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Effects of Traditional Cantonese Opera Songs on Cantonese-Speaking, Community-Dwelling Older Adults' Cognitive and Psychological Function, Well-being, and Health

Abstract

(Objectives) Experiencing multi-sensory cognitive stimulation through the enjoyment of Cantonese opera songs, with their lively rhythms, familiar folk tales, meaningful lyrics and pleasant scenarios, has the potential to increase neuroplasticity and prevent cognitive decline. (Methods) This prospective pre- and post-test quasi-experimental randomised controlled trial design study aimed to explore the social benefits of older adults' active participation in practising Cantonese opera songs as compared with passive participation (as an audience) and a non-interventional control group on cognitive function, psychological function, functional independence, well-being and health. (Results) By recruiting a group of older adults who were receiving day activities social service in Hong Kong. Thirty participants were randomly allocated to active participation in Cantonese opera (ACO). They participated in 10 sessions of practising Cantonese opera songs, twice a week for 5 weeks. Thirty-four participants were assigned to passive participation in Cantonese opera (PCO) for 5 weeks, with 2 sessions each week. They received passive intervention by listening to and

appreciating the opera songs as a social event. Thirty-one participants were used as a control group and received no similar training. (Results) ACO caused a positive change in cognitive function as compared to PCO and to no intervention, which implies that active learning and practise of opera songs benefits global cognitive function. The psychological function of the participants in the PCO group showed an elevated positive affect and a reduced negative affect. A statistically significant difference was noted in the time effect among the physical domains of health status, functional independence and well-being of participants who underwent Cantonese opera intervention. (Conclusion) This pilot study demonstrates Cantonese opera, can enhance cognitive and psychological functioning in older adults.

Background

Activity programmes in community should be an extension of geriatric rehabilitation if the activities are based on rehabilitation principles (Foy et al., 2013; Ghiglieri, McAndrew, Baum, & Taff, 2020; Hildebrand & Neufeld, 2009). Older adults are frequently encouraged to participate in a range of activities, as there is much evidence that this leads to physiological benefits, such as enhanced cardiovascular function, physical stamina (Li, 2013), and muscle strength (Cohen-Mansfield & Eisner, 2020), as well as reduced psychological distress and improved neuropsychological or cognitive performance (McEwan, Tam-Seto, & Dogra, 2017; W. Zhang, Zhao, Qin, & Ma, 2018). The potential for activity-related improvement in cognitive functioning is particularly important for older adults, due to their increased prevalence of cognitive deficits (Lam et al., 2015). It is therefore notable that a higher level of participation in activities, particularly structured activities, has been shown to be significantly associated with improved cognitive function in older adults (G. T. Leung et al., 2010; G. T. Y. Leung et al., 2010). Moreover, a large body of literature has highlighted the beneficial effects of active participation in leisure activities, such as dancing and singing, on psychological function (Chai, Abd Hamid, & Abdullah, 2018; Naveh-Benjamin & Mayr, 2018; Vallet, 2015). For example, participation in Cantonese opera singing is generally considered to be a form of leisure activity rather

than exercise, and it comprises components of listening and singing (Tan, 2000). Singing Cantonese opera by demonstration, practise and performance (as active participants) or watching Cantonese opera (as passive participants, i.e., an audience) is one of the commonest and well-accepted cognitive leisure activities among older adults. This has been practised in various places and well received among various socio-economic classes in Hong Kong (Leung et al., 2010). Moreover, participation in Cantonese opera singing has recently been found to be related to various health and well-being outcomes (Chen, Li, Xu, & Hu, 2020).

Cortical areas are strongly activated when listening to emotionally arousing music (Leonard et al., 2019). For example, the nucleus accumbens is activated by listening to pleasant music, whilst the amygdala is strongly activated when listening to unpleasant or sad music (Baumgartner, Lutz, Schmidt, & Jäncke, 2006; Blood, Zatorre, Bermudez, & Evans, 1999). Recent studies of music therapy for dementia patients have focused on the neurological aspects of processing musical input, specifically the role of the temporal lobes. These studies have shown that the auditory cortex influences the recognition of pitch and tempo (Schirmer, Fox, & Grandjean, 2012), and that the ability to understand a melody is reduced when the temporal lobe is damaged (Milesi et al., 2014).

Singing has been shown to be related to numerous physiological changes. First, the cardiorespiratory system is ~~utilised~~utilized during prolonged periods of singing training, which enhances the strength of the respiratory muscles and ~~optimises~~optimizes the breathing mode (Bernardi, Gabutti, Porta, & Spicuzza, 2001). In a key recent study, near-infrared spectroscopy was used to verify that the concentration of oxygenated blood cells in people with dementia increased while they were singing (Tanaka & Nogawa, 2015). Second, singing can lead to changes in the concentrations of neurotransmitters and hormones, such as the upregulation of concentrations of oxytocin, immunoglobulin A, and endorphins, which leads to improved immune function and increased feelings of happiness (Ashida, 2000; Hegadoren, O'Donnell, Lanius, Coupland, & Lacaze-Masmonteil, 2009). Third, group-singing activities reduce stress and arousal, as measured by the plasma concentrations of oxytocin and adrenocorticotropic hormone, and induce social interaction in participants (Keeler et al., 2015). Researchers have also found that there was a significant decrease in both cortisol and cortisone concentrations in those participating in singing, suggesting that singing in itself is a stress reducing (and possibly health-promoting) activity (Fancourt, Aufegger, & Williamon, 2015).

Furthermore, it has been found that singing has positive cognitive impacts on emotional states and neural network reconfiguration, such that the symptoms of mood

disorders (Tavormina, Tavormina, & Nemoianni, 2014) and dementia (Maguire, Wanschura, Battaglia, Howell, & Flinn, 2015) improve after singing interventions.

Fratiglioni et al. (2004) suggested that three factors are critical for the promotion of brain health: social networking, cognitive leisure activity, and regular physical exercise. Although regular physical exercise is popular in the West, people in the East focus more on traditional Chinese therapies or mind–body exercises, which may benefit physical, cognitive, and/or psychological function. Cognitive leisure activities that involve multi-sensory cognitive stimulation, social interaction, and physical movement sequences that may enhance individuals' functional independence (Y. Zhang et al., 2017), well-being (Tang, Zhang, Chi, Li, & Dong, 2020) and health (Chen et al., 2020), such as Cantonese opera singing, may be of particular interest to older adults because they find such activities meaningful, familiar and easier to learn, due to exposure earlier in life. Singing Cantonese opera by demonstration, practice, and performance (as active participants) or watching Cantonese opera (as passive participants, i.e. an audience) is considered to be one of the most common and well accepted cognitive leisure activities among older adults in Hong Kong, and is ~~practised~~practiced in various places and across a range of socio-economic classes (G. T. Y. Leung et al., 2010). However, although opera is a popular part of Chinese cultural heritage, the unique social benefits of active participation in Cantonese opera

on cognitive and psychological states, health, and well-being in older adults, especially in an ageing population that may have a higher prevalence of cognitive decline, have not been well documented (Chen et al., 2020).

