
Tai Chi for arthritis: a feasibility study with frail older people receiving community services



**National Ageing Research Institute
and
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This report was prepared by:

Dr Keith Hill



National Ageing Research Institute

In collaboration with:

Ms Barbara Whiteford, Care Connect Ltd, Deer Park

Ms Marie Vosti, Care Connect Ltd, Deer Park

Tai Chi for Arthritis trainer:

Mrs Pek Hill, Physiotherapist, Sunbury Community Health Centre

Research Assistant:

Ms Natalie ElHaber, National Ageing Research Institute

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1. Collaborating organisations

The National Ageing Research Institute:

The National Ageing Research Institute (NARI) has developed as a centre of excellence in research on ageing, public health research, including health service evaluation, and the delivery of quality aged care education programs for health professionals and service providers. NARI is committed to the conduct of high quality research and to the development of a research and clinical workforce in aged care. NARI has a dynamic, experienced team with a broad range of research expertise, skills and interests, and has collaborated effectively with a range of organisations in recent and current projects. NARI has recently conducted a number of projects investigating health outcomes associated with physical activity for older people, including a study of the effects of 24 form Beijing style tai chi on balance and related measures.

Care Connect Ltd (Deer Park):

Care Connect is a non profit organisation specialising in assessment, care management and brokerage services. Formerly known as West Care Linkages, our organisation was established to specifically prevent the premature or inappropriate admission of frail aged and younger disabled persons to residential care (ie. nursing homes and hostels).

Care Connect operates in the Eastern and Western Metropolitan Regions of Melbourne and also New South Wales. Care Connect exists to support and complement the community's capacity to enhance the quality of life of people with complex care and support needs, and those of their families and carers.

Based in the Western Region our Community Aged Care Team have developed an initiative / pilot project on Tai-Chi in partnership with the National Ageing Research Institute. The Tai Chi project aims in the prevention of falls in our aged clients.

2. Executive Summary

Older people living at home and receiving community services are potentially at risk of reducing functional abilities and increasing dependency over time. This group are generally frail and have a range of pre-existing co-morbidities. While Tai Chi has been shown to be an effective exercise approach for older people generally, it has rarely been investigated with more frail older people. In this small pilot project, a modified form of Tai Chi (Tai Chi for Arthritis) was used to evaluate the feasibility of this exercise form for frailer older people, and to provide preliminary data about effectiveness of this approach across a range of health outcomes.

Nine participants who were receiving one or more community services through Care Connect Ltd were recruited to commence the program. They had an average age of 72, and one third were living at home alone. Baseline measures indicated that the group had moderate impairment compared to healthy older people on a number of measured domains, including balance, mobility, endurance, leg muscle strength, activity level, self rated health, fear of falling and falls risk.

The Tai Chi for Arthritis program was conducted twice weekly for four months by an accredited trainer. Tai Chi for Arthritis consists of an abbreviated set of 12 forms (or movements). The program was conducted in a community hall, participation was free to participants, and transport to the venue and lunch after the classes were also provided free.

Five participants completed the four month program, with an average attendance rate of 81% of classes. There were small but non-significant improvements on most of the outcome measures following the four month Tai Chi for Arthritis program. Most participants indicated they felt some benefits associated with the program. Although one of the participants reported tiredness after classes, and some exacerbation of leg symptoms that meant modifying some of the

movements in the classes, the classes were generally considered suitable and practical for this group.

In summary, Tai Chi for Arthritis appears a practical and acceptable method of gentle exercise for frailer older people living at home. The results from this small pilot trial provide a positive indication that this type of program may be effective in improving health across a number of important domains such as balance, mobility, cardiovascular fitness and self rated health, although these results need to be investigated further in a larger sample.

The target group for this research – frailer older people receiving community support services – received considerable support for their participation in this program by the Care Connect staff, including provision of transport, booking of the venue, payment of the Tai Chi trainer, and provision of refreshments / meals. These are likely to be important facilitators for participation in exercise for this group. Health problems were the main reasons cited for missing sessions, or for dropping out of the program. The drop out rate for this program was relatively high compared to other exercise programs, although is likely to be related to the increased frailty / co-morbidities in this sample.

