The Effect of Tai Chi on Quality of Life of Older People Living in Long-Term Care and Using Wheelchairs for Mobility: A Randomized Controlled Trial (RCT)

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Statement of Originality

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

Chen-Yuan Hsu
Synopsis

The ageing process results in a range of debilitating physical and psychological conditions. As a result, older people are increasingly residing in Long-Term Care (LTC) facilities and using wheelchairs to assist in independence and maintenance of their daily activities. The use of wheelchairs to aid mobility has the potential to negatively influence the quality of life (QOL) of such people living in LTC and in particular factors related to QOL, such as psychological well-being (depression and mood states) and self-efficacy. In spite of this, there has been limited research on the QOL of older people using wheelchairs for mobility. Most of the studies available focus on the factors influencing QOL and there is a paucity of research that explores the influence of an exercise program on the QOL of older people using wheelchairs.

This study, using a randomized controlled trial (RCT) approach, explores the impact of a 26-week seated Simplified Tai Chi exercise program (STEP) (Chen et al., 2006) on QOL, depression, mood states and self-efficacy of Taiwanese older people living in LTC who use wheelchairs. The randomization, STEP seated Tai Chi intervention and RCT design are powerful methods to examine the effect of the seated Tai Chi exercise. A sample of people was recruited, 30 in the experimental group and 30 in the control group. The baseline data were collected using the World Health Organization Quality of Life BREF (WHOQOL-BREF), Geriatric Depression Scale-Short Form (GDS-SF), Profile of Mood States Short Form (POMS-SF) and Self-efficacy for Exercise Scale (SEE), with follow up measurements collected in weeks 13 and 26.

The results indicate a significant improvement from baseline on QOL using the World
Health Organization Quality of Life BREF (WHOQOL-BREF) at week 26. The following changes in secondary outcomes were also found: a reduction in depression scores was found using the Geriatric Depression Scale-Short Form (GDS-SF); a lower mood state on the fatigue-inertia dimension was found using the Profile of Mood States Short Form (POMS-SF); and an improvement in self-efficacy level was found using the Self-Efficacy for Exercise (SEE) Scale.

In particular, this RCT study shows that a group of older people in wheelchairs living in LTC who undertook a seated Tai Chi intervention for 26 weeks had a significant improvement in QOL, a reduction in their level of depression and in the fatigue-inertia domain, and an increase in self-efficacy compared to those who received the usual standard care with no seated Tai Chi intervention. This study does, however, have limitations: primarily its use of a convenience sample, the short follow-up assessment, and the researcher being unable to be blinded regarding the assessment of outcomes. Recommendations for further research, and associated aspects of education, clinical practice, and health policy in the context of an ageing population, and the rationale behind these have also been set out.

This current study contributes to a relatively new area of knowledge and offers a practical way to help improve the QOL of older people in wheelchairs living in LTC. The use of a seated Tai Chi exercise program as a psychological health maintenance activity and/or social activity for older people in wheelchairs in LTC facilities should be supported. This will be a valuable option for helping maintain the QOL of increasing numbers of older people.
Presentations based on this research

Oral Presentation

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Aging and Society Conference, 5-6 November 2012, Vancouver, Canada.

Poster Presentations

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Abbreviations

ADL Activities of Daily Living
ANCOVA Analysis of Covariance
ANOVA Analysis of Variance
BHP Bureau of Health Promotion
BMI Body Mass Index
BP Bodily Pain
BWG Brisk Walking Group
CA Cognition Action Group
CDC The Centers for Disease Control and Prevention
CES-D Center for Epidemiological Studies Depression Scale
CESEI Cardiac Exercise Self-efficacy Instrument
CG Control Group
CHF Chronic Heart Failure
CIRS Cumulative Illness Rating Scale
CONSORT Consolidated Standard of Reporting Trials
CT Combined Training (Tai Chi and Endurance Training)
CVD Cerebral Vascular Disorder
DVD Digital Video Disc
EC Education Control
ET Endurance Training
GDS Geriatric Depression Scale
GDS-SF Geriatric Depression Scale- Short Form
GH General Health
GHQ General Health Questionnaire
HDRS Hamilton Depression Rating Score
HE Health Education Group
INDCOL Individualism and Collectivism Scale
ITT Intention to Treat
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>LBM</td>
<td>Lean Body Mass</td>
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<tr>
<td>LIE</td>
<td>Low Impact Exercise</td>
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<td>LOT-R</td>
<td>Revised Life Orientation Test</td>
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<td>LTC</td>
<td>Long-Term Care</td>
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<td>MANOVA</td>
<td>Repeated Multiple Analysis of Variance</td>
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<td>MacNewDLMI</td>
<td>QOL Questionnaire</td>
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<td>MCAR</td>
<td>Missing Completely at Random (MCAR)</td>
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<td>MCS-SF-12</td>
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<td>MH</td>
<td>Mental Health</td>
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<td>MLHFQ</td>
<td>Minnesota Living with Heart Failure Questionnaire</td>
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<td>MMSE</td>
<td>Mini Mental State Examination</td>
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<td>MOS</td>
<td>Medical Outcome Social Support Survey</td>
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<td>NYHA</td>
<td>New York Heart Association</td>
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<td>OA</td>
<td>Osteoarthritis</td>
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<td>PANAS</td>
<td>Positive and Negative Affect Schedule</td>
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<td>PCS-SF-12</td>
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<td>PF</td>
<td>Physical Functioning</td>
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<td>PHC</td>
<td>Physical Health Component</td>
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<td>POMS</td>
<td>Profile of Mood States</td>
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<td>POMS-SF</td>
<td>Profile of Mood States - Short Form</td>
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<td>QOL</td>
<td>Quality of Life</td>
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<td>RCT</td>
<td>Randomized Controlled Trial</td>
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<td>RE</td>
<td>Roles Emotional</td>
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<td>ROM</td>
<td>Range of Motion</td>
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<td>RP</td>
<td>Roles Physical</td>
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<tr>
<td>SCG</td>
<td>Sedentary Comparison Group</td>
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<td>SCT</td>
<td>Social Cognitive Theory</td>
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<td>SD</td>
<td>Standard Deviation</td>
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<td>SEE</td>
<td>Self-Efficacy for Exercise</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>SEE-C</td>
<td>Chinese version of the Self-Efficacy for Exercise</td>
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<td>SEES</td>
<td>Subjective Exercise Experiences Scale</td>
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<td>SF</td>
<td>Social functioning</td>
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<td>SF-12</td>
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<td>SFGHS</td>
<td>Short-Form General Health Survey</td>
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<td>SNHI</td>
<td>Satisfaction with the Nursing Home Instrument</td>
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<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
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<td>SSES</td>
<td>State Self-Esteem Scale</td>
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<td>SSQ6</td>
<td>Social Support Questionnaire-Short Form</td>
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<td>STEP</td>
<td>Simplified Tai Chi Exercise Program</td>
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<td>SWLS</td>
<td>Satisfaction with Life Scale</td>
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<td>TC</td>
<td>Tai Chi</td>
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<td>TCEA</td>
<td>Tai Chi Exercise for Arthritis</td>
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<td>TCSE barriers</td>
<td>Self-Efficacy to overcome barriers to Tai Chi</td>
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<td>TCSE performance</td>
<td>Self-Efficacy to perform Tai Chi</td>
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<tr>
<td>TDQ</td>
<td>Taiwanese Depression Questionnaire</td>
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<tr>
<td>TMD</td>
<td>Total Mood Disturbance</td>
</tr>
<tr>
<td>TV</td>
<td>Television</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
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<tr>
<td>VAS</td>
<td>Visual Analogue Scale</td>
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<tr>
<td>VT</td>
<td>Vitality</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<td>WHOQOL</td>
<td>World Health Organization Quality of Life</td>
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CHAPTER ONE