In this study, Cantonese opera, a typical cultural activity in Hong Kong and southern China, is posited to provide cognitive stimulation to older adults, and it is suggested that participation in Cantonese opera-based social activity will support a compensatory neural scaffolding process. It is proposed that through the practice of singing Cantonese opera, the brain function of older adults can be maintained or improved. This effect may be related to focused attention on movement and breathing during opera singing, as well as a relaxation effect, resulting in increased memory recall. This suggests that singing Cantonese opera may be similar or superior to other activities/exercises in enhancing cognitive functioning (Hecht et al., 2008). Indeed, Cantonese opera-singing practice may help to nurture concentration and/or attention, due to the requirements of transitioning between singing and ~~memorising~~memorizing content, and the use of hand/body movement during performance. Also, different kinds and difficulty levels of opera songs represent a form of complex cognitive-skill training that places demands on attention and memory (Hecht et al., 2008). Thus, repeated Cantonese opera-singing practice may enhance the cognitive function of elderly practitioners.

The breathing exercise gained from singing may lead to physical improvements in cognitive function (e.g. increased blood flow or relaxation) and psychological relaxation (i.e. enjoyment derived from playful participation) (Bernardi et al., 2001). Moreover, singing Cantonese opera also improve the self-esteem and enhance the sense of achievement of the elderly. Imitating different characters may help older adults to improve their ability to mentally process information via mental imagery-based cognition (Liu, Chan, Lee, & Hui-Chan, 2004).

However, as mentioned, there is a paucity of studies of the relationship between Cantonese opera singing and cognitive functions in the elderly. As such, the theoretical understanding of this traditional cultural activity and its effects on cognition are under-developed. The above-stated findings of the physiological mechanisms that are operative during listening to and participating in singing Cantonese opera have laid a solid theoretical foundation for further study.

This study explored the social benefits of traditional Cantonese opera singing in older adults in Hong Kong, as this is a popular cognitive leisure activity in this population. The objectives were to evaluate the effectiveness of active participation in Cantonese opera (ACO) by assessing the clinical outcomes of such participation on (a) cognitive functions, such as attention and memory skills, (b) psychological functions, such as mood changes, (c) functional independence and (d) well-being and

health, relative to the outcomes of passive participation in Cantonese opera (PCO) and the outcomes of a control group (CG). The participants' age, sex, education level, and comorbidities were considered as the covariates for the outcomes.

Methods

Design

A prospective pre-test and post-test quasi-experimental randomised control design was adopted in this study.

Participants

The inclusion criteria are: (*a*) age between 65 and 88 inclusive; (*b*) the ability to understand verbal and written Chinese instructions; and (*c*) the ability and willingness to provide informed consent and sign the relevant document. The following exclusion criteria will apply: (*a*) the presence of major neurological illness or other known psychiatric diagnosis; (*b*) a history of substance abuse including alcohol, drugs, or any medication/substances indicative of chronic abuse; and (*c*) participants with major neurological cognitive disorders.

Participants were recruited for the study via randomly assign participants from purposefully recruited day activities social service sectors that provide day activity services for community-dwelling older adults who needed social support in their daily

living. The participants were randomly allocated to one of three groups (ACO, PCO or CG) by using envelop randomization method. Each group comprised approximately 35 participants to account for possible attrition. Participants who had been identified as being at stage 5 or above (moderately severe cognitive decline or moderate dementia) on the Global Deterioration Scale (GDS) were excluded. Participants with severe visual, hearing and speech problems or a history of psychiatric illness were excluded. The purpose of the study was explained to all of the participants in the AOC group, the PCO group and the CG, who were assured that they should experience no harm. Informed consent was obtained from all of the participants before assessment. Approval was given by the university research ethics committee, and the study was conducted according to the Declaration of Helsinki.

Intervention

The interventions were conducted in the centre where individual participants were receiving their day activity services and participants knew each other prior to joining the sessions. The participants in the ACO group would be divided into small groups and underwent a 10-session Cantonese opera training programme twice per week (with each session lasting approximately an hour) over a period of 5 weeks. The participants were not required to be literate, as they were trained to listen, imitate and practise

singing according to the tutor's demonstration and role play to digital versatile disc (DVD) material. With the reminders stated in a written instruction board, the participants in the PCO group simply listened to and appreciated Cantonese opera songs. None of the participants in the ACO or PCO groups had any experience in singing Cantonese opera songs, and none of those in the CG underwent similar training during the study period. Trained assessors administered both the screening and outcome measures to all of the participants in all three groups. Some experienced Cantonese opera director and ex-actor, but without experience in working with people with dementia were employed as tutors to run the 10-session program for the ACO group and the PCO group, respectively. ACOG and PCOG were led and facilitated by invited tutors of Cantonese opera singing groups (group size of 4-6) and the content were tailor made to cover the most popular, short songs and Cantonese minors. Training content in ACOG was structured according to literature such as 《粵曲的學和唱：王粵生粵曲教程》(陳守仁, 2007) or《香港當代粵曲教學活動概說》(劉艾文、陳守仁, 2001). Material for teaching was referenced from 《香港粵語唱片收藏指南─粵劇粵曲 歌壇：二十至八十年代》(香港電台十大中文金曲委員會, 1998),《廣東音樂 200 首》(廣東省當代文藝研究所, 2003), 粵曲小曲實驗教學計劃－跨學科教材》(優質教育基金, 2004). Popular repertoire included: 《荷花香》, 《紅燭淚》, 《百花亭之戀》, 《恨悠悠》, 《祝福詞》, 《平湖秋月》, 《紅豆相思》, 《帝女花之雪

中燕》,《昭君出塞》(選段),《主愛遍人寰》,《鳳閣恩仇未了情之胡地蠻歌》,《分飛燕》, etc. The different emphasis of the training in different groups is depicted in Figure 1.

Figure 1. Emphasis of Training

Group	Active participation in Cantonese Opera Song Group (ACOG)	Passive participation in Cantonese Opera Song Group (PCOG)	Control Group (CG)
Programme Modes	• Demonstration and practice/performing • Active participation, self-pacing • Role play • With feedback from staff or tutor support	• Non-challenging passive participation • Social event • No particular feedback from staff	• No specific training

Measurements

The GDS was used to screen the participants into seven stages, ranging from stage 1 (no cognitive decline) to stage 7 (very severe cognitive decline or severe dementia). Participants who were assigned to stage 5 or above (moderately severe cognitive decline or moderate dementia) were excluded.

The Cantonese version of the Mini-Mental State Examination (CMMSE; (Chiu, Lee, Chung, & Kwong, 1994) was used to measure the individuals' global cognitive levels. The cut-off for the C-MMSE to indicate cognitive impairment is 19 or below. For those with more than 2 years of education, the cut-off score is adjusted to 22 or below; for those with 1 to 2 years of education, the cut-off score is recommended to be 20 or below; and for those with no education, the cut off score is 18 or below.

Visual and auditory attention tests, with components from Digit Span (forward and backward; (Wechsler, 1981)); and the Color Trail Making (CTT Part 1 and 2; (Lee & Chan, 2000)) were used to assess visual and auditory attention functions. The Hong Kong List Learning Test (HKLLT; (Chan & Kwok, 1999)) was used to evaluate the participants' memory performance by documenting their rate of learning (acquisition) and rate of forgetting (retention).