Conclusion:

Tai Chi for Arthritis appears a practical gentle exercise approach for frailer older people. Preliminary results suggest trends for improvement on some balance, mobility, fitness and the mental health component of self rated health, although these warrant further investigation in a larger sample with sufficient power to detect significant differences in this target group.

3. Introduction

3.1 *The burden of physical inactivity among older Australians*

Physical inactivity contributes about seven per cent of the total burden of disease in Australia (Mathers et al, 1999). It has been shown to be associated with all cause mortality (Blair et al, 1989), and morbidity related to cardiovascular disease including stroke and heart attack (Bauman et al, 1999), diabetes (Helmich et al, 1991), and hypertension (Wareham et al, 2000). There is also evidence of reduced physical activity being associated (either as a cause, or as a complication) with osteoarthritis and rheumatoid arthritis (Farrell et al, 1995), respiratory disease (Bath et al, 1998), risk of falling (Campbell et al, 1989), and falls related injuries (Hoidrup et al, 2001). Many of these conditions also increase in incidence with age.

Australia has an ageing population, with 12% of the population aged 65 years or older in 1996, projected to increase to 22% of the population by the year 2050 (Australian Bureau of Statistics, 1997). Given this demographic shift, the number of people seeking support from the health service system is estimated to escalate unless public health approaches such as physical activity are widely implemented to reverse current trends. It is likely that those with most scope to benefit in terms of improved health and quality of life from engaging in physical activity are those who are relatively inactive.

Frail older people living at home are at considerable risk of further ill health and reduced function, which can increase the likelihood of requiring increased support services to remain independent at home, or may even lead to the need for residential care. Tai Chi has the potential to improve health of older people across a range of domains, and if successful, potentially to improve function, independence, quality of life and reduce the need for ongoing services. This approach has not been investigated with frail older people living at home, and is the focus of this research project.

3.2 Tai Chi as a health promotion approach for older Australians

Tai Chi is gaining popularity as a form of exercise for older people in Australia. While there is growing interest in this type of exercise, there remains considerable lack of understanding about the different types of Tai Chi, and that these different types of Tai Chi may be associated with different health benefits. In addition, the majority of existing research on Tai Chi and older people has been conducted on **healthy** older people. This project aims to investigate the effects of a simplified version of Tai Chi among frailer, relatively inactive older people living in the community.

There is considerable research evidence about a range of health benefits of Tai Chi among older people. Using pre / post design, studies have identified significant improvements in leg strength (Lan et al, 1998; Lan et al, 2000), cardiovascular / cardiorespiratory fitness (Lan et al, 1998; Lan et al, 2000), trunk flexibility (Lan et al, 1998), static standing balance (Schaller, 1996), dynamic standing balance (Shih, 1997), pain (Ross et al, 1999) and mood (Ross et al, 1999) following completion of a Tai Chi program. Most commonly, these studies have used 20 or 24 forms (Schaller, 1996; Shih, 1997), and healthy older people as participants. Wolfson et al (1996) introduced low intensity Tai Chi for a six month period following a three month high intensity strength and / or balance training program for older people, and identified maintenance of some of the strength and balance improvements achieved by the initial program. Two randomised controlled trials have been conducted. One of these compared an abbreviated 10 form Tai Chi with a balance platform training program, and an education program (Wolf et al, 1996). Results included a significant lowering of systolic blood pressure post exercise, reduced fear of falling and increased time to first fall. There was, however, no significant improvement in balance measures in the Tai Chi group, although there was a significant improvement in balance for the balance platform training group (Wolf et al, 1997). Another randomised controlled trial using the 24 form Beijing style Tai Chi identified significant improvements in self reported physical function and movement efficacy compared to a control group (Li et al, 2001a & b). Those participants with lower levels of function and health perception demonstrated greater benefit from the Tai Chi program (Li et al, 2002).

