Received: 15 July 2016 | Revised: 30 August 2017 | Accepted: 12 September 2017

DOI: 10.1111/appy.12301

WILEY ASIA-PACIFIC PSYCHIATRY Official journal of the Pacific Rim College of Psychiatrists

ORIGINAL ARTICLE

A nonpharmacological approach to improve sleep quality in older adults

Iris Rawtaer MBBS, MMed, MCI[1] | Rathi Mahendran MBBS, MMed, M Med Ed, FAMS[1,2] | Hui Yu Chan B.Soc.Sci. (Hons.)[2] | Feng Lei MD, PhD[2] | Ee Heok Kua MBBS, MD, FRCPsych[1,2]

[1] Department of Psychological Medicine, National University Hospital, Singapore

[2] Department of Psychological Medicine, Yong Loo Lin School of Medicine, National University of Singapore, Singapore

Correspondence
Iris Rawtaer, Master of Medicine (Psychiatry), Department of Psychological Medicine, National University Hospital, Level 9 1E, Kent Ridge Road 119228, Singapore.
Email: iris_rawtaer@nuhs.edu.sg, iris_rawtaer@hotmail.com

Funding information
Lee Kim Tah Holdings Ltd, Kwan ImThong Hood Cho Temple, Buddhist Library, and Alice Lim Memorial Fund

Objectives: Poor sleep quality is highly prevalent among older adults and is associated with poor quality of life, cognitive and physical decline, depression, and increased mortality. Medication options commonly used are not ideal, and alternative treatment strategies are needed. We evaluate a community-based psychosocial intervention program and its effect on sleep quality in older adults.

Method: Elderly participants aged 60 and above were included. Those with Geriatric Depression Scale and Geriatric Anxiety Inventory scores above 5 and 10, respectively, were excluded. The community program included tai chi exercise, art therapy, mindfulness awareness practice, and music reminiscence therapy. Pittsburgh Sleep Quality Index, Geriatric Depression Scale, and Geriatric Anxiety Inventory were administered at baseline and at 1 year.

Results: A hundred and eighty-nine subjects (44 men, 145 women; mean age = 69 years, SD = 5.7, range = 60-89) participated. The proportion of participants with good sleep quality had increased from 58.2% to 64.6%. Sleep disturbance was significantly reduced (baseline, 1.04; postintervention, 0.76; mean difference 0.28; $P < .01$); men experienced greater improvement ($P < .001$). Improvements were independent of changes in depressive and anxiety symptoms.

Conclusion: Participation in this community program led to positive effects on sleep disturbances after a year. Psychosocial interventions have potential as a nondrug intervention approach for sleep problems, and further research is needed to understand its mediating mechanisms

KEYWORDS

mind-body therapies, sleep, aged, aging in place, Asia

1 | INTRODUCTION

Aging is associated with changes in sleep physiology such as changes in sleep wake architecture and endogenous circadian rhythms (Ohayon, Carskadon, Guilleminault, & Vitiello, 2004; Prinz, Vitiello, Raskind, & Thorpy, 1990; Van Someren, 2000). In addition, increased risk of physical illnesses, psychiatric illnesses, polypharmacy, and multiple life changes compound the propensity for older people to have sleep difficulties (Ancoli-Israel, Ayalon, & Salzman, 2008; Wennberg, Canham, Smith, & Spira, 2013). Previous epidemiological studies indicate that sleep complaints are prevalent in community dwelling older adults (Barbar et al., 2000; Ganguli, Reynolds, & Gilby, 1996; Ohayon & Vecchierini, 2002; Ohayon, Zulley, Guilleminault, Smirne, & Priest, 2001). Sleep disturbances are associated with adverse consequences such as poorer quality of life, cognitive and physical decline, depression, falls, institutionalization, and death (Brassington, King, & Bliwise, 2000; Cricco, Simonsick, & Foley, 2001; Jelicic et al., 2002; Pollak, Perlick, Linsner, Wenston, & Hsieh, 1990; Roberts, Shema, & Kaplan, 1999; Schubert et al., 2002). Benzodiazepines and nonbenzodiazepine hypnotics are commonly used to treat sleep problems in older people (Roehrs & Roth, 2012). However, long-term hypnotic use is associated with developing tolerance or dependence, rebound insomnia, residual daytime sedation, cognitive impairment, and falls (Wennberg et al., 2013). While there is good evidence for cognitive behavioral therapy for insomnia (Okajima, Komada, & Inoue, 2011), there is often resistance to this among local

older people. There is a need for effective, acceptable treatment options to optimize sleep quality in older adults, and mind-body interventions are gaining traction (Kozasa et al., 2010). In recent randomized controlled trials of elderly participants, positive effects on sleep were reported with interventions such as yoga, tai chi, mindfulness, and music (Nguyen & Kruse, 2012; Ong et al., 2014; Shum, Taylor, Thayala, & Chan, 2014).