The Positive and Negative Affect Scales (PANAS; (Watson, Clark, & Tellegen, 1988)) and the Geriatric Depression Scale (Yesavage et al., 1982) were used to assess the level of depression, with additional assessment of participants' positive mood states (i.e., interested, enthusiastic, proud) and negative mood states (i.e., distressed, upset, guilty).

The participants' functional independence in daily living was assessed with the Hong Kong Lawton Instrumental Activities of Daily Living Scale (HKLIADL; (Tong, 1999), which comprises eight items (use of a telephone, transportation, shopping, medication management, money management, meal preparation, housework and laundry work). The Hong Kong Chinese version of the World Health Organization Quality of Life Instrument–short version (WHOQOL-BREF; (Leung, Wong, Tay, Chu, & Ng, 2005)) was used to evaluate the participants' overall quality of life and overall health condition. The eight scales of the 36-item Short Form Health Survey (SF-36)

were used to assess the participants' health status.

All the measurements stated were ~~preformed~~performed by research assistant who had background of occupational therapy training and working in elderly services.

Sample Size Estimation

The sample size estimation (using analysis of variance [ANOVA] as an example) was initially carried out using G*Power 3.1.9.2 with an expected effect size *f* of 0.3 for the interventions, a Cronbach's alpha of 0.05, a power of 0.8, three groups and eight measurements. The result was a suggested total of 90 participants for recruitment, with 30 participants in each group.

Plan for Data Analysis

Descriptive statistics were generated for the demographic data and cognitive performance (attention and memory) of each group (ACO group, PCO group and CG) for each outcome measure. A Kruskal-Wallis one-way ANOVA was used to examine differences in selected demographic data from the three groups across the tests. Statistical procedures such as a between-groups repeated-measures ANOVA were used to determine the existence of a group (ACO group, PCO group, CG), time (pre-test and post-test) and/or interaction effect on the outcome measures. An analysis of covariance was used to control for confounding variables such as differences in educational level,

functional health and global cognitive level when analysing measures taken, such as by the CMMSE or SF-36.

Results

Demographic Characteristics

Ninety-five older adults at least 65 years of age (age ranged from 65 to 80) were recruited. They either had no cognitive impairment or were judged to be in the mild to moderate stages of cognitive impairment (stage 1-4 of 7 stages) according to their results on the GDS. They were selected by cluster sampling of 125 older adults from various community service centres. Thirty were allocated to the ACO group, 34 were assigned to the PCO group and 31 were included in the CG. No statistically significant difference was found in an overview of the stages of cognitive function across the three groups ($F = 0.251$, df = 2, $p = 0.778$). Similarly, no significant differences in age ($F = 0.70$, df = 2, $p = 0.499$), sex (Pearson's chi-square = 1.7462, $p = 0.418$) or education level (Pearson's chi-square = 5.052, $p = 0.282$) were identified across the three groups. Table 1 summarises the demographics of the older adults in the three groups.

[Please insert Table 1 here]

Table 2 summarises the average pre-test and post-test assessment results of the outcome measures in cognitive function, psychological function and functional elements.

[Please insert Table 2 here]

Inferential Statistics

Inferential statistics were also used for data analysis. A repeated-measures ANOVA was administered to check for group (ACO, PCO, CG), time (pre-test and post-test) and interaction effects on the outcome measures. After computation, only a few situations showed statistically significant results. Significant group effects were found on the negative affect of PANAS ($p = 0.048$) and the physical domain of the SF-36 ($p = 0.016$) and a time effect on several outcome measures, such as a visual attention test ($p = 0.009$), an auditory attention test of acquisition ability ($p < 0.05$), the HKLLT learning slope subtest ($p < 0.05$), a retrieval ability subtest ($p < 0.01$), a recognition correct hits subtest ($p < 0.01$), a discrimination subtest ($p < 0.01$) and the WHOQOL-BREF subtest ($p = 0.05$); the summary of repeated-measures ANOVA of outcomes is depicted in Table 3.

[Please insert Table 3 here]

However, further analysis of the findings with respect to personal and psychological well-being shows group differences in the group interaction effect on negative affect among the three groups (Figure 1). The PCO group demonstrated a significant improvement by achieving a lesser negative effect, showing that these older adults appeared to benefit from passive participation (i.e., listening to and appreciating

Cantonese opera). The CG essentially maintained its original level. The ACO group did not seem to benefit greatly from the active training, which may be attributable to the demanding level of practise and the possible distress caused when a participant's performance was not up to his or her own satisfaction.

[Please insert Figure 1 here]

Notably, Figure 2 shows a group difference exists in SF-36 (physical domain), with a decrease in the score implying that perceived changes occurred in participants' health status. Thus, the ACO group experienced fewer limitations of physical activities (as assessed by a summation of 10 physical activities, including vigorous activities, climbing one flight of stairs, and bathing or dressing).

[Please insert Figure 2 here]

The three groups showed changes over time in some areas of cognitive function. Auditory attention function, for example, was found to improve over time in both the APO group and the PCO group, whereas the CG participants only maintained their starting level of auditory attention function (Figure 3).

[Please insert Figure 3 here]

Four memory subtests of the HKLLT showed changes over time: acquisition and retrieval ability, learning slope, recognition (correct hit), and the discrimination score of the HKLLT. A further illustration of these results can be found in Figure 4.

Obviously, a mixed pattern of changes was seen over time among the three groups (Table 3). For example, the ACO group and PCO group showed more positive improvement and a higher rate of improvement in the discrimination score than the participants in the CG.

[Please insert Figure 4 here]

The physical domain of the WHOQOL-BREF showed changes over time. Both the ACO and PCO exhibited a slight but significant improvement, such that both groups' participants expressed fewer problems in eight items, including pain and discomfort, energy and fatigue, sleep and rest, and ADL, as depicted in Figure 5.

[Please insert Figure 5 here]

Characteristics of Participants That Contribute to the Extent of Improvement

To further differentiate the participants' characteristics in relation to the effectiveness of the intervention, a further analysis was performed to stratify some of the variables in the following way:

- Age (≥82.52 [group mean] versus <82.52)
- MMSE (≥18 versus <18)
- PANAS (≥53 [75th percentile] versus <53)
- Geriatric Depression Scale (≥8 versus <8)
- Global Depression Scale (>2 versus ≤2)

The repeated-measures ANOVA by stratum and some patterns are shown in Table 4.

[Please insert Table 4 here]

For the auditory attention test, if we focus on the stratum or a further re-grouping with a score of at least 18, we find a statistically significant group difference ($p = 0.043$) exists, with the ACO group scoring higher than the PCO group and the CG on either the pre-test or the post-test. Thus, for those without cognitive impairment, ACO led to much better performance in auditory attention than PCO or no intervention. However, neither the time effect ($p = 0.891$) nor the interaction effect ($p = 0.502$) were significant.