A number of review papers have been published describing the current research evidence about the effectiveness of Tai Chi in improving a range of health domains for older people (Li J et al, 2001; Chen and Snyder, 1999; Kessenich, 1998; Wu, 2002). The recent review by Wu (2002) highlights the limitations of current research in this area, including that most studies:

- use reasonably healthy older participants;
- use different styles of Tai Chi (and sometimes don't clearly report the style used);
- utilise differing outcome measures; and
- vary in the duration and frequency of Tai Chi practice.

In recommendations for future research, Wu (2002) identifies the need for Tai Chi programs to target frailer older people with balance disorders, and to use sensitive measures of balance performance. This pilot study aims to address these issues.

3.3 *Tai Chi for Arthritis*

The gentle, flowing movements associated with Tai Chi have resulted in it being considered a useful exercise form for people with arthritis. A number of different types of Tai Chi have been reported for use by people with arthritis. Fifteen movements from the Yang style Tai Chi Chuan were adapted in a pre-post study by Kirsteins et al (1991) with patients with rheumatoid arthritis. They reported that this gentle, modified form of Tai Chi was a safe form of exercise for people with rheumatoid arthritis, which did not aggravate arthritic symptoms. Hartman et al (2000) reported a randomised controlled trial using a nine form Yang style Tai Chi for people with arthritis which resulted in significant improvements in arthritic self-efficacy, quality of life and function.

Tai Chi programs using a larger number of forms (eg Beijing 24 form) are considerably more challenging to perform from a balance perspective, and while there is evidence of these programs being beneficial for reasonably healthy older people (Li et al, 2001a and b; Hill et al, 2002a), these programs appear too difficult for frailer older people with moderate balance and mobility impairments. Some of the modified approaches to Tai Chi that have been described for people with arthritis appear more practical for frailer older people. The simplified type of Tai Chi

proposed for this study (Tai Chi for Arthritis) is one that is becoming increasingly popular in Australia for people with arthritis. Tai Chi for Arthritis has been developed by Dr Paul Lam in Sydney, Australia (Lam, 1998). However, there has been very little research undertaken about the specific effectiveness of Tai Chi for Arthritis, with none targeting frail older people generally, as opposed to people with arthritis. A study comparing Tai Chi for Arthritis to hydrotherapy for community dwelling people over 60 years of age is currently underway in Sydney (Vouketalos and Metcalfe, 2002), although the study methodology indicates the target group is not likely to be “frail”. One current study in the United States of America is investigating a modified type of Tai Chi for older people in residential aged care settings (Wolf et al, 2001). Anecdotally, Tai Chi for Arthritis appears practical and acceptable for older people with arthritis, and is envisaged to have similar application to frail older people with a range of other co-morbidities. The applicability and effectiveness of Tai Chi for Arthritis for frail older people receiving community services was investigated in this current study.

3.4 Summary

While there appears to be increasing research evidence supporting Tai Chi as a gentle form of physical activity with positive health outcomes for older people, there is a clear need to extend the current Tai Chi research to incorporate evaluation of effectiveness to groups who have previously not been the target of this stream of research, such as frailer older people living at home. Tai Chi for Arthritis is a simplified type of Tai Chi that appears suitable for this target group, and was evaluated in this current pilot study.

4. Method

4.1 *Primary hypothesis*

That a simplified version of Tai Chi (Tai Chi for Arthritis) will result in improved physical, functional, psychological, and self rated health measures in frail older people living at home.

4.2 *Study aims*

- to evaluate the effect of a simplified Tai Chi program for frail older people living at home, on balance and mobility, confidence, self rated health and falls risk; and
- to evaluate the acceptability of the simplified version of Tai Chi for frail older people living at home.

4.3 *Procedures*

Subjects:

Nine subjects were recruited from existing clients receiving home care from Care Connect Ltd. The program was promoted to potential participants by an information flier, and by Care Connect staff in their discussions with clients.