INTRODUCTION

Due to age-related changes, older people may have to adapt to frailty and as a consequence, disability, or physical degeneration that may require living in long-term care (LTC). As a result, many frail older people may need to use wheelchairs to assist their independence and mobility. As such, it is common for older people to use wheelchairs in the community and in LTC facilities. In Canada, approximately 49% of residents of LTC facilities were identified as requiring wheelchairs in the 1996 National Population Health Survey (Shields, 2004). National Center for Health Statistics surveys undertaken in 1997 showed that 62.3% of older people in LTC facilities in the United States were using wheelchairs (Gabrel, 2000). Likewise, in Taiwan also, a wheelchair is a common assistive device used by older people living in LTC facilities. A survey of locomotive assistive devices used for LTC residents in Taiwan showed that 67% of the people 65 years of age or older in LTC were using wheelchairs for their daily activities (Hu, 2004). It is clear from these statistics that the use of wheelchairs in LTC is common in Taiwan, and higher than in these other countries, and the needs of people using them must be given particular consideration. This includes investigating the impact of the limitation of activity and the potential reduction in quality of life (QOL) as a consequence.

Reid, Hebert, and Rudman (2001) point out that older wheelchair users in Toronto, Canada used a wheelchair as their primary means of mobility on average for five
years, and this population identified challenges in participating in activities when in a wheelchair. Due to the low level of rehabilitation programs in LTC in Taiwan, older Taiwanese people in institutions are often limited to remaining in wheelchairs for the rest of their lives and this may affect their QOL (Tsai & Tsai, 2008). It is therefore important to consider activities that may improve the QOL of this population.

The aim of this research is to explore the impact of seated Tai Chi exercise on the QOL of older Taiwanese people using wheelchairs to aid mobility. The intention is to gain a better understanding of the benefits of Tai Chi exercise for older people confined to wheelchairs, a better understanding which may help in the development of a program to improve QOL of this population.

This chapter will begin with a discussion of the background to this study, including the ageing process and its attendant impact on QOL. Self-efficacy, depression and mood states for older people are all essential aspects which are outlined in this section because there is a correlation between psychological well-being and QOL. Following this, a statement highlighting the research problem will be detailed, and the purpose, significance, research questions, operational definitions of terms and the structure of the thesis will be presented.

1.1 Background to the study

The World Health Organization (2009a) defined “older persons” to be 65 years and older. This population is rapidly increasing worldwide and is also increasing
significantly in Taiwan where there were 1,865,472 older people in 1999 (Department of Household Registration, 2008) and by 2009, this population had increased to 2,430,460 (Department of Household Registration, 2009a).

Ageing of the population is increasing and “advanced age” countries have become a common phenomenon in the demographics of the world’s population. The United Nations defines an “advanced age” country, as a country where the percentage of people aged over 65 years, exceeds 7% (United Nations Programme on Aging, 2009). The United Nations also defines an “aged society” as a society in which the population percentage aged over 65 years is higher than 14%, and a “super aged society” as one where the percentage of older people is more than 20% (United Nations Programme on Aging, 2009). At present, there are several countries where the percentage of the population aged over 65 exceeds 14%, for example Japan (21%), Italy (20%), Germany (19%), Britain (16%) and France (16%), thus these can all be classified as either an “aged society” or a “super aged society” (Department of Household Registration, 2008).

Not only is the world’s older population increasing, but it is also increasing rapidly. The United Nations stated that there were 332,000,000 older people in the world in 1991 (Department of Household Registration, 2008). By 2000, this number had increased to 426,000,000, which indicates that older people have increased by approximately 100,000,000 during the last decade of the 20th century. In this population of older people, 70% are from developing counties (i.e. China, India, Indonesia, Africa, and South America), and it is predicted that the “aged society”
category will be encroaching quickly worldwide. Given this prediction, the QOL concerns of this older population are even more worth investigating.