A community-based mental health promotion program for community-dwelling older people was established in Singapore to provide psychosocial interventions such as tai chi exercise, mindfulness awareness practice, music reminiscence, and art therapy (AT) (Wu et al., 2014). We hypothesized that participants would benefit from these programs and preliminary results indicate a positive effect on subthreshold depressive and anxiety symptoms (Kua, Mahendran, Feng, Tian, & Ng, 2013; Rawtaer et al., 2015). In this study, we report on the sleep quality of this cohort of older adults after a year of participation in this program.

2 | METHODS

2.1 | Design and participants

This is a naturalistic study reporting on the outcomes of participants of a community-based mental health promotion program.

Participants were recruited from a geographically defined area in Western Singapore based on the following inclusion criteria: 60 years of age and above, able to communicate in either English or Mandarin, and able and willing to provide written informed consent.

Exclusion criteria were Geriatric Depression Scale > 5, Geriatric Anxiety Inventory (GAI) > 10, and fulfilled DSM IV criteria for a major psychiatric disorder.

2.2 | Procedures

Details of the procedures have been described in a previous publication (Rawtaer et al., 2015). Briefly, all activities were delivered at the Training and Research Academy, a research center located at a shopping center. The participants would receive health education talks including but not limited to chronic disease management and healthy lifestyle advice. The participants would then engage in a combination of tai chi exercise, mindfulness awareness practice, AT, and music reminiscence therapy for 1 to 2 hours. Activities were conducted weekly for 10 weeks, fortnightly for 18 weeks, and monthly for the rest of the year. All groups were conducted by qualified instructors, including certified art psychotherapists and tai chi master trainers with over 10 years of experience.

2.3 | Group activities

2.3.1 | Music reminiscence

An instructor would facilitate discussion of past events or experiences after a sing along of popular evergreen songs. While music was the focus of reminiscence, other prompts were used, including photographs and pictures.

2.3.2 | Mindfulness awareness practice

The participants were guided through mindfulness meditation focusing on body sensations, feelings, and thoughts. They were instructed on various techniques including mindfulness of the senses, body scan practice, walking meditation, "movement nature meant" practice, and visuomotor limb tasks.

2.3.3 | Tai chi exercise

The participants were taught traditional Sun and Yang styles of tai chi. Instructors would take the participants through warm up exercises for 5 minutes, tai chi movements and form for 20 minutes, and cool down exercises for 5 minutes.

2.3.4 | Art therapy

Art therapists would focus on the narrative aspects of AT rather than the creative aspects. The participants were not expected to create an art piece in the limited time. Rather, they were shown an art piece to appreciate and they would reflect on their inner thoughts and experiences.

2.4 | Measures

2.4.1 | Pittsburg Sleep Quality Index

The Pittsburg Sleep Quality Index (PSQI) (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) is a widely used, 19 item self-report measure of sleep quality over the past month. It consists of 7 component scores (ranging from 0 to 3), measuring subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The 7 component scores are summed to give a global PSQI score ranging from 0 to 21, with higher scores reflecting greater overall sleep disturbance. A global PSQI score of 5 or more indicates poor sleep quality. English and Chinese questionnaires were available to the participants. Trained research staff were on hand to provide explanation when queries arose. The PSQI was administered at baseline (T0) and at 1 year (T1).

2.5 | Statistical analyses

Differences between component and total scores of the PSQI at baseline and 1 year were compared by using paired *t*-tests (normality assumptions were satisfied). Change scores were calculated as postmeasurement scores minus premeasurement scores with a negative change representing an improvement in sleep quality, depressive symptoms, and anxiety symptoms. Univariate analyses were performed to evaluate the association between age, gender, marital status, employment status, living arrangements, attendance rates, depression scores, anxiety scores, and improvements in sleep quality. Factors found to be significant in univariate analyses were included as covariates in a multiple linear regression model with improvement of sleep quality as the dependent variable. All analyses were carried out by using the Statistical Package for the Social Sciences (SPSS version 20) software.