Inclusion criteria were that subjects be receiving community support services through Care Connect Ltd., that they were able to walk independently, and be able to understand conversational English. Exclusion criteria were presence of acute medical conditions, or presence of chronic medical conditions limiting mobility as described above, and cognitive impairment (Abbreviated Mental Test Score <7).

All subjects underwent a brief screening process, including reporting of medical past history, medication use, and community services used, to ensure they met the project inclusion criteria. Subjects then completed a comprehensive series of baseline measurements, as described below. These same measures were repeated following the four month Tai Chi for Arthritis program.

This project was approved by the Royal Melbourne Hospital Clinical Research Ethics Committee, and all participants provided informed consent to participate.

Baseline and follow-up assessments

A/ baseline measures

The following series of measures were completed by a trained research assistant in the testing laboratory at NARI. In total, the measurement sessions took approximately 1 to 1¼ hours to complete.

1. Retrospective recall of all falls in the last six months
2. **Clinical measures of balance.** These included:
 - a. Functional Reach test. The subject stood with their feet 10 cm apart, and reached as far forward as possible, with the amount of reach recorded (Duncan et al, 1990);
 - b. The Step Test. The subject stood facing a 7.5cm block, and stepped one foot on, then off the block as quickly as possible for 15 seconds (Hill et al, 1996). This was repeated for the opposite leg.
 - c. Timed Up and Go. The subject sat in a standard (45cm) chair with arms. On the instruction “go”, they stood, walked three metres to a line, turned and returned to the chair and sat again (performed at comfortable walking speed with usual walking aid) (Podsiadlo and Richardson, 1991).
3. **Comfortable walking speed**, measured over a 10 metre walkway using a stopwatch (Hill et al, 1997). Subjects were instructed to walk at their comfortable speed through to the end of the walkway. Measurement took place over the central 6 metres of the walkway so that the subject was measured at their constant velocity. Subjects used their usual walking aid for indoors mobility.
4. **Muscle strength measurement.** Lower limb muscle strength was assessed by timing the duration to complete three sit to stand to sit movements from a standard 45 cm chair (based on the method reported by Cheng et al, 1998). Subjects were allowed to use their arms to push up if required.
5. **Fear of falling** was assessed using the Modified Falls Efficacy Scale (Hill et al, 1996). This is a 14 item questionnaire investigating the subject’s confidence in performing a range of routine activities without overbalancing. Each item is rated on a 0 – 10 scale, with 10 indicating “completely confident” in performing the task without overbalancing, 5 indicating “fairly confident” in performing the task without overbalancing, and 0 indicating “not confident at all” that the task

can be performed without overbalancing. An average score / item was calculated.

6. **Activity level** was measured using the Human Activity Profile (HAP, Fix & Daughton, 1988). This 94 item questionnaire has been used in a number of studies of older people (Hamdorf et al, 1999; Hill et al, 1999). The items are organised in order of increasing energy expenditure, with a higher score indicating increased activity level. Each activity item is recorded as “still doing”, “have stopped doing” or “never did”. Two measures were derived from the HAP, the Maximal Activity Score (MAS) which is the number of the highest numbered item still being used, and the Adjusted Activity Score (AAS), which is the MAS less the number of items lower than the MAS that are recorded as “have stopped doing”. The AAS is considered a more accurate indicator of global activity level, and is the measure used in this study.
7. **Fitness level** was evaluated using the 6 minute walk test (Guyatt et al, 1985). This test is conducted on a level 30 metre corridor. Subjects were asked to walk as many laps of the corridor as they could for a period of 6 minutes, and the total distance covered was calculated. Subjects could stop during the six minutes if required, although any rests were considered as part of the six minute test period. Subjects used their usual walking aid for this test.
8. **Falls risk assessment** was measured using the NARI Falls Risk for Older People – community version (FROP-Com). This 13 item falls risk assessment tool has been pilot tested in a study of older people presenting to Emergency Departments with a fall (Hill et al, 2002b). The assessment tool was completed by the research assessor, and involved some questions being answered by the participant, and some objective measures.
9. **Self rated health**, using the SF-36. The SF36 is a short generic index of health status (Katz et al, 1992; Ware et al, 1993). Two components of the SF-36 were analysed – the Physical Health Component Score (PCS) and the Mental Health Component Score (MCS) (Ware and Kosinski, 2002).
10. **Blood pressure** was assessed in lying, then standing after one and three minutes.