There are two main factors related to this global situation, the first being the ageing of the “baby boomer” generation. For example, the number of older people in the United States is expected to double between 2000 and 2030 due to the “baby boomer” generation (Powers & Howley, 2007). The other factor is that people are living much longer than in the past. In both developed and developing countries, life expectancy for older people has increased due to improved public health and medical advances (Luleci, Hey, & Subasi, 2008).

The older population in Taiwan has made up more than 7% of the population since 1993 and Taiwan has fallen into the category of an “advanced age” country. Taiwan’s older population increased rapidly, to 10.21% in 2007, and this group is predicted to reach 13% by 2016 and exceed 14% by 2018. Taiwan is predicted to become an “aged society” by 2018 and a “super aged society” by 2026 (Department of Household Registration, 2008; Wang et al., 2010).

Taiwan’s demography is essentially characterized by longer life expectancy and lower fertility rates, rather than a baby boomer generation. Improved public health and medical advances are related to the ageing of the population, and in Taiwan, as elsewhere, this will also result in the proportion of older people increasing (Department of Household Registration, 2008; Kim, 2009; Someya & Wells, 2008; Wang et al., 2010). Unfortunately, there is no empirical evidence showing that with
increasingly longer life expectancy older people age well and enjoy a good QOL.

Frailty influences the physical, functional, psychological and social domains of human life and there is a correlation between frailty and deterioration of these domains among the aged (Chan, 2008). In LTC facilities in Taiwan, once a wheelchair is regularly used, there is little importance given to rehabilitation of the older Taiwanese people living there (Jao, 2006). Therefore the likelihood is that they will remain in a wheelchair for the rest of their lives with limited mobility, and as already pointed out, this has the potential to have a negative influence on their QOL.

Quality of life (hereafter ‘QOL’) is a multidimensional concept which includes physical, psychological, spiritual, functional, and social dimensions (Bond & Corner, 2004; Cooney, Murphy, & O'Shea, 2009; Ferrans, 1996; Murphy, Cooney, Shea, & Casey, 2009; Murphy, Shea, & Cooney, 2007). In spite of the increase in knowledge about QOL, there has been relatively limited research regarding the QOL of older people using wheelchairs for mobility. More needs to be known about the perception of older people in wheelchairs have of their QOL because of the growth of this population.

Older people’s psychological health may be affected by a lack of motivation to participate in activities and influenced by their becoming socially isolated. Netuveli and Blane (2008) suggest that QOL goes beyond health and includes such things as being active and able to participate in socially and personally meaningful activities. While participation in an activity for older people in wheelchairs can be meaningful,
not all activities are feasible for them. For this population not being able to participate in activities can have negative effects on the physical, psychological and social aspects of their lives, and also limit their satisfaction with their environment and consequently affect their QOL. Tai Chi may have desirable effects on QOL, because there is evidence that suggests Tai Chi can improve both physical and emotional health in older populations (Frye, Scheinthal, Kemarskaya, & Pruchno, 2007; Lee, Lee, & Woo, 2009; Torre, 2008). To date, however, there is no empirical evidence to support the beneficial effect of Tai Chi on the QOL of older people using wheelchairs for mobilization. A more extensive discussion of QOL and older people is presented later in this chapter.

In summary, with the number of older people increasing, there is a need to consider the practical implications of the later stage of life of this population. Due to their physical, psychological, social and environmental changes, older people have to face numerous challenges, all of which can have an effect on their QOL. Thus given the predicted older population increase, it is important to raise awareness of QOL issues and provide ways to enhance the QOL of older people. Nevertheless, there has been a lack of evidence for many health care programs for frail older people and in particular any focusing on an improvement in QOL (Department of Household Registration, 2008; Kim, 2009; Luleci et al., 2008; Rodgers & Neville, 2007; Someya & Wells, 2008; Wang et al., 2010; World Health Organization, 2009b, 2009c).

The next section outlines the impact of the ageing process on older people, particularly the physical and psychological changes, and associated issues.
1.1.1 The impact of the ageing process on older people

The World Health Organization (hereafter ‘WHO’) defines ‘health’ as “complete physical, mental and social well-being and not merely the absence of disease or infirmity” (2001, p.1). Ageing brings with it a number of influences on health and can result in increased frailty and diagnoses of chronic disease that can influence mental health and development of disabilities (Chiou, Lin, & Huang, 2009; Lin, Wang, & Huang, 2007; Lin, Wolf, Hwang, Gong, & Chen, 2007; Tsai, Wong, & Ku, 2008; Yu, Tang, Kuo, & Yu, 2006).

The majority of people older than 65 years of age are estimated to have at least one chronic physical or psychological illness. The major diseases of older people include diabetes, arthritis, cancer (Bowling, Seetai, Morris, & Ebrahim, 2007; Watson, 2008), cardiovascular disease (Bowling et al., 2007; Watson, 2008; WHO, 2003), musculoskeletal problems, incontinence (WHO, 2003), osteoarthritis (Chiou et al., 2009), sleep disturbances (Tsai et al., 2008) and chronic pain (Yu et al., 2006). Falls are another concern for older people (Wu, White, Cash, & Foster, 2009; Lin et al., 2007). These physical problems can result in the older population in Taiwan experiencing lower life satisfaction (Chiou et al., 2009), poor health, and problems with mobility (Yu et al., 2006). Furthermore, ageing can result in psychological problems, such as mental health deterioration (Watson, 2008; WHO, 2003); dependency as a result of illness (Watson, 2008); dementia (Watson, 2008); sensory impairments (WHO, 2003) and depression (Lin et al., 2007). This clearly indicates that older people suffer from a wide range of illnesses and health-related problems.
and may also have to deal with reduced ability to maintain their daily activities.