3 | Results

3.1 | Participant characteristics

Of 200 older adults screened, 189 participants were recruited into this study. The mean age of participants was 69.3 ± 5.7 years (range 60-89): 145 were female and 44 were male. The participants received a mean of 5.6 ± 4.4 years of schooling. All participants were of Chinese ethnicity. Participants' baseline characteristics are shown in Table 1. Mean attendance rates of the program was 83.6%.

3.2 | Changes in sleep quality

At baseline, 110 (58.2%) of the participants had good sleep quality as indicated by a global PSQI score less than 5. At 1 year, 122 (64.6%) had good sleep quality. There was a marginal decline of poor sleepers, indicated by a global PSQI score of more than 5, from 56 (29.6%) to 53 (28%). Overall, 73 (48%) of participants had some improvement in their global sleep quality indicated by reduction in global PSQI scores. The 7 PSQI component scores and total scores at baseline and at 1 year is shown in Table 2. Sleep disturbance was significantly reduced (baseline, 1.04; postintervention, 0.76; mean difference 0.28; $P < 0.01$). No statistically significant changes were detected for the 6 other component scores and the total PSQI score.

TABLE 1 Baseline participant characteristics

	n (%)
Gender	
Female	145 (76.7)
Education	
None	62 (32.8)
Primary	76 (40.2)
Secondary	39 (20.6)
Tertiary or more	12 (6.3)
Marital Status[a]	
Single	6 (3.2)
Married	122 (64.6)
Divorced/separated	13 (6.9)
Widowed	47 (24.9)
Employment Status[a]	
Full-time employment	11 (5.8)
Part-time employment	19 (10.1)
Retired	97 (51.3)
Homemaker	59 (31.2)
Living Arrangement	
Living alone	25 (13.2)
Living with others	164 (86.7)
Housing Type[b]	
One to 2 room PH	10 (5.3)
Three room PH	30 (50.9)
Four to 5 room PH	131 (69.3)
Executive maisonette	12 (6.3)
Private housing	3 (1.6)
	Mean (SD)
Baseline GDS score	1.92 (1.89)
Baseline GAI score	1.40 (2.65)

Note: GDS indicates Geriatric Depression Scale; GAI, Geriatric Anxiety Inventory; PH, public housing.

[a]Frequency may not add up to 189 due to missing responses.

[b]Housing type is used as a rough gauge for socioeconomic status, ie, 1 to 2 room PH to lowest tier and private housing to highest tier

3.3 | Factors associated with change in sleep quality

Male gender was associated with greater improvements in overall sleep quality (global PSQI scores) and sleep disturbance (Table 3). Attendance weakly correlated with change in sleep disturbance ($r = -0.16$, $P < 0.05$). In multivariate linear regression, male gender and higher attendance rates remained significantly associated with greater improvements in sleep disturbance. In this model, adjustments for age, anxiety, depression, and baseline sleep disturbance were made. Male gender had a negative effect on sleep disturbance (ie, reduction of sleep disturbance) with a β coefficient −0.40 (−0.60 to −0.19) ($P < 0.001$). Attendance rates also had a negative effect on sleep disturbance with a β coefficient −0.06 (−0.12 to −0.001) ($P = 0.02$). Geriatric Depression Scale and GAI change scores were not associated with change in sleep disturbance.

4 | DISCUSSION

At baseline, almost two thirds of participants had good sleep quality. While this is not in keeping with previous western population studies that indicate sleep problems are highly prevalent in the community (Foley et al., 1995; Foley, Ancoli-Israel, Britz, & Walsh, 2004), it is consistent with several studies evaluating Asian cohorts (Chen, Su, & Chou, 2013; Haseli-Mashhadi et al., 2009). The participants (48%) experienced reduction in global PSQI scores. One would expect that the psychosocial interventions delivered in this program to positively impact sleep onset, sleep efficiency, or overall sleep quality. However, our findings only indicate a significant positive effect on the domain of sleep disturbance—a domain that includes difficulty initiating sleep among other somatic factors such as snoring, nightmares, nocturia, pain, and breathing difficulties. This is an interesting finding and may point toward the biologic effects of the relaxation-response elicitation (Bhasin et al., 2013) including changes in energy metabolism and inflammatory responses. Moreover, evidence suggests that mindfulness and tai-chi are beneficial for pain reduction (Yan et al., 2013; Zeidan, Grant, Brown, Mchaffie, & Coghill, 2012)

Depression and anxiety are known to be associated with sleep problems (Jansson-Fröjmark & Lindblom, 2008; Yu et al., 2016), and it was important to evaluate if improvement in sleep disturbance was due to improvement in depressive and anxiety symptoms. We found that improvements in sleep disturbance were independent of the improvement in Geriatric Depression Scale and GAI scores. This is consistent with other studies evaluating mind body interventions and its effects on sleep (Kozasa et al., 2010; Ong et al., 2014; Shum et al., 2014).