A prospective falls diary was provided to all participants to record details on all falls which occurred during the 4 month Tai Chi training period. Falls diaries have been shown to improve accuracy of falls recall by up to 20% (Hill et al, 1999).

B/ Re-assessment after the intervention

After the four month intervention period, subjects were re-assessed on each of the baseline measures. In addition, participants were asked to complete a survey about factors associated with the program, perceived benefits, and ways the program could be improved. The survey was based on one used in a previous Tai Chi study (Kutner et al, 1997).

Throughout the Tai Chi program, attendance at classes (participation rate) was recorded by the Tai Chi practitioner.

C/ The Tai Chi intervention

The Tai Chi exercise intervention was conducted in a community hall two times weekly, for four months. An abbreviated form of Tai Chi, considered to be most suitable for use with frailer older people, was used in this study (Tai Chi for Arthritis program, Dr Paul Lam). An experienced physiotherapist who had undergone formal training in the delivery of Tai Chi for Arthritis, conducted the program, and at least one additional staff member from Care Connect Ltd was involved in the training program to monitor participants, and provide additional support if required. Transport was provided for participants. Refreshments were available following each Tai Chi session.

Only one or two of the 12 movement sequences were initially taught in the early sessions. Each session consisted of warm up exercises / movements, then observation and practice of the Tai Chi for Arthritis movements that had been introduced, and then finished off with additional flexibility, relaxation and postural exercises as warm down. Rests were allowed throughout the session as required. Participants were gradually introduced to more of the 12 Tai Chi movement sequence as they developed confidence with the movements they had learnt.

Figure 1 Photos of Tai Chi group



5. Results

5.1 Profile of the participants

Nine participants commenced the Tai Chi program. The nine participants had an average age of 72.3 years (± 10.1), with 89% of participants being female. Five of the participants were widowed, 3 were married, and one was single. One third were living at home alone, one third with their spouse, and one third lived with others. The community services used by participants are described in Table 5.1. On average, participants used two community services each. Average participant's height was 1.6 m (± 0.09), and weight was 76.4 kg (± 14.7). Five participants walked unaided indoors, two used a single stick, one a four point stick, and one a walking frame. Outdoors, only two participants walked with no gait aid, while five used a single point stick, one used a four point stick, and two used a frame.

Table 5.1. Community services used by participants

Community service	Number	Percentage
Meals on wheels	1	11.1
Home help	9	100.0
Day Hospital / community rehabilitation	0	0.0
Day Centre	1	11.1
Community nurse	0	0.0
Personal alarm	2	22.2
Home maintenance	5	55.6
Respite care	1	11.1

Performance on the physical, functional and self rated health measures for the nine participants at commencement of the Tai Chi program are reported in Table 5.2. The third column reports scores on the various measures for samples of healthy older people, to provide a comparison. These measures indicate that the sample participating in this study had moderate balance, mobility, and functional impairments, compared to measures reported previously for healthy older people.

On most measures, the study sample mean score was outside the 95% Confidence Intervals (CI) reported for healthy older people.

Table 5.2. Physical, functional and self rated health measures of participants at baseline.