The influences of ageing on health becomes more complex when there is disability or frailty (Watson, 2008). Wu, Leu, and Li (1999) surveyed 1,321 community-dwelling older people in Taiwan who were unable to independently carry out at least one of such basic self-care activities as bathing, dressing, eating, transferring from a bed to a chair, toileting, and walking inside the house. During a 3-year study period, 11.0% of their subjects developed chronic immobility that influenced their ability to carry out activities of daily living (ADL) and those aged 70 to 79 years or older had an increased risk.

The Taiwanese government has also surveyed older people regarding their living conditions and found that older people face physical degeneration and various psychological and social challenges. In 2005, 65.2% of older people were reported to have chronic diseases and to have more specific and complex health requirements (Department of Household Registration, 2008). These health problems of the older population in Taiwan and various social-economic changes have resulted in LTC facilities becoming a care option for older people (Wu et al., 2009). This is particularly the case when older people become dependent on assistive devices or others for care and help with their daily lives, performing activities of daily living (ADL) such as bathing, dressing, eating, transferring from a bed to a chair, and toileting (Luleci et al., 2008).

Nevertheless, although most “aged society” countries are faced with the task of
establishing LTC systems, there is still a lack of understanding of how such care systems affect the QOL of older people (Kim, 2009), particularly those who are limited to using a wheelchair for their mobility and daily activities.

Various individual aspects, such as self-efficacy, also influence QOL. The next section discusses the concept of self-efficacy and its influence on the QOL of older people.

1.1.2 Self-efficacy of older people

Bandura (1997, p. 3) defined an individual’s ‘self-efficacy’ as “belief in one’s capabilities to organise and execute the courses of action required to produce given attainments”. In lay terms it is their confidence about being able to perform a task successfully. It influences how an individual then approaches tasks and challenges, and their motivation. Self-efficacy is an important factor associated with an individual’s behavioural strategies, affecting their ability to handle distress and to control emotional reactions connected with QOL (Lev et al., 2007). Many studies have found a positive effect of ‘perceived self-efficacy’, in the sense of people’s perceptions of their own capacity to perform a task or meet a challenge, being reported in relation to QOL in the older age group participating in an intervention such as a physical activity or exercise (Dechamps, Onifade, Decamps, & Bourdel-Marchasson, 2009; Lee, Avis, & Arthur, 2007; Lee et al., 2009; Umstattd & Hallam, 2007). It is therefore important to include consideration of the factor of an individual’s self-efficacy in this study that will examine seated Tai Chi exercise. In particular, it is important to consider whether self-efficacy influences activity levels
and results in participants’ perceiving that they are enjoying improved QOL.

Psychological well-being is an important aspect of how individuals perceive their QOL. For this reason the depressive symptoms and mood states of older people in wheelchairs living in LTC are important considerations. These are discussed in the next section.

1.1.3 Depression and mood states of older people

The everyday experience of older people living in LTC facilities in Taiwan consists of a highly structured lifestyle, restricted activities, concern with safety issues, and limited social interactions (Tsai & Tsai, 2008). Quality of life for frail older people who require the assistance of a wheelchair for mobility can be affected by a number of factors, such as individual expectations and experiences, cultural values, and a sense of empowerment (Murphy et al., 2009); and psychological factors such as depression and mood states (Tsai & Tsai, 2008). Depression is a common mental health problem and it is estimated to affect between 300,000 to 360,000 Taiwanese, and the prevalence of depression in the older Taiwanese population is between 12.9% and 21.7% (Department of Health, Executive Yuan, R.O.C., 2010). Evidence suggests a higher prevalence of depression (81.8%) in LTC than for those people living in the community (Lin et al., 2007). Mood states such as depression can be associated with significant disability and poor QOL. Therefore improving depressive symptoms and mood in older people may result in an improvement in QOL (Kerse et al., 2008). Qualitative studies have shown that older people who are living with physical and
mental disabilities in LTC facilities are able to describe how they perceive good QOL (Bowling et al., 2007; Murphy et al., 2009; Murphy et al., 2007). These studies do not, however, provide data that can identify whether intervention programs influence older peoples’ depressive symptoms and mood. They do not for example explore the effect of exercise, specifically doing Tai Chi, on depression and mood states. Additionally, there is a lack of intervention research investigating the key QOL components of frail older people in LTC facilities. The QOL of older people will be further discussed in the next section.

1.1.4 Quality of life of older people

Quality of life has been a concern in the medical and nursing professions since the 1970s. It is rooted in the cultures and disciplines of economics, sociology, psychology, philosophy, medicine, nursing, and geography (Murphy et al., 2009; Murphy et al., 2007). QOL is a complex multi-dimensional concept, and it is imperative to understand older people’s perception of their QOL, in order to ensure that appropriate health promotion programs can be designed and implemented (Bond & Corner, 2004; Bowling, 2005).

There are many and varied definitions of QOL. The World Health Organization Quality of Life (WHOQOL) group defined QOL as “individuals’ perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns” (WHOQOL group, 1995, p.1405). Quality of life involves both subjective and objective elements
George and Bearn (1980) for example, emphasize four dimensions of QOL: two identified as “objective” (general health/functional status and socio-economic status), and two identified as “subjective” (life satisfaction and self-esteem). Hughes (1990) identifies QOL as having the following eight dimensions: personal autonomy; expressed satisfaction; physical and mental well-being; socio-economic status; quality of the environment; purposeful activity; social integration; and cultural factors. More recently, Bowling et al. (2003) argue that QOL is made up of a collection of interacting objective and subjective dimensions which may change over time in response to life, health events and experiences. Of particular relevance to this study is their judging social relationships and health as being the most important aspects of QOL. Grewal et al. (2006) identify QOL in terms of having five aspects: attachment (feeling of love, friendship, affection and companionship); role (having a purpose and feeling valued); enjoyment (feeling pleasure, joy and a sense of satisfaction, having personal and communal activities); security (feeling safe and secure, having sufficient finances, feeling sufficient practical emotional support and health); and control (having independence and able to make one’s own decisions). QOL is clearly a complex phenomenon and of course differs from individual to individual. It is variously interpreted by older people and by society, and is therefore difficult to define.