For the CMMSE with stratum or a further selection of participants with a Geriatric Depression Scale (GDeS) score of at least 18, a statistically significant time difference (p=0.022) was found, with the post-test lower than pre-test in both treatment groups and vice versa in the CG. Thus, for those without depression, the CMMSE of the ACO group would change over time, and improvement was detected (but not in the PCO group or CG). The interaction effect between time and group was marginally significant (p=0.05); however, the group effect was not statistically significant at either the pre-test or the post-test.

The WHOQOL-BREF with the higher age stratum (≥82.52) shows a statistically significant time difference (p=0.031), with the post-test higher than pre-test in the PCO

group and the CG. In other words, the older the adult, the more physical-related quality of life problems were expressed. In contrast, the group effect was not statistically significant (p=0.353) on either the pre-test or the post-test. Moreover, the interaction effect between time and group was not statistically significant (p=0.106).

Only a few situations showed significant changes even after stratification, as mentioned above. Thus, further simple descriptive statistics on all testing results were obtained to investigate the actual percentage change.

Clinically, the ACO group showed much better performance in visual attention by taking less time to respond and in auditory attention by making more correct hits after training, whereas the PCO group was found to have slight drop in the speed of visual attention but a positive improvement in target hits during auditory testing. The CG saw only slight improvement in speed and correct hits (Table 4). Moreover, the participants in the ACO and PCO groups demonstrated higher percentage changes than those in the CG when they were tested at retrieving auditory information. Similarly, the participants in the ACO group showed a positive change on the CMMSE relative to the PCO group and the CG. After training, the participants in the ACO group showed a positive change on the GDeS relative to those in the PCO group and the CG.

Clearly, the participants in the PCO group seemed to benefit most from the intervention, as indicated by elevated positive affect and reduced negative affect. In addition, the negative affect of the participants in the PCO group, as indicated in the ANOVA analysis above, differed significantly from that of the participants in the ACO group and the CG.

The opposite pattern was seen in the participants in the ACO group such that active participation seemed to give older adults less positive affect and more negative affect. The CG with no training showed the greatest negative affect change across the three groups, although they did experience some positive affect change. Functionally, IADLs were found to improve in both the ACO group and the PCO group, but not in the CG, which suggests that training may cause a perceptual change in functional independence among older adults.

As for health and well-being, the participants in the ACO group had better results on the SF-36 (physical) than those in the PCO group and the CG. This result was consistent with the ANOVA analysis reported above. In other words, the older adults in the APO group had few complaints about physical problems such as pain and discomfort, likely due to their participation (either active or passive) in Chinese opera training. In a similar way, the WHOQOL-BREF (physical) indicated changes in the

ACO group; the participants in the PCO group also improved, but those in the CG deteriorated.

Discussion

Cognitive leisure activities constitute a major part of daily life and assume roles in providing cognitive stimulation, social engagement and physical exercise that earlier in life were offered by employment. The three main hypotheses that relate cognitive function to leisure activities are the reserve hypothesis, the vascular hypothesis and the stress hypothesis (Fratiglioni et al., 2004). A mounting body of literature has addressed the beneficial effects of participation in leisure activities on cognitive function. The literature shows that a high level of late-life leisure activity participation, particularly in intellectual activities, has a significant association with better cognitive function in older adults (G. T. Y. Leung et al., 2010). Various theoretical definitions and operationalisation of activity participation have been used, and activities have been categorised in several ways. Most activities involve varying degrees of intellectual, physical and social components, but it is unclear how these components should be quantified or prioritised, particularly across diverse cultural and socioeconomic contexts.

In Oriental culture, Chinese opera is a classical cognitive leisure activity that may bring benefits to our aging population. This study may be few of this kind in

exploring the effects of traditional Chinese opera on the cognitive, psychological and functional health and well-being of community-dwelling older adults. This pilot study indicated some positive changes from the use of Chinese opera to maintain or improve function in older adults as compared to those in a CG.

Our findings support a recent study on application of Zumba, a kind of cognitive leisure activity was shown to have peak improvement in the participants' cognitive function, psychological well-being and quality of life (Stonnington et al., 2020). Moreover, the results were consistent with findings of an interaction between cognitive function and the intervention time (Särkämö et al., 2014). Nevertheless, other studies showed that those cognitive leisure activities required long implementation periods (ranging from 24 to 48 weeks) to have a significant effect on cognition, given the repetitive practices needed (Doi et al., 2017, Lazarou et al., 2017, Rektorova et al., 2019). Due to the constraints of resources, the 10-session training effect across the three groups (ACO group, PCO group and CG) and over time (pre-test and post-test) was not fully demonstrated in a statistical manner, possibly because the training period was too short and thus reduced the training effect. Still, some interesting and/or clinically significant findings were made.

For comparison purposes, the three groups in this study were similar in age, gender, education and cognitive levels. Although the training period for ACO and

PCO was short, observable positive changes were noted, and relative advantages were initially identified in the active (ACO) and passive (PCO) groups. The findings from this study serve as a foundation in choosing Cantonese opera as an activity for older adults in the community and can serve as the foundation for further study.

Our findings echo those of another local study in which a high level of participation in cognitive leisure activities had a significant and positive association with performance on various cognitive tests (G. T. Y. Leung et al., 2010). The most encouraging results were related to cognitive function, which is well documented to be greatly affected by the normal ageing process. Statistical significance was not demonstrated in the CMMSE, whereas the clinical significance found in the ACO group was much greater than that in the PCO group or the CG, although the 10-session training period was considered short. This CMMSE improvement is consistent with the specific cognitive improvement and clinical improvements in attention (visual and auditory) and memory function (such as retrieving auditory information).

With consideration of the participants' characteristics, for those with a CMMSE score of at least 18, ACO was found to improve auditory attention and led to a group difference with the participants in the PCO group and the CG. Similarly, if the older adults did not have depression (i.e., GDeS score ≥8), both ACO and PCO led to improvement in the CMMSE score over time. In short, the ACO group seems to have

benefited from active training in Chinese opera by developing improved attention, memory and global cognitive function.

PCO led to greatly improved auditory attention relative to visual attention. This seems to suggest that the members showed a practise effect in listening rather than simply reading (looking at) the words of the songs shown on a projection screen or song book (which was the case with ACO, although this group also actively sang). This effect may be related to the focused-attention on movement and breathing and the relaxation effect during opera practise promoting better memory recall, which might be similar or superior to other activities/exercises in enhancing cognition (Chai et al., 2018; Tang et al., 2020; W. Zhang et al., 2018; Zhu, Qiu, Zeng, & Li, 2017). Because attention and memory decline are the most prominent feature of cognitive ageing and early signs of dementia, the findings of our study may also serve as a health promotion strategy, especially to maintain cognitive reserve in older adults.

PCO appears to have benefited those who underwent passive participation by leading to a more positive affect and lower negative affect. For negative affect in particular, the PCO group differed statistically from the ACO group and the CG. As mentioned above, this may be attributable to the format and expectations of the group. That is, the members found it less stressful to participate because they enjoyed the group ethos and the attractive and familiar content of Chinese opera. ACO, in

contrast, led to a more negative affect after training, possibly due to the demanding nature of practise, performance and comparison among members. However, ACO also led to a higher positive affect. Clearly, the CG did not benefit from training and showed the most negative affect.