	Score (mean \pm SD)	Score for healthy older people
Timed Up and Go test (secs)	18.11 (8.8)	9.1 (95%CI 6.6-11.6) [#]
Functional Reach test (cm)	24.1 (4.9)	30.7 (95%CI 23.1-38.3) [#]
Step Test (steps in 15 secs)	8.9 (4.3)	16.1 (95%CI 10.2-22.0) [#]
Comfortable walking speed (mt / min)	41.6 (16.5)	67.6 (95%CI 49.6-85.6) [#]
Six minute walk test (mt)	227.2 (97.7)	583 (SD=53) [*]
Time for 3 x sit to stand (secs)	10.7 (3.0)	4.4 ^{**}
Modified Falls Efficacy Scale	6.5 (1.6)	9.8 (95%CI 9.2-10.0) [#]
Human Activity Profile (AAS)	36.2 (9.5)	69.9 (95%CI 56.8-83.0) [#]
SF-36 – Physical Component Score	30.5 (9.0)	42.6 (SD=11.4) [^]
SF-36- Mental Component Score	48.2 (14.7)	52.4 (SD=9.2) [^]

[#]Hill et al, 1999 (females aged 74.1 \pm 4.0 years)

^{*}Gibbons et al, 2001 (females aged 61-80 years)

^{**} Composite score derived from normative data from Cheng et al, 1998 (mean age 63 \pm 8).

[^] Ware and Kosinski, 2002 (SF-36 Manual, 2nd edition.)

Five participants reported at least one fall in the previous 12 months, with four of these participants falling twice. The falls risk assessment tool indicated that participants had a moderate risk of falling. Participants had an average total falls risk score of 20.1 (\pm 8.0) [it should be noted that one item on the FROP(Com) was unable to be rated as it required the assessment to be undertaken within the home]. A previous study of older people presenting to an Emergency Department after a fall (ie subjects with high risk of recurrent falls) reported an average total FROP(Com) score of 23.9 (\pm 8.8). The falls risk score demonstrates another domain on which the participants in this study could be considered frail and at moderate risk.

The individual components of the falls risk score [FROP(Com)] are reported in Table 5.3. Some participants demonstrated moderate or high falls risk on most of the individual items. Of note, all participants had a number of chronic conditions

affecting balance and mobility, they were on multiple medications (with all participants having at least one medication which increases risk of falling), and most required assistance with Instrumental Activities of Daily Living such as shopping, housework and laundry.

Table 5.3. Participant's falls risk score for individual items on the FROP(Com).

Falls risk item	Number	Percentage
Number of falls in past 12 months		
- Nil	4	44.4
- One	1	11.2
- Two	4	44.4
Injuries associated with falls		
- No	2	
- Yes	3	
Number of medications		
- No medications	0	0.0
- 1-2 medications	1	11.1
- 3 medications	1	11.1
- 4 or more medications	7	77.8
Number of high falls risk medications		
- None	0	0.0
- 1-2	4	44.5
- 3	3	33.3
- 4 or more	2	22.2
Number of chronic medical conditions affecting balance or mobility		
- None	0	0.0
- 1-2	0	0.0
- 3-4	3	33.3
- 5 or more	6	66.7
Uncorrected sensory deficit		
- Vision	0	0.0
- Hearing	1	11.1
- Somato-sensory	2	22.2
Foot problems		
- Yes	5	55.6
Footwear problems		
- None (footwear appropriate)	3	33.3
- One problem	5	55.6
- Two problems	0	0.0
- Three or more problems	1	11.1
Cognition (AMTS)		
- 9-10	3	33.3
- 7-8	6	66.7
- <7	0	0.0
Continence		
- reports some incontinence	5	55.6
- regularly gets up at night for toileting	5	55.6
Food intake declined in past 3 months		
- No	7	77.8
- Small change, but intake remains good	1	11.1
- Moderate loss of appetite	1	11.1
- Severe loss of appetite / poor oral intake	0	0.0