Several studies have shown that a good QOL of older people is associated with family, social contacts, health, mobility/ability, psychological well-being, activities, independence, happiness, material circumstances, youthfulness, and living environment (Bond & Corner, 2004; Farquhar, 1995; Murphy et al., 2007; Murphy,
In 2004, Tester and colleagues sought the opinions of frail older people with physical and mental disabilities living in institutions about their QOL. These frail older people reported that the important aspects of QOL were a strong sense of self, the care environment, relationships, and activities in LTC (Tester, Hubbard, Downs, MacDonald, & Murphy, 2004). Similarly, Cooney et al. (2009) identified that an ethos of care, sense of self and identity, connectedness, activities and therapies impacted on older people’s perceptions of QOL. Choosing care priorities is also an important element of the care environment and the QOL of older people in LTC. Older people in LTC explain good QOL in their environment as when they are offered the opportunity to enhance their psychological well-being, especially by being able to keep up social relationships and develop new friendships through participation in an enjoyable activity (Murphy et al., 2007). This combination of factors suggests that participating in Tai Chi exercise may offer an improvement in the QOL of older people in LTC.

The literature also reflected research interest in the more focused concept of the relationship between health and QOL (Blane, Netuveli, & Montgomery, 2008). An early definition of health-related QOL is as the subjective evaluation of health function and satisfaction with that function (Kraenzle Schneider, Cook, & Luke, 2008; Rejeski, Brawley & Shumaker, 1996). Haas (1999, p.219) defines it as a ‘subjective sense of well-being’. The Centers for Disease Control and Prevention, CDC (2007) defines health-related QOL as a person’s or group’s perceived physical and mental health over time. Rejeski and Mihalko (2001) define health-related QOL as one’s perception of satisfaction with valued domains of life. They argue that the
psychological construct may underlie the relationship between physical activities and QOL and that experiencing enjoyment for participating in activities also directly affects life satisfaction.

Health-related QOL is also seen as a multidimensional construct (Saavedra, Cruz, Escalante, & Rodriguez, 2007), one which represents personal satisfaction with life in four domains: physical (Revicki, 1989; Saavedra et al, 2007); cognitive (Saavedra et al, 2007); emotional (Revicki, 1989; Saavedra et al, 2007); and social (Revicki, 1989; Saavedra et al, 2007). It is influenced by factors such as physical activity, age, gender, education level, place of residence, and illness, amongst others (Saavedra et al, 2007). Health-related QOL is therefore a self-perceived quality and difficult to objectively measure (Saavedra et al, 2007). Similarly, Bize, Johnson, and Plotnikoff (2007) summarize health-related QOL as including the perceived and valued health qualities, such as the sense of comfort or well-being, the ability to maintain good physical, emotional, and intellectual functions, and satisfaction with social activities.

Although there is a wide range of definitions of QOL, the research literature indicates that the QOL aspect of health care (and health-related QOL) is worth exploring, especially its relationship with nursing care. There are in fact similarities in the definitions of health-related QOL and QOL. QOL is seen as encompassing factors such as individual experiences, values, cultures, life standards, goals, expectations, considerations, health consciousness, and well-being in the physical, psychological and social domains. This includes physical functioning, emotional well-being, and social functioning.
Health-related QOL is generally accepted as a subjective experience, and the related research looks at such concepts as what constitutes a good QOL level, what improvements are needed, and the aspects of QOL that should be adjusted. This study evaluating the QOL of older people in wheelchairs living in LTC must therefore also pay attention to both generic QOL and health-related QOL.

Interaction with one’s environment must also be included in a definition of QOL because as mentioned above research has shown that older people in LTC identify environmental factors as an important component of QOL (Cooney et al., 2009; Murphy et al., 2007; Tester et al., 2004). This current study will use the WHO (1997) definition of QOL, one that incorporates health-related QOL, physical, psychological social, and environmental components. The WHO defines QOL as:

... individuals’ perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in a complex way by the person’s physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment (1997, p.1)

Additionally, if importance is to be attached to QOL improvement (including generic QOL and health-related QOL), then it is important to identify a way, or ways, to do so. Further to examining the suggestion that participating in an enjoyable activity may
increase QOL (Murphy et al., 2007), it is also necessary to identify exactly what activities assist older people in wheelchairs in LTC and the optimal frequency, duration and intensity of any such activity.

An understanding of the relative factors of QOL is important in nursing, particularly gerontological nursing care, and in education. Furthermore, there is a need to improve the efficacy of nursing care within the physical, psychological, social and environmental domains in LTC settings. This will significantly contribute to successfully improving an older individual’s perceived quality of life.

In summary, to date little research attention has been given to examining which interventions improve individual perception of self-efficacy, or of depression and mood states in older people using wheelchairs for mobility and living in LTC. No research was found which identifies interventions associated with improving individuals’ perceptions of their physical capacity, psychological well-being, social relationships, and environment. It is therefore necessary and also important to pay much more attention to the efficacy of interventions for improving QOL of older people in wheelchairs. Despite much research related to Tai Chi exercise, there is still no reliable evidence showing whether any relationship exists between Tai Chi exercise and self-efficacy, depression, mood states, and/or QOL (including the physical, psychological, social and environment domains). Tai Chi can improve psychological health (i.e. depression and mood states) (this is discussed and studies cited in Chapter 2), but its effect on the QOL of older people in wheelchairs living in LTC needs to be clarified. This highlights the knowledge gap this study hopes to fill.
The statement of the problem for this study is given in the next section.

