–43.78)
Week 24 Follow-Up									
Positive response	8/20	40	8/14	57	13/18	72	2.26 (0.47–10.84)	**2.51 (1.11–5.70)**	1.96 (0.48–7.93)
Positive remission	6/20	30	6/14	43	11/18	61	2.40 (0.53–10.85)	**2.20 (1.04–4.64)**	2.09 (0.42–10.34)

[a]Bolded values indicate $P < .05$.

group, education group, and the tai chi intervention group, respectively. The tai chi group, when compared to the waitlisted group, showed greater response (odds ratio [OR] = 2.11; 95% CI, 1.01–4.46) and remission (OR = 3.01; 95% CI, 1.25–7.10) rates at week 12 (Table 2). Moreover, these improvements were sustained at week 24 follow-up. The tai chi group, when compared to the education group, showed significantly greater response (OR = 8.90; 95% CI, 1.17–67.70) and a trend toward greater remission that was not statistically significant (OR = 4.40; 95% CI, 0.78–24.17) at week 12; there were no differences in their response and remission rates during follow-up at week 24, 12 weeks after the completion of tai chi intervention for the tai chi group.

In examining the changes in continuous variables at week 12 (Table 3), the tai chi group showed improved CGI-I, MSPSS (friends subscale), MAAS, and SF-36 (health subscale) scores when compared to both the waitlisted group and the education group, and the effect sizes (Cohen *d*) for tai chi intervention ranged from medium (0.5–0.8) to large (> 0.8). $HDRS_{17}$, CGI-S, and BDI also showed a trend of improvement due to tai chi intervention, but the improvement did not reach statistical significance.

DISCUSSION

The existing literature suggests that tai chi may alleviate symptoms of anxiety and depression and may be an effective adjunctive treatment for patients with MDD. This study investigated depressed Chinese Americans who were not receiving conventional treatment and showed that a tai chi intervention resulted in improved treatment response (≥ 50% symptom reduction from baseline) when compared to both waitlisted and education control groups. Using continuous measurements, tai chi was associated with improvements in

Table 3. Secondary Outcomes[a]

Outcome	Baseline			Week 12			ANOVA to Compare Changes Pre- and Post-Intervention		Effect Size[b] (Cohen *d*)	
	Tai Chi Group (n = 23)	Education Group (n = 22)	Waitlist Group (n = 22)	Tai Chi Group (n = 18)	Education Group (n = 14)	Waitlist Group (n = 19)	F_2	*P*	Tai Chi vs Education[c]	Tai Chi vs Waitlist[d]
$HDRS_{17}$ score	19 ± 3	19 ± 3	19 ± 2	9 ± 5	15 ± 7	134 ± 7	2.9	.07		
CGI score										
Severity (CGI-S)	4 ± 1	4 ± 1	4 ± 1	3 ± 1	3 ± 1	3 ± 1	2.0	.15		
Improvement (CGI-I)	4 ± 0	4 ± 0	4 ± 0	2 ± 1	3 ± 1	3 ± 1	3.4	.04*	0.74	0.78
MSPSS score										
Significant other	14 ± 7	16 ± 9	13 ± 8	20 ± 7	18 ± 8	16 ± 7	2.7	.08		
Family	21 ± 6	17 ± 8	19 ± 6	23 ± 5	19 ± 8	19 ± 6	1.0	.39		
Friends	15 ± 7	16 ± 8	13 ± 8	21 ± 6	17 ± 9	15 ± 7	3.4	.04*	0.96	0.63
MAAS score	51 ± 14	50 ± 9	55 ± 15	65 ± 14	54 ± 12	55 ± 14	5.3	.01*	0.83	0.98
BDI score	20 ± 7	24 ± 9	24 ± 8	11 ± 6	18 ± 9	19 ± 10	2.7	.08		
SF-36 score										
Physical function	653 ± 212	711 ± 164	652 ± 205	778 ± 18	718 ± 184	703 ± 174	2.2	.12		
Role limitation, physical	144 ± 158	171 ± 168	150 ± 157	267 ± 172	129 ± 149	184 ± 180	2.4	.10		
Role limitation, emotional	122 ± 135	114 ± 123	80 ± 120	333 ± 114	121 ± 131	179 ± 123	1.9	.16		
Energy	146 ± 86	156 ± 68	131 ± 60	200 ± 86	151 ± 91	148 ± 62	2.3	.11		
Emotional well-being	210 ± 84	201 ± 87	198 ± 70	277 ± 87	240 ± 89	236 ± 66	1.0	.38		
Social function	125 ± 34	127 ± 32	122 ± 40	151 ± 33	127 ± 32	145 ± 34	1.8	.18		
Pain	123 ± 45	113 ± 21	104 ± 40	151 ± 40	117 ± 30	116 ± 33	1.5	.22		
Health	181 ± 76	170 ± 62	160 ± 75	265 ± 103	177 ± 90	188 ± 81	4.5	.02*	0.91	0.76