In sum, PCO was beneficial to the participants' emotional health. The improvement in psychological function may be attributable to mental activity helping to build better personal and psychological well-being. Moreover, active participation in Cantonese opera also improved ~~participants~~participants' self-esteem and enhanced their sense of achievement. Imitating various operatic characters may help older adults to mentally rehearse the information through the beneficial cognitive process of mental imagery (Liu et al., 2004), which could further enhance the development of a reserve against cognitive decline (G. T. Y. Leung et al., 2010). Furthermore, previous studies have indicated that by stimulating the cerebral limbic system, which is associated with emotion, music interventions can regulate the function of the cerebral cortex and release endorphins, thus creating a sense of pleasure (Fusar-Poli, Bieleninik, Brondino, Chen, & Gold, 2018; Ueda, Suzukamo, Sato, & Izumi, 2013). Each of these factors plays a crucial role in alleviating depression and anxiety. Some studies have shown that traditional music also alleviates depressive symptoms in people with dementia (Ashida, 2000; Chae, 2015; Chu et al., 2014). Our findings with

Cantonese opera partially support previous findings about music therapy, in which the use of traditional opera was found to be beneficial in relieving disturbing emotions (Ashida, 2000).

In terms of health and well-being outcomes, the short-term training effect makes it unlikely that a drastic improvement would result. However, a group difference was found on the SF-36 (physical functioning) between the participants in the PCO group and those in the ACO group and the CG. A time effect in the WHOQOL-BREF was also identified in the three groups. Thus, the older adults experienced a positive change over time in physical functioning. Positive changes were seen over time in the Lawton IADL in both the ACO group and the PCO group, but not in the CG. This suggests that older adults who participate in these group activities can enhance their social interaction with others and reduce their social isolation, which may change their perception of community independence.

To elucidate the distinct effects of Cantonese opera, future studies would benefit from analyses of specific activities, the assessment of performance in a wider range of cognitive domains, and the careful consideration of information that may potentially confound the results. The control of relevant variables is another crucial issue, because many factors may influence or relate to a person's lifestyle, and such factors may also be associated with cognitive function. Moreover, the use of different raters

may impose measurement errors. The rate of attendance was only 70% for various reasons, such as health condition, visitors and medical follow-up. In addition, there was no restriction among participants conducting self-practise or listening to Chinese opera during non-training days or periods. These might be confounding variables to the study's main effect.

Further studies comprising longer-term clinical trials are needed to define the causal role of participation in cognitive leisure activities to establish the specific nature of the cerebral responses in older adults to such activities.

Conclusions

The study findings have important public health implications. Greater participation in cognitive leisure activities was found to be associated with better cognitive function, psychological function, health and well-being in older adults. The practise of Chinese opera by older adults is considered acceptable and feasible in community-dwelling older adults, particularly in a community resources centre such as a retirement home or hostel. It is appears that active participation may benefit older adults in the cognitive aspect, although passive participation actually has advantages over active participation, especially in improving affect. Therefore, instead of placing an emphasis on active participation (i.e., learning, practice, role-play), it may be more cost-effective to encourage participation in passive groups, enabling participants to

gradually adapt and decide whether they wish to shift to more active participation. It also may be worth establishing a combination group, whose members can choose the extent of their active and passive participation. In this way, the participants may gain maximal benefit in the cognitive, psychological and functional domains of training.

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Table 1: Demographics of the older adult participants (N = 95).

	ACO group (n = 30)	**PCO group (n = 34)**	**CG (n = 31)**
Global Deterioration Scale Stage			
No or very mild cognitive decline	22 (73.7%)	27 (79%)	25 (80.6%)
Mild cognitive decline	8 (26.7%)	3 (8.0%)	5 (16.1%)
Moderate cognitive decline	0 (0%)	4 (13 .0%)	1 (3.3%)
Sex			
Male	9 (30.0%)	9 (26.5%)	5 (16.1%)
Female	21 (70.0%)	25 (73.5%)	26 (83.9%)
Education Level			
No formal education	13 (43.3%)	23 (67.6%)	16 (51.6%)
Primary school	14 (46.3%)	9 (26.5%)	14 (45.2%)
Secondary school or above	3 (10%)	2 (5.9%)	1 (3.25%)
Mean Age (SD)	82.1 (SD = 8.11)	84.06 (SD = 7.01)	84.29 (SD = 6.59)

Table 2. Summary of average pre-test and post-test assessment results.

Outcome		ACO group			PCO group			CG		
		A	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
Cognitive Functions										
Global Cognitive Level	CMMSE	21.77	22.13	1.80	20.41	20.61	1.43	21.26	21.14	0.04
		(3.55)	(4.27)	(13.49)	(4.76)	(4.90)	(11.94)	(4.11)	(4.2)	(12.44)
Visual and Auditory Attention Test	Visual	38.17	40.44	5.95	42.70	44.55	4.33	42.27	43.07	1.89
	(right hits)	(18.97)	(15.30)	(17.23)	(16.48)	(13.20)	(14.93)	(15.56)	(14.43)	(15.01)
	Visual	31	21	-32.26	16.16	21	29.95	3.2	4.4	14.29
	(wrong hits)	(30.8)	(10.54)	(24.39)	(7.39)	(38.65)	(27.83)	(3.03)	(7.23)	(6.54)
	Visual	7.46	6.17	-46.15	4.25	5.85	66.75	4.19	6.78	-20.48
	(speed)	(4.44)	(2.94)	(79.27)	(1.35)	(2.47)	(52.52)	(1.62)	(6.16)	(420.03)
	Auditory	23.41	26.67	22.21	24.68	26.29	10.07	26.71	26.57	1.41
	(target hits)	(6.08)	(3.62)	(39.94)	(5.26)	(4.75)	(28.68)	(3.51)	(5.06)	(26.79)
	Auditory	5.41	4	-6.81	6.18	4.07	-16.49	5.67	2.33	-26.67
	(wrong hits)	(4.58)	(4.31)	(69)	(4.76)	(4.80)	(105.78)	(4.04)	(1.15)	(70.95)
Memory Performance	HKLLT (acquisition)	12.17	14.00	13.93	10.32	13.23	49.43	12.17	15.08	26.79
		(4.15)	(6.57)	(33.69)	(4.40)	(4.86)	(96.35)	(4.86)	(4.86)	(40.68)