1.2 Statement of the problem

Given an increase in the aged and frail older population in LTC, there has also been an increase in the older population who are wheelchair bound. Concerns are held about the highly structured and restricted life frail older people experience in LTC facilities in Taiwan. The lifestyle of these older people in wheelchairs is limited to static activities, such as watching television (Tsai & Tsai, 2008), and static activities make it difficult to improve the physical function and mental health of older people in wheelchairs.

The static activities in LTC facilities may affect the QOL of older people in wheelchairs and result in negative mood states (particularly depression), and lessen opportunities for social activities, and this in turn may increase pharmacotherapy and the cost of care. For these reasons activities that benefit the QOL of this population of frail older people need to be explored.

Providing meaningful activities might offer opportunities to enhance the lives of older residents in LTC facilities by providing stimulating living experiences with other residents (Cooney et al., 2009; Tsai & Tsai, 2008). There is evidence that a meaningful activity or change in older LTC residents’ constant lifestyle, such as changing potential stimulation source from static to dynamic activities, may help to improve QOL (Cooney et al., 2009; Tsai & Tsai, 2008). As such, seated Tai Chi
exercise may provide a meaningful activity for older people in wheelchairs living in LTC. Seated Tai Chi exercise could potentially improve physical health and bodily functioning, and also mental health, by reducing depression, improving mood states, and enjoyment of life. Seated Tai Chi exercise could also potentially affect social relationships by increasing the opportunity for social interactions and personal support within the LTC environment, consequently improving the QOL of older residents.

Exercise is an important part of life from youth to old age and it is known to have a positive effect on older people (Baker, Atlantis, & Singh, 2007; Courtney et al., 2009; Cook, Silver, Mier, & York, 2007; Sato, Kaneda, Wakabayashi, & Nomura, 2009; Peri et al., 2008; Powers & Howley, 2007). There is a vast amount of evidence about the effect of Tai Chi exercise on improving physical and emotional health of older populations (Chen, Hsu, Chen, & Tseng, 2007; Chen & Tseng, 2008; Choi, Moon, & Song, 2005; Frye et al., 2007; Lee et al., 2009; Lin, Hwang, Wang, Chang, & Wolf, 2006; Piliae & Elaine, 2005; Torre, 2008; Tsang, Orr, Comino, & Singh, 2008; Wolf et al., 2006; Woo, Hong, Lau, & Lynn, 2007). There is, however, a paucity of information about any ideal exercise program that contributes to improving the QOL of older people in wheelchairs, and there is limited evidence about the effect on older people using wheelchairs for mobility doing Tai Chi exercise.
1.3 Purpose of the study

This study was undertaken to explore the influence of a seated Tai Chi exercise intervention on the QOL (primary outcome), and the self-efficacy, depression, and mood states (secondary outcomes) of older people using wheelchairs for mobility and living in LTC in Taiwan.

1.4 Significance of study

This study is significant for a number of reasons in particular it offers an opportunity to focus on older people who as the population ages are increasing. Alongside an ageing of the population there is the potential for an increase in frailty and as a consequence this may result in an increase in the use of wheelchairs for mobility. This has the potential to negatively influence QOL of older people. This research is therefore are important as the research intervention has the potential to improve QOL for older people using wheelchairs.

Secondly, the study will provide information about a practical measure which can potentially be integrated into strategies for increasing exercise for older people with the potential to improve the QOL experienced in LTC facilities. It will provide an evidence-based understanding of how a seated Tai Chi program affects the QOL of older people in wheelchairs in LTC, and this information can be made available to assist the design of health promotion programs in relation to the QOL of this population. This may contribute to the design of care models for older people in LTC,
particularly in the implementation of activities to improve the QOL of older people in wheelchairs.

Thirdly, this study will provide valuable evidence about the benefits of seated Tai Chi exercise for the psychological well-being of older people in wheelchairs. Such findings have the potential to influence the development of health policy addressing ways to improve the QOL of older people in wheelchairs. Seated Tai Chi exercise may offer older residents an opportunity to experience more enjoyment and improve life satisfaction. It could potentially also have a positive impact on their psychological health by reducing depression and/or improving mood states. If Tai Chi improves psychological well-being, this could reduce the associated pharmacological treatment and potential side-effects, and thereby have a significant impact on health care budgets.

In conclusion, the research expects to identify the effect of 26 weeks of seated Tai Chi exercise on improvements in self-efficacy, depression, mood states and QOL. The results are expected to contribute new knowledge to a little explored area in the wider field of ageing health, and more immediately offer a practical solution to positively affect the problem of the currently less than ideal QOL of older people in wheelchairs living in LTC.
1.5 Research questions

This study focuses on the following questions:

1. What is the effect of seated Tai Chi exercise on the QOL of older people using wheelchairs for mobility?
2. What effect does seated Tai Chi exercise have on self-efficacy of older people using wheelchairs for mobility?
3. What is the effect of seated Tai Chi exercise on depression in older people using wheelchairs for mobility?
4. What is the effect of seated Tai Chi exercise on mood states of older people using wheelchairs for mobility?

1.6 Operational definitions of terms

Tai Chi: In this study, seated Tai Chi exercise (see 3.6 Intervention) was operationalized as practicing the STEP program (Chen et al., 2006) three times a week in 40-minute practice sessions.

QOL: In this study, QOL includes generic QOL and health-related QOL. QOL therefore is defined as having four dimensions: physical capacity, psychological well-being, social relationships and environment. This study was concerned with psychological well-being and therefore depression and mood states were measured.
Self-efficacy: In this study, self-efficacy is defined as the participant’s perception of their confidence to continue doing exercise in the face of various circumstances, such as bad weather, tiredness, and feeling depressed.

Depression: In this study, depression is defined as a negative affective state, which includes the perception of how a person feels.