[a]All values are mean ± SD unless otherwise noted.
[b]Effect sizes were calculated for variables with positive ANOVA tests.
[c]"Tai Chi vs Education" shows comparisons between tai chi group and education group in the changes in their outcome variables from baseline to week 12.
[d]"Tai Chi vs Waitlist" shows comparisons between tai chi group and waitlist group in the changes in their outcome variables from baseline to week 12.
*$P < .05$.
Abbreviations: ANOVA = analysis of variance, BDI = Beck Depression Inventory, CGI = Clinical Global Impressions scale, $HDRS_{17}$ = 17-item Hamilton Depression Rating Scale, MAAS = Mindful Attention Awareness Scale, MSPSS = Multidimensional Scale of Perceived Social Support, SF-36 = 36-item Short Form Health Survey.

CGI-I, MSPSS (friends subscale), MAAS (the mindfulness scale), and SF-36 (health subscale) with medium to large effect sizes. The small sample size may explain why some of the continuous measurements did not show statistically significant improvement at week 12. Similar to previous studies, there were no serious side effects from the practice of tai chi.[32,33]

There have been a limited number of studies that examined the effects of tai chi in patients with MDD. Tsang et al[34] conducted a small randomized controlled trial of 14 older Chinese patients with depression and reported a positive impact of tai chi on depressive symptoms. Similarly, Cho et al[35] and Chou et al[36] also reported beneficial effects of tai chi on elderly patients with depression. However, these 2 studies did not mention whether the patients were receiving antidepressant medications. Lavretsky et al[37] studied depressed elderly patients who partially responded to antidepressant treatment and found that both tai chi and health education were effective adjunctive treatments. In an earlier study,[38] our team examined the feasibility and outcomes of a tai chi intervention on depressed Chinese American patients. That naturalistic study allowed patients to continue to receive antidepressants and other depression treatments during the tai chi intervention. In that study, we demonstrated the feasibility and acceptability of tai chi in the treatment of depressed Chinese American patients, and reported descriptive outcomes with no formal statistical analyses. In this current study, we used a more sophisticated design to compare the outcomes of 3 groups: a tai chi intervention group, an active control group that received the same number of sessions of psychoeducation, and a waitlisted group. To investigate the efficacy of tai chi as monotherapy for treatment of MDD, the current study excluded patients receiving antidepressant, psychotherapy, or complementary and alternative treatments and those who were practicing other mind-body interventions. Outcomes from this current study show that tai chi, as the primary treatment, provided significant improvement in treatment response over both active and passive control groups for Chinese Americans with MDD. If confirmed by future studies with larger sample sizes, the findings from this study could have a significant clinical and public health impact. Tai chi, a culturally sanctioned folk treatment, could be used as a primary treatment for depressed Chinese and Chinese Americans who tend to avoid mental health services. Tai chi could also help to fill the gap of a serious shortage of mental health clinicians, both within and outside of the United States.

In recruiting for this study, we advertised using "tai chi for stress reduction," and the Chinese community responded positively as tai chi is a popular practice for both physical and mental well-being. Tai chi is not associated with the

negative stigma that Chinese American patients typically associate with mental health services. At baseline evaluation, all participants had positive expectations of tai chi, ranging from "maybe" to "yes" and "definite," supporting our hypothesis that the Chinese community has confidence in tai chi to promote health and mental well-being.

There are a number of limitations of this study. First, at week 12, the significant improvement in both response and remission in MDD was demonstrated only when the tai chi intervention group was compared to the waitlisted group. When compared to the education group, the tai chi group showed statistically significant improvement in response, but not in remission. To evaluate whether tai chi improved remission over an attention control group would require a larger sample size to allow more accurate estimation of response and remission rates and an adequately powered study.