	HKLLT (retention – short)	-2.67 (2.73)	-1 (1.78)	-51.98 (113.07)	-2.5 (2.07)	-2.88 (1.13)	-20 (194.12)	-2 (2.37)	-2.5 (1.62)	-13.75 (68.50)	
	HKLLT (retention – long)	-4 (1.47)	-3.28 (2.57)	-3.26 (80.10)	-3.29 (1.61)	-3.11 (1.71)	6.43 (70.78)	-3 (1.73)	-2.62 (1.80)	-15.23 (65.88)	
	HKLLT (learning slope)	-23.17 (8.16)	-27.11 (13.12)	16.04 (35.79)	-21.13 (7.79)	-24.88 (9.34)	24.19 (39.09)	-21.81 (8.23)	-27.13 (14.06)	21.64 (42.30)	
	HKLLT (retrieval ability)	11.90 (5.46)	14.28 (5.20)	53.32 (136.74)	12.38 (4.41)	13.25 (2.82)	18.85 (40.87)	13.58 (3.94)	17.25 (5.74)	28.48 (35.89)	
	HKLLT (recognition – correct hits)	9.83 (4.58)	11.83 (3.25)	47.03 (91.32)	11.13 (3.76)	12.38 (2.39)	22.83 (41.86)	11.92 (3.15)	13.33 (3.34)	15.96 (33.11)	
	HKLLT (recognition – false alarm)	7.31 (4.95)	6.35 (4.05)	-13.13 (4.52)	7.52 (4.50)	5.78 (4.05)	-23.13 (4.28)	6.52 (4.33)	6.2 (5.21)	-2.47 (4.79)	
	HKLLT (acquisition)	12.17 (4.15)	14.00 (6.57)	13.93 (33.69)	10.32 (4.40)	13.23 (4.86)	49.43 (96.35)	12.17 (4.86)	15.08 (4.86)	26.79 (40.68)	
Psychological Functions											
PANAS	Positive	27.35 (7.18)	26.68 (7.73)	-0.316 (25.23)	24.82 (8.30)	24.87 (7.00)	7.13 (36.65)	25.77 (6.88)	26.48 (7.33)	5.58 (26.86)	
	Negative	21.70 (7.78)	22.48 (7.99)	8.48 (35.50)	19.48 (7.47)	17.94 (6.52)	1.13 (45.88)	18.45 (7.22)	19.39 (6.87)	11.41 (34.40)	
	Total	48.75	49.92	5.13	44.3	42.81	3.25	44.22	45.87	6.50	

				(13.25)	(15.49)	(31.62)	(12.29)	(9.21)	(35.30)	(11.52)	(11.13)	(23.93)
	Geriatric Depression		Score	7.96	7.21	-3.13	6.47	6.27	-0.20	6.47	6.27	-0.20
	Scale			(3.20)	(3.15)	(43.81)	(3.52)	(4.28)	(51.50)	(3.52)	(4.28)	(51.50)
Functional Independence												
HKLIADL		Score		11.20	9.80	-0.14	12.60	12.45	9.09	15.64	14	6.55
				(7.67)	(6.51)	(52.43)	(6.88)	(6.53)	(46.72)	(7.49)	(6.79)	(64.53)
Well-being and Health												
WHOQoL-BREF		Physical		58.67	.38	2.06	59.58	59.08	1.59	63.13	57.92	-7.36
				(14.43)	(12.59)	(19.59)	(13.62)	(11.84)	(20.45)	(9.66)	(11.26)	(17.40)
		Physiological		59.92	59.42	1.80	60.53	63.63	7.26	63.63	63.55	0.99
				(13.54)	(13.55)	(24.59)	(15.28)	(15.74)	(20.94)	(11.20)	(16.13)	(25.44)
		Social Relationship		60	55.11	-2.10	58.18	55.35	2.36	61.72	61.29	3.98
				(16.61)	(17.24)	(37.96)	(14.07)	(13.28)	(40.26)	(11.15)	(11.21)	(36.57)
		Environment		66.08	68.50	4.96	68.09	73.46	11.90	69.92	74.19	7.23
				(10.88)	(13.78)	(23.86)	(14.80)	(11.06)	(25.33)	(10.28)	(12.51)	(19.81)
SF-36		Physical		50.11	49.42	-0.45	53.04	46.86	-7.07	62.26	59.24	-2.03
				(16.89)	(18.04)	(21.05)	(17.02)	(15.44)	(31.15)	(21.02)	(20.23)	(23.62)
		Role-physical		75.46	70.83	-3.52	77.50	70.00	-7.95	81.48	69.44	-11.84

	(22.60)	(19.92)	(18.19)	(17.18)	(19.59)	(21.95)	(19.42)	(18.19)	(24.91)
Bodily Pain	43.94	46.67	18.59	39.66	42.42	23.59	39.49	42.95	24.28
	(24.93)	(29.41)	(69.21)	(24.03)	(23.58)	(67.12)	(22.96)	(22.39)	(63.35)
General Health	57.6	60.93	7.00	58.18	59.27	4.83	61.16	61.68	4.32
	(8.11)	(10.80)	(19.64)	(9.70)	(10.51)	(27.61)	(12.10)	(10.77)	(26.19)
Vitality	67.10	68.24	3.85	69.01	63.54	-4.31	67.26	67.26	2.7
	(10.82)	(15.28)	(27.62)	(15.26)	(12.83)	(24.44)	(14.29)	(15.95)	(26.77)
Social Functioning	63.46	55.77	-9.12	57.14	57.14	3.35	60.97	61.29	6.41
	(14.95)	(15.28)	(27.76)	(9.76)	(12.72)	(32.51)	(12.74)	(11.47)	(37.49)
Role-emotional	78.33	71.67	-3.22	71.71	77.27	15.35	82.80	82.26	4.19
	(23.22)	(20.60)	(32.51)	(19.31)	(25.96)	(48.73)	(20.41)	(21.92)	(36.08)
Mental Health	72.72	75.56	6.09	75.98	78.00	4.93	73.60	72.04	-0.75
	(12.28)	(12.44)	(21.69)	(13.95)	(14.31)	(22.11)	(10.06)	(12.09)	(19.51)

N.B.

A: Average of Pre-test (Standard Deviation or SD)

B: Average Post-test (SD)

C: Average for difference between pre-test and post-test % change (SD)

CMMSE: Cantonese Version of Mini-Mental Status Examination

HKLLT: Hong Kong List Learning Test

PANAS: Positive and Negative Affect Scales

A lower Geriatric Depression Scale implies improvement [Chinese version of the 15-item Geriatric Depression Scale (0-15) (sensitivity = 96.3%; specificity = 87.5%; cut off = 8+)].

WHOQOL-BREF: The Hong Kong Chinese version of the World Health Organization Quality of Life Instrument (short version)

SF-36: The medical outcomes study 36 items short form health survey

HKLIADL: Hong Kong Lawton Instrumental Activities of Daily Living Scale

Table 3. Summary of repeated-measures analysis of variance of outcomes

Outcomes			*p*-value		
			Group Effect	**Time Effect**	**Interaction Effect**
Cognitive Functions	**Visual Attention Test**	Right	0.693	0.347	0.942
		Wrong	0.376	0.202	0.751
		Speed	0.962	0.320	0.872
	Auditory Attention Test	Target Hits	0.297	0.009**	0.079
		Wrong Hits	0.449	0.920	0.419
		Acquisition Ability	0.124	<0.050*	0.521
		Retention Ability (short)	0.424	0.331	0.580
		Retention Ability (long)	0.375	0.975	0.650
	HKLLT	Learning Slope	0.693	<0.050*	0.643
		Retrieval Ability	0.905	<0.010**	0.233
		Recognition, Correct Hits	0.929	<0.010**	0.632
		Recognition, False Alarm	0.796	0.778	0.585
		Discrimination Score	0.711	<0.010**	0.547
	CMMSE	Score	0.402	0.576	0.744

Psychological Functions	**PANAS**	Positive	0.444	0.904	0.723
		Negative	0.048*	0.633	0.252
		Total	0.096	0.729	0.580
	Geriatric Depression Scale	Score	0.612	0.493	0.589
Functional Independence	**HKLIADL**	Score	0.101	0.397	0.580
Well-being and Health	**SF-36**	Physical Functioning	0.016*	0.113	0.125
		Role Physical	0.925	0.256	0.780
		Bodily Pain	0.721	0.064	0.792
		General Health	0.394	0.197	0.710
		Vitality	0.876	0.765	0.166
		Social Function	0.081	0.320	0.207
		Role Emotional	0.169	0.823	0.191
		Mental Health	0.253	0.519	0.480
	WHOQOL-BREF	Physical	0.774	0.050	0.125
		Physiological	0.478	0.393	0.316

	Social Relationship	0.138	0.164	0.648
	Environment	0.185	0.004	0.676

*p < 0.05; **p < 0.01*

Table 4. Change of study outcomes.