In this study, only gender and attendance rates were factors associated with improvements in sleep disturbance. Higher attendance

TABLE 2 Changes in sleep measures

	Baseline (T0) Mean ± SD	1 Year (T1) Mean ± SD	Mean Difference ± SD
PSQI total score	4.68 ± 3.34	4.45 ± 3.42	−0.24 ± 4.82
Component Scores			
Duration of sleep	0.84 ± 0.93	0.85 ± 0.96	0.01 ± 1.3
Sleep latency	1.13 ± 1.11	1.06 ± 1.08	−0.07 ± 1.48
Sleep disturbance	1.04 ± 0.58	0.76 ± 0.59	−0.28 ± 0.85*
Daytime dysfunction	0.24 ± 0.56	0.28 ± 0.59	0.04 ± 0.77
Habitual sleep efficiency	0.63 ± 0.99	0.69 ± 0.99	0.06 ± 1.39
Subjective sleep quality	0.87 ± 0.68	0.81 ± 0.70	−0.06 ± 1.02
Use of sleep medication	0.04 ± 0.29	0.02 ± 0.15	−0.02 ± 0.33

*$P < .01$.

TABLE 3 Results of *t*-test for difference in global PSQI and difference in sleep disturbance by gender

	Sex						95% CI for Mean Difference	
	Male			Female				
	Mean	SD	N	Mean	SD	N		*t*
Global PSQI difference (T1-T0)	−1.38	2.47	32	0.00	3.21	120	−2.58, −0.17	−2.25*
Sleep disturbance difference (T1-T0)	−0.59	0.60	37	−0.13	0.72	125	−0.73, −0.21	−3.60**

*$P < .05$.

**$P < .001$.

rates correlated with more improvements in sleep disturbances, albeit a very weak correlation. Information on exposure to these interventions prior to the program and practice in between intervention sessions was not captured; it would have been useful to evaluate if regular practice in between sessions would have a stronger correlation with improvements and if prior exposure affects the degree of improvement. Male gender was associated with greater improvements in overall sleep quality and sleep disturbances. Gender differences have been noted in earlier sleep research (Ancoli-Israel & Martin, 2006; Foley et al., 1995; Ohayon et al., 2001) with chronic insomnia independently predicting cognitive decline in men (Cricco et al., 2001). Further evaluation is necessary to identify if psychosocial interventions have gender-specific effects on sleep quality.

As discussed in our earlier publication (Rawtaer et al., 2015), the strengths of this program are its acceptability and accessibility. Utilizing activities with a strong eastern influence ensures that it is more appealing to local older people who tend to be resistant to traditional psychotherapy approaches such as cognitive behavioral therapy. Limitations of the study include its small sample size. Information on sleep quality was obtained via self-report, and there was no objective measurement of sleep such as polysomnography. Combination interventions limit our ability to determine which among the different activities were most useful for improving sleep quality. Lastly, it was a purely observational study and there was no control group. However, the program was initially conceptualized as a service. Moving forward, we may consider quasi-experimental designs in our evaluation of similar programs being replicated across community centers in Singapore. Randomized controlled trials of individual psychosocial interventions such as mindfulness, horticulture, and choral singing are also underway.

5 | CONCLUSION

This approach was beneficial for improving sleep disturbances in community dwelling older adults. Given the longer-term consequences associated with poor sleep including falls, physical decline, cognitive decline, and poorer quality of life, it is important to intervene early for sleep difficulties. Psychosocial interventions are a viable alternative that needs to be more rigorously evaluated in both subclinical and clinical populations.

ACKNOWLEDGMENTS

The Jurong Ageing Study in Singapore (JASS) is funded by Lee Kim Tah Holdings Ltd, Kwan Im Thong Hood Cho Temple, Buddhist Library, and Alice Lim Memorial Fund. We thank the donors and volunteers from NUS, Presbyterian Community Services, and Singapore Action Group of Elders (SAGE) Counselling Centre. We acknowledge A/Prof Goh Lee Gan, A/Prof Lau Tang Ching, and Wong Lit Soon for their technical assistance and contributions. Special thanks to Fadzillah Nur Mohamed Abdullah for data management.