Second, multiple statistical analyses were performed to compare the outcomes of continuous outcome measurements used in this study, which may lead to false positives or type I error. Third, there was a considerable drop-out rate, 15 patients (22%) dropped out after randomization. Nevertheless, most participants (75%) persisted through the end of the 12-week intervention and described highly positive personal experiences with learning and practicing tai chi (which will be reported elsewhere using qualitative analyses).

Fourth, the intervention group and 2 control groups were not blinded in their randomization status, which, for patients in the control groups, might have manifested expectancy effects owing to patients' thinking they have to wait for the "active" treatment. Such an effect may affect the waitlisted group more because the education group could be considered an active treatment.

Finally, as patients in this study were predominantly recent Chinese immigrants, we cannot be sure whether these results would generalize to other populations. Further studies will be needed to examine if tai chi is effective for treating depression in the mainstream population and in other ethnic minority groups that may or may not share similar positive expectations of the intervention. Overall, since this is a pilot, single blinded study with a small sample size and participants who were aware of their intervention assignment, the findings should be considered preliminary. Nevertheless, we are encouraged by the improvement in treatment response shown by the tai chi intervention despite a relatively small sample size.

With respect to further investigation, we note that interventions such as tai chi involve a complex system of movement, breathing, concentration, mindfulness, and psychosocial interactions.[39] Future studies with larger sample sizes and better concealment of the targeted intervention (eg, the study involving tai chi and other treatment modalities) will be needed to confirm these findings and to determine which components of tai chi may be responsible for its effects. The addition of objective physiological measurements (eg, biological markers associated with stress such as salivary cortisol and proinflammatory cytokines in peripheral blood) is also likely to further elucidate the mechanisms of mind-body interventions such as tai chi on depression.

CONCLUSIONS

A 12-week tai chi intervention is safe and feasible and shows promise in improving depression outcomes in Chinese Americans with MDD. If confirmed by more definitive studies, tai chi could be a valuable treatment option for depressed Chinese Americans who prefer a culturally sanctioned intervention.

Submitted: February 26, 2016; accepted July 11, 2016.