Mood states: In this study, mood states are defined as positive (i.e. lively or active) and negative (i.e. tension or nervous) affective states, and these relate to a person’s total mood disturbance.

Older people using wheelchairs: In this study, older people using wheelchairs are defined as those using wheelchairs for mobility, 65 years of age and older, and living in LTC.

In summary, improved public health and medical advances for older people have resulted in increased life expectancy. This in turn has resulted in an ageing of the population and an increase in the frail older population. Despite a trend towards improved care for people living in LTC facilities, there is still a need to improve the QOL of older people in wheelchairs. There is currently a lack of evidence of how exercise, specifically Tai Chi, would benefit the QOL of this particular population of older people living in LTC facilities in Taiwan.
1.7 Structure of thesis

This thesis consists of six chapters. This chapter, Chapter 1, has provided an overview of the research background, statement of the problem, the purpose and the significance of this study, the research questions, and operational definitions of terms. Chapter 2 presents search strategy and the literature review of research into topic areas relevant to this study:

- **QOL:** QOL studies related to older people, and the importance of activities for QOL and older people in LTC in Taiwan
- **Self-efficacy:** self-efficacy theory, and self-efficacy studies related to QOL and engagement in physical activities
- **Depression and mood states:** older people with depression in Taiwan, and depression and mood states studies related to QOL and older people engaging in physical activities
- **Tai Chi exercise:** the theoretical basis of Tai Chi exercise, its benefits, and debate about Tai Chi exercise
- **Research on Tai Chi and the QOL of older people.**

Chapter 2 draws further on the literature to present the conceptual framework of this study. This illustrates why a Tai Chi exercise intervention for older people in wheelchairs in LTC was selected for the aim of increasing QOL; reducing depression and improving mood states; and increasing self-efficacy.
Chapter 3 describes the design used for this study. A randomized controlled trial (RCT) was used to determine the effect of a 26-week seated Simplified Tai Chi Exercise Program (STEP) (Chen et al., 2006) on particular aspects of QOL (the psychological health, social relationships, and environmental domains), depression, mood states, and self-efficacy of older Taiwanese people in wheelchairs living in LTC. This chapter presents the methodology used to conduct this study, including the research design, sample and setting, randomization, blinding, intervention, outcomes and data collection, and the associated methodological considerations. In addition, a detailed description of the data analysis is presented, and the ethical considerations of this study are also outlined.

Chapter 4 details the results of the implementation and evaluation of this randomized controlled trial which examined the effects of a Tai Chi exercise intervention on the QOL, depression, mood states and self-efficacy of older Taiwanese people in wheelchairs living in LTC. Information detailing participant flow, recruitment, demographic characteristics, level of cognitive impairment, obtained through Mini Mental State Examination (MMSE) and self-reported reasons for wheelchair usage, is reported. The findings from the primary (i.e. QOL) and secondary (i.e. depression, mood states, and self-efficacy) outcome measures for the control group and the intervention group are then presented.

Chapter 5 presents a discussion of the findings and how they relate to the research literature. The final chapter, Chapter 6, presents the conclusion and associated remarks, and outlines recommendations for clinical practice.
CHAPTER TWO

LITERATURE REVIEW

This chapter examines the research literature and presents the theoretical perspective of this study examining aspects of the lives of Taiwanese older people in wheelchairs living in LTC. The review undertaken explored the literature on a wide range of topics: Tai Chi interventions with older people and its effect on QOL; self-efficacy, depression, mood states, and Tai Chi; and the theoretical basis of Tai Chi, its benefits, and debate surrounding Tai Chi.

2.1 Search strategy

A search of major databases for literature pertaining to Tai Chi and its effect on the QOL, self-efficacy, depression, and mood state of older people in wheelchairs was undertaken. For English language publications these databases were: CINAHL, MEDLINE, EBSCO, PubMed, Sciverse, Scopus, Science Direct, Dissertations and Theses, and the Australian Digital Theses Program. The search terms were: “older, old, elderly”, “people, population, men, women”, “quality of life (QOL)”, “depression, mood, feelings”, “self-efficacy, confidence”, “wheelchair-bound, lack of mobility, mobility-impaired, wheelchairs” and “Tai Chi”. The inclusion criteria were: original research, published in English, from 2001-2011. Research not focusing on QOL, Tai Chi, or older people; and review articles, study protocols, and case studies were all excluded.
The National Library of Taiwan database was searched for Chinese language publications. The search terms were: “輪椅倚賴老人 (lunyi yilai laoren older people in wheelchairs)”, “生活品質 (shenghuo pinzhi quality of life)”, “憂鬱症 (youyuzheng depression)”, “情緒狀態 (qingxu zhuangtai mood states)”, “自我效能 (ziwo xiaoneng self-efficacy)”, and “太極 (taiji Tai Chi)”. Except for the language aspect, the inclusion and exclusion criteria were the same as detailed above for the English publications. Four hundred and eighty-five abstracts were identified, of which 73 papers are described in this chapter.

2.2 QOL and older people

As outlined in Chapter 1, QOL is a broad, complex, and important aspect of a person’s life. This section focuses on examining the literature on QOL in the older population. The studies focusing on the QOL of ageing, the influences of QOL, and QOL and older people in LTC in Taiwan are presented.

2.2.1 QOL of older people

There has been an increasing amount of research conducted on the QOL of older people (for example, Cheung et al., 2005; Gabriel & Bowling, 2004; Manthorpe et al., 2008; Wilhelmson, Andersson, Waern, & Allebeck, 2005; Xavier, Ferraz, Marc, Escosteguy, & Moriguchi, 2003). Gabriel and Bowling (2004) interviewed 80 older people from private households in Britain and found that the majority associated
having good health with a good QOL. As indicated in Chapter 1, there are many other domains of QOL apart from health status, and QOL instruments have been used to examine domains corresponding to physical, emotional, cognitive, and social functions (Bowling et al., 2007; Cheung et al., 2005; Lin et al., 2007; Wilhelmson et al., 2005), and to sexual functions (Wilhelmson et al., 2005). As well as these, independence (Cheung et al., 2005; Manthorpe et al., 2008) and mobility (Cheung et al., 2005) also affect people’s perceptions of QOL. The research undertaken into these various influences on the QOL of older people is outlined and discussed below.