REFERENCES

Ancoli-Israel, S., Ayalon, L., & Salzman, C. (2008). Sleep in the elderly: Normal variations and common sleep disorders. *Harvard Review of Psychiatry*, *16*, 279–286.

Ancoli-Israel, S., & Martin, J. L. (2006). Insomnia and daytime napping in older adults. *Journal of Clinical Sleep Medicine*, *2*, 333–342.

Barbar, S. I., Enright, P. L., Boyle, P., Foley, D., Sharp, D. S., Petrovitch, H., & Quan, S. F. (2000). Sleep disturbances and their correlates in elderly Japanese American men residing in Hawaii. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, *55*, M406–M411.

Bhasin, M. K., Dusek, J. A., Chang, B.-H., Joseph, M. G., Denninger, J. W., Fricchione, G. L., … Libermann, T. A. (2013). Relaxation response induces temporal transcriptome changes in energy metabolism, insulin secretion and inflammatory pathways. *PloS One*, *8*. e62817

Brassington, G. S., King, A. C., & Bliwise, D. L. (2000). Sleep problems as a risk factor for falls in a sample of community-dwelling adults aged 64-99 years. *Journal of the American Geriatrics Society*, *48*, 1234–1240.

Buysse, D. J., Reynolds, C. F., Monk, T. H. 3rd, Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research*, *28*, 193–213.

Chen, H.-C., Su, T.-P., & Chou, P. (2013). A nine-year follow-up study of sleep patterns and mortality in community-dwelling older adults in Taiwan. *Sleep*, *36*, 1187.

Cricco, M., Simonsick, E. M., & Foley, D. J. (2001). The impact of insomnia on cognitive functioning in older adults. *Journal of the American Geriatrics Society*, *49*, 1185–1189.

Foley, D., Ancoli-Israel, S., Britz, P., & Walsh, J. (2004). Sleep disturbances and chronic disease in older adults: Results of the 2003 National Sleep Foundation Sleep in America Survey. *Journal of Psychosomatic Research*, *56*, 497–502.

Foley, D. J., Monjan, A. A., Brown, S. L., Simonsick, E. M., Wallace, R. B., & Blazer, D. G. (1995). Sleep complaints among elderly persons: An epidemiologic study of three communities. *Sleep*, *18*, 425–432.

Ganguli, M., Reynolds, C. F., & Gilby, J. E. (1996). Prevalence and persistence of sleep complaints in a rural older community sample: The MoVIES project. *Journal of the American Geriatrics Society*, *44*, 778–784.

Haseli-Mashhadi, N., Dadd, T., Pan, A., Yu, Z., Lin, X., & Franco, O. H. (2009). Sleep quality in middle-aged and elderly Chinese: Distribution, associated factors and associations with cardio-metabolic risk factors. *BMC Public Health*, *9*, 1.

Jansson-Fröjmark, M., & Lindblom, K. (2008). A bidirectional relationship between anxiety and depression, and insomnia? A prospective study in the general population. *Journal of Psychosomatic Research*, *64*, 443–449.

Jelicic, M., Bosma, H., Ponds, R. W., Van Boxtel, M. P., Houx, P. J., & Jolles, J. (2002). Subjective sleep problems in later life as predictors of cognitive decline. Report from the Maastricht Ageing Study (MAAS). *International Journal of Geriatric Psychiatry*, *17*, 73–77.

Kozasa, E. H., Hachul, H., Monson, C., Pinto, L. Jr., Garcia, M. C., Mello, L. E., & Tufik, S. (2010). Mind-body interventions for the treatment of insomnia: A review. *Revista Brasileira de Psiquiatria*, *32*, 437–443.

Kua, E. H., Mahendran, R., Feng, L., Tian, X., & Ng, T. P. (2013). Preventive psychiatry in late life: Studies on depression and dementia from the Singapore Gerontology Research Programme. *Taiwanese Journal of Psychiatry*, *27*, 267–275.

Nguyen, M. H., & Kruse, A. (2012). A randomized controlled trial of tai chi for balance, sleep quality and cognitive performance in elderly Vietnamese. *Clinical Interventions in Aging*, *7*, 185–190.