Weight loss in the past 3-12 months		
- Nil	5	55.6
- Minimal (<1kg)	0	0.0
- Moderate (1-3 kg)	0	0.0
- Marked (>3kg)	4	44.4
Environmental hazards contributing to fall/s		
- No environmental hazard	2	
- Minimal environmental hazard contribution	1	
- Moderate environmental hazard contribution	0	
- Major involvement of environmental hazards	2	
Did the environment appear safe	Not assessed	
Observed behavior in ADL and mobility		
- Consistently aware of current abilities	6	66.7
- Occasional risk taking behaviour	2	22.2
- Under-estimates abilities / inappropriately fearful	1	11.1
- Over-setimates abilities / frequent risk taking	0	0.0
Assistance with personal care		
- None	6	66.7
- Supervision	0	0.0
- Some assistance required	3	33.3
- Completely dependent	0	0.0
Has this changed since most recent fall		
- Yes	1	
Assistance with IADL		
- None	2	22.2
- Supervision	0	0.0
- Some assistance required	7	77.8
- Completely dependent	0	0.0
Has this changed since most recent fall		
- Yes	0	
Balance scores within normal limits		
- Both TUG and FR within normal limits	4	44.5
- One within normal limits	3	33.3
- Both outside normal limits	2	22.2
- Requires assistance to perform	0	0.0
Walk safely around home		
- Independent, no gait aid needed	6	66.7
- Independent with a gait aid	3	33.3
- Safe with supervision / physical assistance	0	0.0
- Unsafe	0	0.0
Walk safely in the community		
- Independent, no gait aid needed	2	22.2
- Independent with a gait aid	7	77.8
- Safe with supervision / physical assistance	0	0.0
- Unsafe	0	0.0
How physically active is the individual		
- Very active (exercises 3 times per week)	2	22.2
- Moderately active (exercises <2 times per week)	5	55.6
- Not very active (rarely leaves the house)	2	22.2
- Inactive (rarely leaves one room of the house)	0	0.0
Has this changed since most recent fall		
- Yes	1	

Note: shaded areas indicate where data only relates to those participants who had fallen, and not the full sample.

5.2 Participation in the Tai Chi program

Five of the nine participants completed the four month Tai Chi for Arthritis program (56%). Those who did not complete the program ceased participation because of new health problems or exacerbation of pre-existing health problems (not associated with the program).

The five participants who completed the program had an average age of 73.6 (± 9.8), and were similar on most baseline measures to those who withdrew ($p > 0.05$).

The five participants who completed the program attended an average of 81% of available classes (range 73% to 97%). Reasons for non-attendance at classes for these five participants were mostly related to illness.

5.3 Comparison of pre and post Tai Chi measures

Scores for the five participants who completed the four month Tai Chi for Arthritis program are reported in Table 5.4. Although the changes were relatively small, on most measures there was a small but non-significant improvement. Given the small sample size, it is not surprising that none of these changes were significant. Apriori power calculations indicated that a sample of approximately 60 participants would be required to achieve significant group differences. As such, this study should be considered as a pilot study, and this level of improvement considered a positive outcome supporting the need for a larger sample study.

Table 5.4 Pre and post Tai Chi scores for participants completing the program.

Measure	Pre Tai Chi score (mean ± SD)	Post Tai Chi score (mean ± SD)	Significance (p<0.05)*
Timed Up and Go test (secs)	17.8 (8.5)	18.0 (10.4)	0.88
Functional Reach test (cm)	22.2 (5.5)	24.4 (7.1)	0.60
Step Test (steps in 15 secs) – right leg up	10.3 (1.5)	11.0 (3.5)	0.64
Comfortable walking speed (mt / min)	37.9 (14.1)	42.3 (15.7)	0.08
Six minute walk test (mt)	209.0 (80.3)	229.2 (86.9)	0.51
Time for 3 x sit to stand (secs)	10.2 (2.2)	10.0 (3.1)	0.80
Modified Falls Efficacy Scale	6.5 (1.0)	6.7 (0.4)	0.72
Human Activity Profile (AAS)	34.6 (5.9)	33.6 (10.6)	0.82
SF-36 Physical Health Component Score	30.4 (6.7)	29.8 (6.2)	0.86
SF-36 Mental Health Component Score	48.5 (13.8)	54.1 (10.7)	0.25
Falls risk score (FROP-Com)	20.2 (4.6)	20.4 (2.7)	0.91

* t-test

5.4 Survey of participants perceptions of the Tai Chi program

The five participants who completed the Tai Chi program filled in a survey about the program. Questions included factors associated with commencing the program, which parts were easiest and hardest, and practice outside the formal class sessions. The main factors associated with participants becoming involved in the Tai Chi program were that they were keen to be involved in research (80%), wanted to improve aspects of their health (60%), no cost associated with the program (60%), and central location / accessible (40%). The hardest aspects of classes were noted to be keeping balance when learning the new movements, and one participant reported feeling fatigued at the end of classes. Two respondents noted that there were no hard aspects. All participants reported some practice at home, ranging from 10-30 minutes duration, and from twice each week to daily in frequency.