Potential conflicts of interest: **Dr Wayne** is the founder and sole owner of the Tree of Life Tai Chi Center and his interests were reviewed and are managed by Brigham and Women's Hospital in accordance with their conflicts of interests policies. **Dr Denninger** holds a position at the Benson-Henry Institute for Mind Body Medicine at MGH, which is paid by patients and their insurers for running the SMART-3RP and related relaxation/mindfulness clinical programs; markets related products such as books, DVDs, CDs and the like; and holds a patent pending (PCT/US2012/049539 filed August 3, 2012) entitled "Quantitative Genomics of the Relaxation Response"; and receives research support in the form of an investigator-initiated grant from Onyx/Amgen and devices from Basis/Intel. **Dr Fricchione** receives book royalties from Johns Hopkins University Press; has received speaker honorarium from Loma Linda University, Meridian Healthcare/Jersey Shore MC, Tallahassee United Way, and Oregon Health Science University; and has a patent pending with Doctors Renaissance Hospital, Texas, on PCT/US2012/049539 (filed August 3, 2012) entitled "Quantitative Genomics of the Relaxation Response." **Dr Alpert** has received research support from Abbott, Alkermes, Lichtwer, Lorex, Aspect Medical Systems, AstraZeneca, Bristol-Myers Squibb, Cephalon, Cyberonics, Eli Lilly, Forest, GlaxoSmithKline, Johnson & Johnson, National Institutes of Health, National Alliance for Research on Schizophrenia and Depression (NARSAD), Novartis, Organon, Pamlab, Pfizer, Pharmavite, Roche, Sanofi-Synthelabo, Solvay, and Wyeth-Ayerst; has participated on advisory boards or consulted for Eli Lilly, Luye, Pamlab, and Pharmavite; has received speakers' honoraria from Eli Lilly, Xian-Janssen, Organon, Psicofarma, Massachusetts General Hospital (MGH) Academy, Reed Medical Education, Primedia, Nevada Psychiatric Association, American Society of Clinical Psychopharmacology, and American Psychiatric Association; and has received editorial fees from Belvoir Publishing. **Dr Fava**'s lifetime disclosures are described below, and they can also be viewed online at http://mghcme.org/faculty/faculty-detail/maurizio_fava. He has received research support from Abbott, Alkermes, American Cyanamid, Aspect Medical Systems, AstraZeneca, Avanir, Bio Research, BrainCells, Bristol-Myers Squibb, CeNeRx BioPharma, Cephalon, Cerecor, Clintara, Covance, Covidien, Eli Lilly, EnVivo, Euthymics Bioscience, Forest, FORUM, Ganeden Biotech, GlaxoSmithKline, Harvard Clinical Research Institute, Hoffman-LaRoche, Icon Clinical Research, i3 Innovus/Ingenix, Janssen R&D, Jed Foundation, Johnson & Johnson R&D, Lichtwer, Lorex, Lundbeck, MedAvante, Methylation Sciences, NARSAD, National Center for Complementary and Alternative Medicine, National Coordinating Center for Integrated Medicine, National Institute on Drug Abuse (NIDA), National Institute of Mental Health, Neuralstem, Novartis, Organon, Pamlab, Pfizer, Pharmacia & Upjohn, Pharmaceutical Research Associates, Pharmavite, PharmoRx Therapeutics, PhotoThera, Reckitt Benckiser, Roche, RCT Logic (formerly Clinical Trials Solutions), Sanofi-Aventis US, Shire, Solvay, Stanley Medical Research Institute, Synthelabo, Takeda, Tal Medical, and Wyeth-Ayerst; has received advisory board/consultant fees from Abbott, Acadia, Affectis, Alkermes, Amarin, Aspect Medical Systems, AstraZeneca, Auspex, Avanir, AXSOME, Bayer, Best Practice Project Management, Biogen, BioMarin, Biovail, BrainCells, Bristol-Myers Squibb, CeNeRx BioPharma, Cephalon, Cerecor, CNS Response, Compellis, Cypress, DiagnoSearch Life Sciences, Dainippon Sumitomo, DOV, Edgemont, Eisai, Eli Lilly, EnVivo, ePharmaSolutions, EPIX, Euthymics Bioscience, Fabre-Kramer, Forest, FORUM, GenOmind, GlaxoSmithKline, Grunenthal, i3 Innovus/Ingenix, Intracellular, Janssen, Jazz, Johnson & Johnson R&D, Knoll, LaboPharm, Lorex, Lundbeck, MedAvante, Merck, Methylation Sciences, Naurex, Nestle Health Sciences, Neuralstem, Neuronetics, NextWave, Novartis, Nutrition 21, Orexigen, Organon, Osmotica, Otsuka, Pamlab, Pfizer, PharmaStar, Pharmavite, PharmoRx, Precision Human Biolaboratory, Prexa, Pharmaceutical Product Development (PPD), PureTech Ventures, PsychoGenics, Psylin Neurosciences, RCT Logic (formerly Clinical Trials Solutions), Rexahn, Ridge Diagnostics,

Roche, Sanofi-Aventis US, Sepracor, Servier, Schering-Plough, Solvay, Somaxon, Somerset, Sunovion, Supernus, Synthelabo, Taisho, Takeda, Tal Medical, Tetragenex, TransForm, Transcept, Vanda, and VistaGen; has received speaking/publishing fees from Adamed, Advanced Meeting Partners, American Psychiatric Association, American Society of Clinical Psychopharmacology, AstraZeneca, Belvoir Media Group, Boehringer Ingelheim, Bristol-Myers Squibb, Cephalon, CME Institute/Physicians Postgraduate Press, Eli Lilly, Forest, GlaxoSmithKline, Imedex, MGH Psychiatry Academy/PriMedia, MGH Psychiatry Academy/Reed Elsevier, Novartis, Organon, Pfizer, PharmaStar, United BioSource, and Wyeth-Ayerst; has equity holdings in Compellis and PsyBrain; and receives royalty/patent or other income from Patents for Sequential Parallel Comparison Design (SPCD), licensed by MGH to PPD; and patent application for a combination of Ketamine plus Scopolamine in MDD, licensed by MGH to Biohaven; and holds the copyrights for the MGH Cognitive & Physical Functioning Questionnaire (CPFQ), Sexual Functioning Inventory (SFI), Antidepressant Treatment Response Questionnaire (ATRQ), Discontinuation-Emergent Signs & Symptoms (DESS), Symptoms of Depression Questionnaire (SDQ), and SAFER, and from Lippincott, Williams & Wilkins; Wolkers Kluwer; and World Scientific Publishing. **Drs Yeung**, **Yeh**, **Baer**, **Lee**, and **Benson** and **Ms Feng** and **Mr Kim** have no conflicts of interest to report.