Ohayon, M. M., Carskadon, M. A., Guilleminault, C., & Vitiello, M. V. (2004). Meta-analysis of quantitative sleep parameters from childhood to old age in healthy individuals: Developing normative sleep values across the human lifespan. *Sleep*, *27*, 1255–1273.

Ohayon, M. M., & Vecchierini, M. F. (2002). Daytime sleepiness and cognitive impairment in the elderly population. *Archives of Internal Medicine*, *162*, 201–208.

Ohayon, M. M., Zulley, J., Guilleminault, C., Smirne, S., & Priest, R. G. (2001). How age and daytime activities are related to insomnia in the general population: consequences for older people. *Journal of the American Geriatrics Society*, *49*, 360–366.

Okajima, I., Komada, Y., & Inoue, Y. (2011). A meta-analysis on the treatment effectiveness of cognitive behavioral therapy for primary insomnia. *Sleep and Biological Rhythms*, *9*, 24–34.

Ong, J. C., Manber, R., Segal, Z., Xia, Y., Shapiro, S., & Wyatt, J. K. (2014). A randomized controlled trial of mindfulness meditation for chronic insomnia. *Sleep*, *37*, 1553–1563.

Pollak, C. P., Perlick, D., Linsner, J. P., Wenston, J., & Hsieh, F. (1990). Sleep problems in the community elderly as predictors of death and nursing home placement. *Journal of Community Health*, *15*, 123–135.

Prinz, P. N., Vitiello, M. V., Raskind, M. A., & Thorpy, M. J. (1990). Geriatrics: Sleep disorders and aging. *The New England Journal of Medicine*, *323*, 520–526.

Rawtaer, I., Mahendran, R., Yu, J., Fam, J., Feng, L., & Kua, E. H. (2015). Psychosocial interventions with art, music, tai chi and mindfulness for subsyndromal depression and anxiety in older adults: A naturalistic study in Singapore. *Asia-Pacific Psychiatry*, *7*, 240–250.

Roberts, R. E., Shema, S. J., & Kaplan, G. A. (1999). Prospective data on sleep complaints and associated risk factors in an older cohort. *Psychosomatic Medicine*, *61*, 188–196.

Roehrs, T., & Roth, T. (2012). Insomnia pharmacotherapy. *Neurotherapeutics*, *9*, 728–738.

Schubert, C. R., Cruickshanks, K. J., Dalton, D. S., Klein, B. E., Klein, R., & Nondahl, D. M. (2002). Prevalence of sleep problems and quality of life in an older population. *Sleep*, *25*, 889–893.

Shum, A., Taylor, B. J., Thayala, J., & Chan, M. F. (2014). The effects of sedative music on sleep quality of older community-dwelling adults in Singapore. *Complementary Therapies in Medicine*, *22*, 49–56.

Van Someren, E. J. (2000). Circadian and sleep disturbances in the elderly. *Experimental Gerontology*, *35*, 1229–1237.

Wennberg, A. M., Canham, S. L., Smith, M. T., & Spira, A. P. (2013). Optimizing sleep in older adults: treating insomnia. *Maturitas*, *76*, 247–252.

Wu, D. X., Feng, L., Yao, S. Q., Tian, X. F., Mahendran, R., & Kua, E. H. (2014). The early dementia prevention programme in Singapore. *The Lancet Psychiatry*, *1*, 9–11.

Yan, J.-H., Gu, W.-J., Sun, J., Zhang, W.-X., Li, B.-W., & Pan, L. (2013). Efficacy of tai chi on pain, stiffness and function in patients with osteoarthritis: A meta-analysis. *PloS One*, *8*. e61672

Yu, J., Rawtaer, I., Fam, J., Jiang, M. J., Feng, L., Kua, E. H., & Mahendran, R. (2016). Sleep correlates of depression and anxiety in an elderly Asian population. *Psychogeriatrics*, *16*, 191–195.

Zeidan, F., Grant, J., Brown, C., Mchaffie, J., & Coghill, R. (2012). Mindfulness meditation-related pain relief: evidence for unique brain mechanisms in the regulation of pain. *Neuroscience Letters*, *520*, 165–173.

How to cite this article: Rawtaer I, Mahendran R, Chan HY, Lei F, Kua EH. A nonpharmacological approach to improve sleep quality in older adults. *Asia-Pacific Psychiatry*. 2018;10:e12301. https://doi.org/10.1111/appy.12301