Additional questions were asked based on a survey used by Kutner et al (1997) in a study of a Tai Chi program targeting improved balance performance, and which achieved a reduction in falls rates (Wolf et al, 1996). Results of these questions are compared to those from Kutner et al's study (1997) in Table 5.5. Overall results from

the small sample involved in this Tai Chi for Arthritis were positive, and comparable to those from Kutner et al's study (1997), which involved a more well group of older people, involved in a more challenging form of Tai Chi. Four of the five participants considered they had benefited from the program, with one participant reporting she felt enough benefit to take up an additional form of exercise as the classes progressed. All five participants responded that they did not encounter any difficulties with the program, although one participant did note some increase in her leg symptoms.

Four participants considered the Tai Chi for Arthritis classes should be continued, and one suggested an option for a more advanced class for those who now felt proficient with the program.

Overall, the survey responses indicated that this frail older group of participants considered the Tai Chi for Arthritis program to be an acceptable and practical exercise approach for them, and most perceived some benefits associated with the program.

Table 5.5 Survey results for questions based on Kutner et al's (1997) study

	Response	Kutner et al	Current study Response	Current study Comments
1. Has participation in this program had any noticeable effect on your life?	Yes	86%	4 (80%)	One participant indicated that she was more outgoing and confident as a result of the program.
	No	14%	1 (20%)	
2. Has participation in this program changed your sense of confidence in any area?	Yes	55%	3 (60%)	No specific comments
	No	45%	2 (40%)	
3. Has participation in the program affected your activities of daily life in any way?	Yes	80%	3 (60%)	No specific comments
	No	20%	2 (40%)	
4. Has your normal physical activity changed as a result of your participation in his study?	Yes	65%	3 (60%)	One participant reported that she has commenced a new exercise program because of the improvements from the tai chi program.
	No	35%	2 (40%)	
5. Do you feel that you benefited from participating in this program?	Yes	96%	4 (80%)	Increased confidence and activity were reported
	No	4%	1 (20%)	
6. Suggested improvements for the program				<ul style="list-style-type: none"> • Please continue the program (3) • Everything went well, don't change it (1) • Perhaps have option to progress to more advanced program (1)

6. Summary and discussion

The results reported in this study can only be considered preliminary, given the small sample size. Nonetheless, they provide sufficient data to conclude that Tai Chi for Arthritis is an acceptable and practical form of exercise for frail older people living at home and receiving community support services. This group have been shown in this study to have a range of co-morbidities, moderate balance and mobility impairments, and moderately high risk of adverse events such as falls. As such, approaches aiming to improve balance, mobility, fitness, and confidence may result in improved capacity to maintain community living.

The results of this study indicated trends for improvement on a number of the key domains identified. However, investigation with a larger sample is required to establish the strength of these improvements, and use of a control group and randomised controlled trial design would clearly establish the effectiveness of Tai Chi for Arthritis for this target group. Although other studies are currently underway using the Tai Chi for Arthritis approach (for example Vouketalos and Metcalfe, 2002), as well as investigating effects of another modified version of Tai Chi with frail residents in residential aged care (for example, Wolf et al, 2002), these are not targeting the important group investigated in the current project. In a review of the research on tai chi conducted to date, Wu (2002) identified key gaps in the current research, and noted the importance for studies to target frailer older people. Li et al (2002) also reported that participants with poorer health in their study tended to have greater benefit associated with the Tai Chi intervention. There appears a clear need for further research to establish the effectiveness of Tai Chi for Arthritis for frail older people living at home.

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