	ACO group	PCO group	Control
Changes of Visual Attention Test			
Visual Speed (time taken)			
Pre-test	7.46 (4.44)	4.25 (1.35)	5.38 (2.45)
Post-test	6.17 (2.94)	5.85 (2.47)	6.38 (4.40)
% change	-46.15 (79.27)	66.75 (52.52)	-19.11 (297.87)
Auditory test (target hit)			
Pre-test	23.41 (6.08)	24.68 (5.26)	26.71 (3.51)
Post-test	26.67 (3.62)	26.29 (4.75)	26.57 (5.06)
% change	22.21 (39.94)	10.07 (28.68)	1.41 (26.79)
Change of HKLIST			
Retrieval Ability			
Pre-test	11.90 (5.46)	12.83 (5.25)	11.66 (4.81)
Post-test	14.28 (5.20)	14.51 (4.90)	15.34 (6.10)

% change	53.32 (136.74)	61.32 (224.26)	46.72 (75.01)
Change of CMMSE			
Pre-test	21.77 (3.55)	21.26 (4.11)	20.41 (4.76)
Post-test	22.13 (4.27)	21.14 (4.2)	20.61(4.90)
% change	1.80 (13.49)	0.04 (12.44)	0.43 (11.94)
Change of Geriatric Depression Scale			
Pre-test	7.42 (3.60)	6.06 (3.61)	6.11 (4.01)
Post-test	6.96 (3.14)	6.30 (4.16)	6.37 (3.60)
% change	20.19 (92.47)	21.54 (88.72)	48.80 (118)
Change of PANAS			
PANAS- Positive Affect			
Pre-test	27.35 (7.18)	24.82 (8.30)	25.77 (6.88)
Post-test	26.68 (7.73)	24.87 (7.00)	26.48 (7.33)
% change	-0.316 (25.23)	7.13 (36.65)	5.58 (26.86)
PANAS- Negative Affect			
Pre-test	21.70 (7.78)	19.48 (7.47)	18.45 (7.22)
Post-test	22.48 (7.99)	17.94 (6.52)	19.39 (6.87)
% change	8.48 (35.50)	1.13 (45.88)	11.41 (34.40)

Change of Lawton IADL			
Pre-test	12.60 (6.88)	15.64 (7.49)	11.20 (7.67)
Post-test	12.45 (6.53)	14.00 (6.79)	9.80 (6.51)
% change	9.09 (46.72)	6.55 (64.53)	-0.14 (52.43)
Change of SF36			
Physical functioning			
Pre-test	50.11(16.89)	53.04 (17.02)	62.26 (21.02)
Post-test	49.42 (18.04)	46.86 (15.44)	59.24 (20.23)
% change	-0.45 (21.05)	-7.07 (31.15)	-2.03 (23.62)
Changes of WHOQOL-BREF (Physical)			
Pre-test	58.67 (14.43)	59.58 (13.62)	63.13 (9.66)
Post-test	58.38 (12.59)	59.08 (11.84)	57.92 (11.26)
% change	2.06 (19.59)	1.59 (20.45)	-7.36 (17.40)

N.B. Pre-test: Average of Pre-test (Standard Deviation or SD)

Post-test: Average Post-test (SD)

% Change: Average for difference between pre-test and post-test % change (SD)

Figure 1. Profile plot of negative affect change of PANAS showing group effect of ACO group, PCO group and CG.

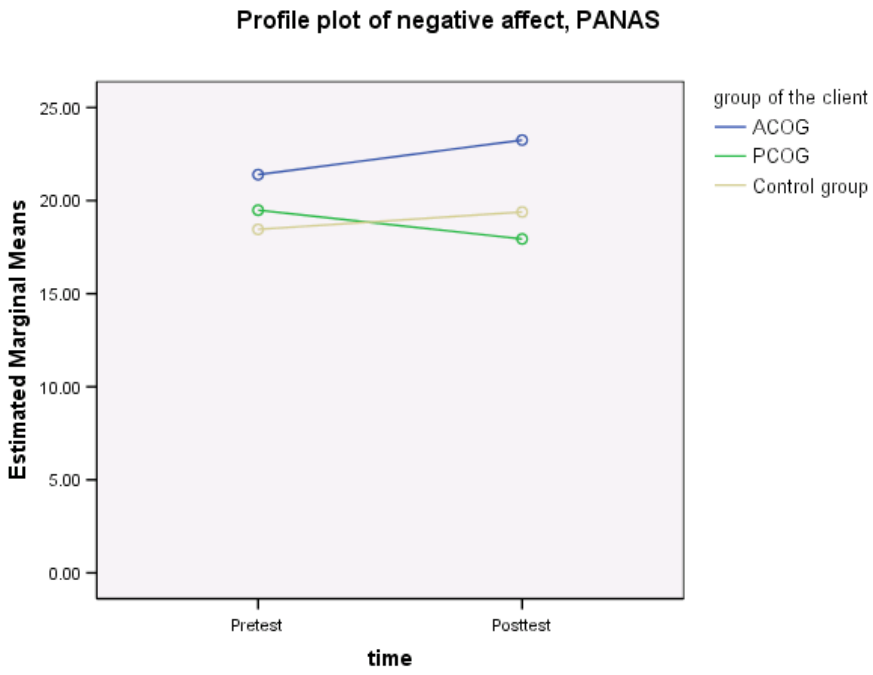

Figure 2: Profile plot of SF-36 (Physical) showing group effect of ACO group, PCO group and CG