Funding/support: The study was supported by an R21AT006123 grant from National Center for Complementary and Integrative Health**,** Bethesda, MD 20892-2182.

Role of the sponsor: The National Center for Complementary and Integrative Health provided oversight in the reliable implementation of the study protocol and accurate documentation of the study processes.

Previous presentation: Presented at the American Psychiatric Association annual meeting; May 16–20, 2015; Toronto, Ontario, Canada ▪ Society for the Study of Psychiatry and Culture annual meeting; April 23–25, 2015; Providence, Rhode Island.

REFERENCES

1. Surgeon General. U.S. Department of Health and Human Services: Mental Health: A Report of the Surgeon General–Executive Summary. Rockville, MD: US Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Mental Health Services, National Institutes of Health, National Institute of Mental Health; 1999.
2. Yeung A, Chang D, Gresham RL Jr, et al. Illness beliefs of depressed Chinese American patients in primary care. J Nerv Ment Dis. 2004;192(4):324–327.
3. Yeung A, Chan R, Mischoulon D, et al. Prevalence of major depressive disorder among Chinese-Americans in primary care. Gen Hosp Psychiatry. 2004;26(1):24–30.
4. Yeung A, Yu SC, Fung F, et al. Recognizing and engaging depressed Chinese Americans in treatment in a primary care setting. Int J Geriatr Psychiatry. 2006;21(9):819–823.
5. Qian G, Xue K, Tang L, et al. Mitigation of oxidative damage by green tea polyphenols and Tai Chi exercise in postmenopausal women with osteopenia. PLoS One. 2012;7(10):e48090.
6. Benson H, Dryer T, Hartley LH. Decreased VO2 consumption during exercise with elicitation of the relaxation response. J Human Stress. 1978;4(2):38–42.
7. Peng CK, Mietus JE, Liu Y, et al. Exaggerated heart rate oscillations during two meditation techniques. Int J Cardiol. 1999;70(2):101–107.
8. Swaab DF, Bao AM, Lucassen PJ. The stress system in the human brain in depression and neurodegeneration. Ageing Res Rev. 2005;4(2):141–194.
9. Yehuda R, Giller EL, Southwick SM, et al. Hypothalamic-pituitary-adrenal dysfunction in posttraumatic stress disorder. Biol Psychiatry. 1991;30(10):1031–1048.
10. Li F, Harmer P, Chaumeton NR, et al. Tai Chi as a means to enhance self-esteem: a randomized controlled trial. *J Appl Gerontol*. 2002;21(1):70–89.
11. Sandlund ES, Norlander T. The effects of Tai Chi chuan relaxation and exercise on stress responses and well-being: an overview of research. *Int J Stress Manag*. 2000;7(2):139–149.
12. Lam LC, Chau RC, Wong BM, et al. Interim follow-up of a randomized controlled trial comparing Chinese style mind body (Tai Chi) and stretching exercises on cognitive function in subjects at risk of progressive cognitive decline. *Int J Geriatr Psychiatry*. 2011;26(7):733–740.
13. Matthews MM, Williams HG. Can Tai chi enhance cognitive vitality? a preliminary study of cognitive executive control in older adults after a Tai chi intervention. *J S C Med Assoc*. 2008;104(8):255–257.
14. Wang WC, Zhang AL, Rasmussen B, et al. The effect of Tai Chi on psychosocial well-being: a systematic review of randomized controlled trials. *J Acupunct Meridian Stud*. 2009;2(3):171–181.
15. Wang F, Lee EK, Wu T, et al. The effects of tai chi on depression, anxiety, and psychological well-being: a systematic review and meta-analysis. *Int J Behav Med*. 2014;21(4):605–617.
16. American Psychiatric Association. *Diagnostic and Statistical Manual for Mental Disorders*. Fourth Edition. Washington, DC: American Psychiatric Association; 1994.
17. Hamilton M. A rating scale for depression. *J Neurol Neurosurg Psychiatry*. 1960;23:56–62.