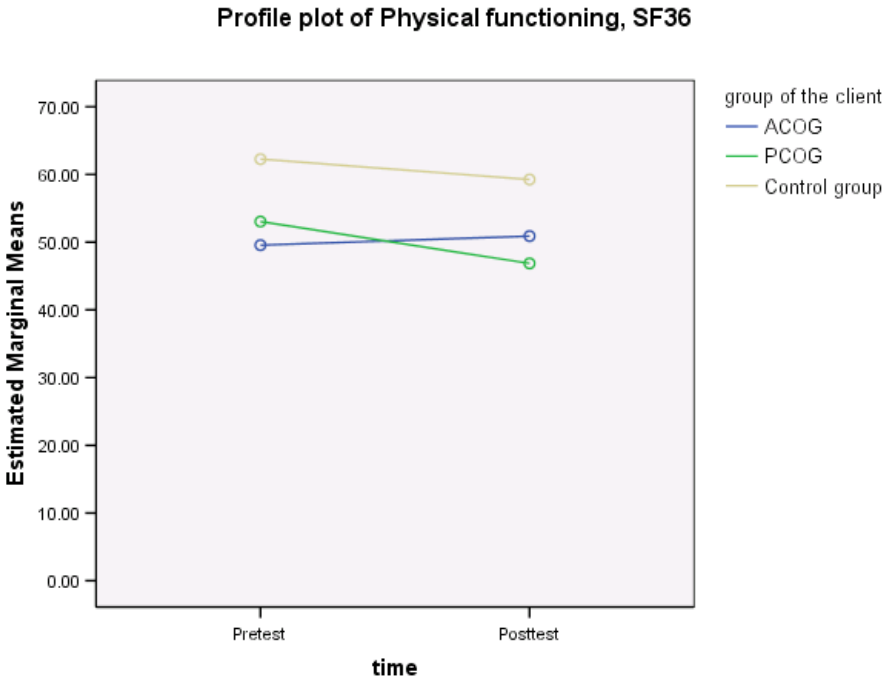

Figure 3. Profile plot of Auditory Attention Test (target hits) showing time effect of ACO group, PCO group and CG

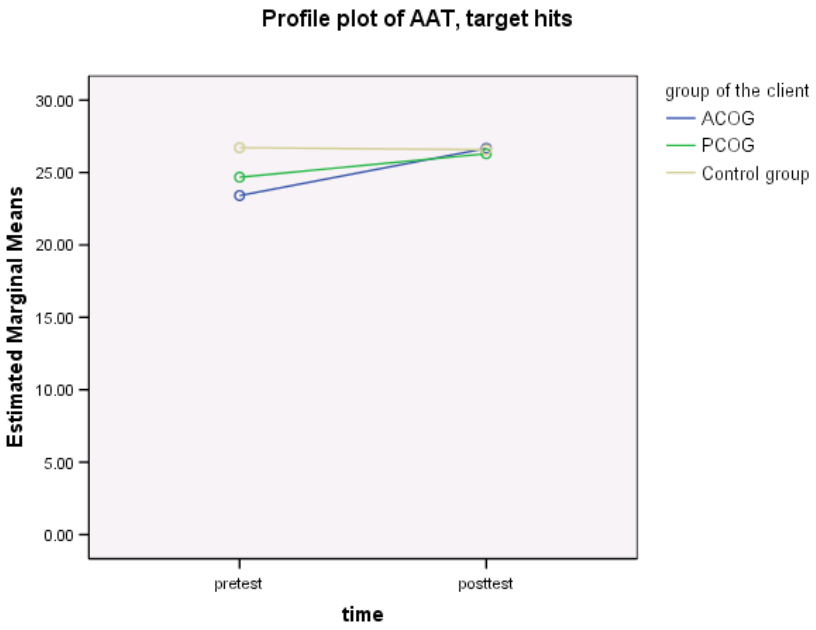

Figure 4: Examples of profile plot of HKLLT subtests showing time effect of ACO group, PCO group and CG

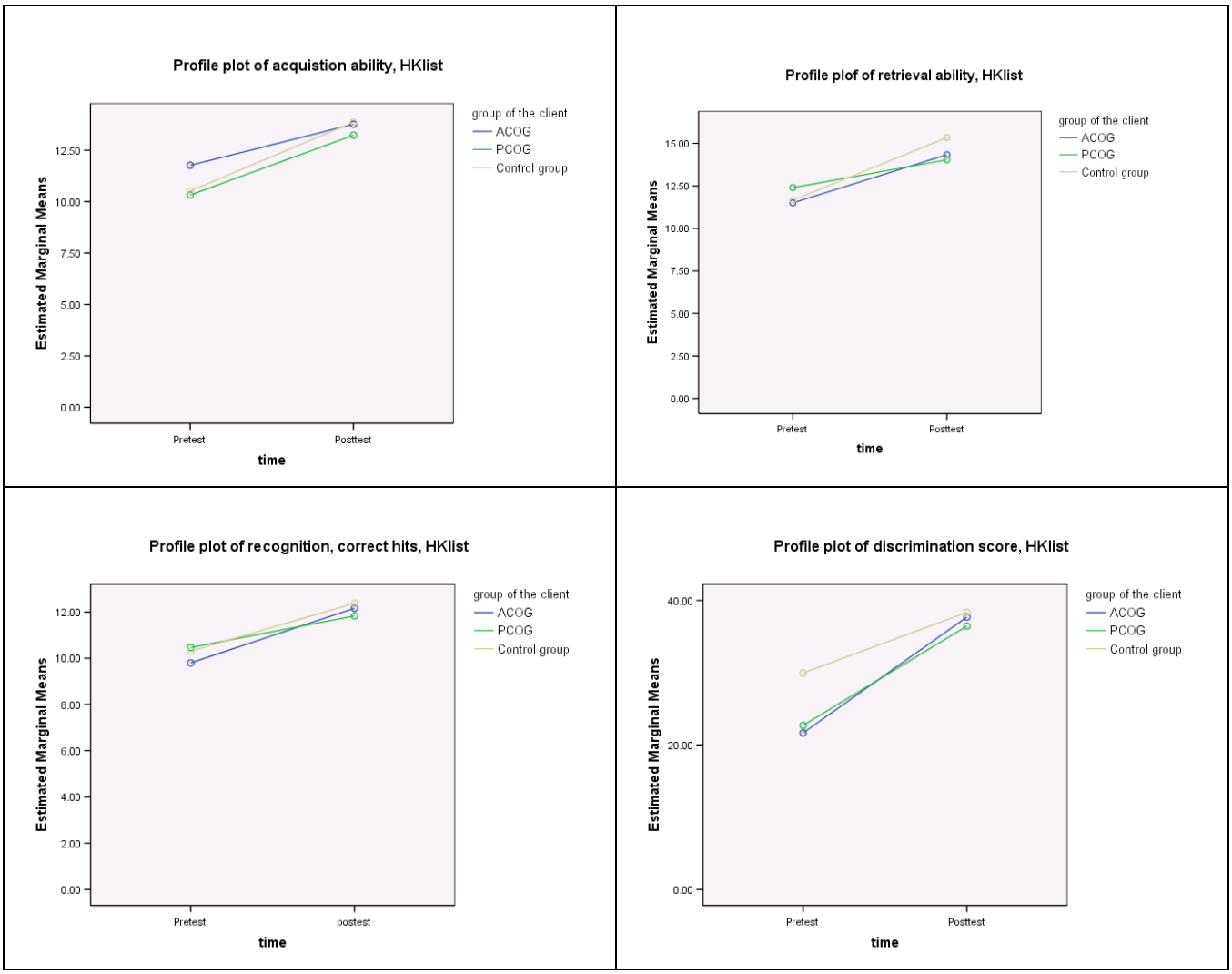

Figure 5. Profile plot of WHOQOL-BREF (physical domain) showing time effect of ACO group, PCO group and CG