18. Ryder AG, Goldbloom DS, Schuller DR, et al. Use of psychometric principles in evaluating the Hamilton Depression Rating Scale. *Directions in Psychiatry*. 2005;25(4):241–255.
19. Kam ESI, Leung CM, Chung D, et al. The Chinese-bilingual SCID-I/P Project: stage 1—reliability for mood disorders and schizophrenia. *Hong Kong J Psychiatry*. 2003;13(1):7–18.
20. Yang JM. *Taijiquan, Classical Yang Style: The Complete Form and Qigong*. Boston, MA: YMAA Publication Center; 1999.
21. Guy W. *ECDEU Assessment Manual for Psychopharmacology*. Revised Edition. Washington, DC: US Department of Health, Education, and Welfare; 1976.
22. Gandek B, Sinclair SJ, Kosinski M, et al. Psychometric evaluation of the SF-36 health survey in Medicare managed care. *Health Care Financ Rev*. 2004;25(4):5–25.
23. Yang Z, Li W, Tu X, et al. Validation and psychometric properties of Chinese version of SF-36 in patients with hypertension, coronary heart diseases, chronic gastritis and peptic ulcer. *Int J Clin Pract*. 2012;66(10):991–998.
24. Langer E, Moldoveanu M. Construct of mindfulness. *J Soc Issues*. 2000;56:1–9.
25. Black DS, Sussman S, Johnson CA, et al. Psychometric assessment of the Mindful Attention Awareness Scale (MAAS) among Chinese adolescents. *Assessment*. 2012;19(1):42–52.
26. Zimet GD, Dahlem NW, Zimet SG, et al. The Multidimensional Scale of Perceived Social Support. *J Pers Assess*. 1988;52(1):30–41.
27. Zimet GD, Powell SS, Farley GK, et al. Psychometric characteristics of the Multidimensional Scale of Perceived Social Support. *J Pers Assess*. 1990;55(3–4):610–617.
28. Zheng YP, Zhao JP, Phillips M, et al. Validity and reliability of the Chinese Hamilton Depression Rating Scale. *Br J Psychiatry*. 1988;152:660–664.
29. Vincent CA. Credibility assessment in trials of acupuncture. *Complementary Medical Research*. 1990;4(1):8–11.
30. Trivedi MH, Rush AJ, Wisniewski SR, et al; STAR*D Study Team. Evaluation of outcomes with citalopram for depression using measurement-based care in STAR*D: implications for clinical practice. *Am J Psychiatry*. 2006;163(1):28–40.
31. SPSS Statistics for Windows, Version 20.0 [computer program]. Armonk, NY: IBM Corp; 2011.
32. Channer KS, Barrow D, Barrow R, et al. Changes in haemodynamic parameters following Tai Chi Chuan and aerobic exercise in patients recovering from acute myocardial infarction. *Postgrad Med J*. 1996;72(848):349–351.
33. Wolf SL, O'Grady M, Easley KA, et al. The influence of intense Tai Chi training on physical performance and hemodynamic outcomes in transitionally frail, older adults. *J Gerontol A Biol Sci Med Sci*. 2006;61(2):184–189.
34. Tsang HW, Mok CK, Au Yeung YT, et al. The effect of Qigong on general and psychosocial health of elderly with chronic physical illnesses: a randomized clinical trial. *Int J Geriatr Psychiatry*. 2003;18(5):441–449.
35. Cho KL. Effect of Tai Chi on depressive symptoms amongst Chinese older patients with major depression: the role of social support. *Med Sport Sci*. 2008;52:146–154.
36. Chou KL, Lee PW, Yu EC, et al. Effect of Tai Chi on depressive symptoms amongst Chinese older patients with depressive disorders: a randomized clinical trial. *Int J Geriatr Psychiatry*. 2004;19(11):1105–1107.
37. Lavretsky H. Tai Chi boosts efficacy of antidepressant therapy in older adults. New Clinical Drug Evaluation Unit, 50th Anniversary meeting. 2010. Boca Raton, Florida.
38. Yeung A, Lepoutre V, Wayne P, et al. Tai chi treatment for depression in Chinese Americans: a pilot study. *Am J Phys Med Rehabil*. 2012;91(10):863–870.
39. Wayne PM, Kaptchuk TJ. Challenges inherent to Tai Chi research: part II-defining the intervention and optimal study design. *J Altern Complement Med*. 2008;14(2):191–197.