A positive or negative perception of QOL in older people varies between people, and strongly depends on individuals’ subjective emotional interpretation and assessment. Xavier et al. (2003) used a semi-structured questionnaire on QOL with five non-inductive questions and open answers. They assessed depressive symptoms using the Geriatric Depression Scale (GDS), and general health using the Cumulative Illness Rating Scale (CIRS) to identify positive and negative experiences among 77 older people living in the community in Veranopolis, a city in Southern Brazil. Their findings indicate that a positive QOL is linked to a large range of factors, such as activities, income, social life, and relationships with the family; and a negative QOL was associated with poor health. QOL differed from person to person and was influenced by their health status.

Wilhelmson et al. (2005) surveyed 141 community-dwelling older people aged from 67 to 99 years living in the city of Goteborg, an extensive rural area in the west of Sweden, using a semi-structured questionnaire and identified the domains which they
considered affected their QOL. Participants were asked to choose three items important to their perception of QOL. Older people’s social relationships, functional ability, and activities were all identified as affecting their QOL, as much as their health status itself. Accordingly Wilhelmson et al. argue that social relationships and activities, and improving the functional ability of older people might enhance their QOL as much as health care. It is therefore important to take the factors social relationships, functional ability, and activities into consideration when developing suitable activities for older people. Their study was limited by its small sample size, and its specific rural setting and associated cultural influences. Nevertheless the finding of their study outlined above suggests that a better understanding of the social factors contributing to QOL may be conducive to enhancing older people’s QOL.

Fu, Anderson, Courtney, & Hu (2007) investigated the differences in culture, attitudes, and social networks between Australian and Taiwanese men and women and identified factors that predict midlife men and women’s QOL in both countries. Midlife men and women (aged 40-59 years) in Australia (n=278) and Taiwan (n=398) were surveyed using the following instruments: their physical, psychological, social, and environmental health were assessed using the World Health Organization Quality of Life BREF (WHOQOL-BREF) (WHOQOL group, 1998); cultural and social orientation was assessed using the Individualism and Collectivism scale (INDCOL) (Singelis, Traindis, Bhawuk, & Gelfand, 1995); attitudes were assessed using the revised Life Orientation Test (LOT-R) (Scheier, Carver, & Bridges, 1994); and the influence of social networks was assessed with the Medical Outcome Social Support Survey (MOS) (Sherbourne & Stewart, 1994). Fu et al. (2007) found significant
relationships between culture, attitudes, social networks and QOL. In particular, a higher degree of social support and a healthy optimistic disposition may significantly enhance QOL.

Fu et al.’s findings that social networks predict both social health and QOL are consistent with those of Wilhelmson et al. (2005). Fu et al. further suggested that those with positive attitudes and better social support had better physical, psychological, social, and environmental health. Thus, psychological well-being may predict life satisfaction. Fu et al.’s study has several limitations. There were generally larger correlations in the Taiwanese sample compared to the Australia sample and cultural bias may have confounded the data.

A person’s experience and how they adjust to their deteriorating health status has a major impact on their psychological health, and similarly, their QOL may be influenced by their attitudes, mental outlook, and personality characteristics (Murphy et al., 2009). A study undertaken in Ireland by Murphy et al. showed that feelings of well-being, social involvement, and opportunities to reach personal potential are significant elements of QOL. This was a grounded theory study involving interviews with 122 older people (ranging in age from younger than 65 to over 85) living in the community with one of four main categories of disability: physical, sensory, mental, and/or intellectual disabilities. They had one of six health problems: stroke (n=20); arthritis (20); vision deficits and/or hearing deficits (20); learning disability (24); depression (20); and dementia (18). Most interviewees identified “to live well”, “my health”, “social connectedness”, “being my self”, and “financial security” as
important factors in their QOL. This finding supports the hypothesis that good support from nurses, and improving peoples’ abilities, and their economic and social environment are more likely to improve their QOL (Murphy et al., 2009).

There is empirical evidence that older people with disabilities have views about their social support and social environment and that these views are related to how they view their QOL. But no research has been carried out exploring the effect of an improvement in the social relations domain of the QOL of older people with disabilities, in particular on the effect of providing a program for older people in wheelchairs to satisfy their needs for personal relationships.

2.2.2 The importance of activities for QOL

The importance of activities is clear in the QOL data from older people. Undertaking activities was frequently mentioned by the 141 older people in Sweden in Wilhelmson et al.’s (2005) study as being an important influence on QOL. The participants reported a higher QOL as being related to thinking about travelling, listening to music, being occupied, going for a walk, playing bridge, enjoying flowers, reading a good book, drinking good wine, and experiencing a range of activities. Gabriel and Bowling (2004) had similar findings when they surveyed 999 people aged from 65 and living in private households in Britain. Eighty of these people were followed-up in greater depth one year after, and again two years after the baseline interview. The study indicated, “keeping busy” as important for maintaining psychological well-being. The interviewees reported that social activities were important for their
QOL because they made them feel valued, especially activities involving voluntary work and helping other people. Other stimulating activities, such as learning new skills, and seeing new places on holiday or weekends enabled respondents to meet new friends. Regular socializing and keeping busy and active were also important. Specifically, such activities help older people to feel valued and to engage with in society in their retirement (Gabriel & Bowling, 2004).

As Gabriel and Bowling point out, a limitation of their study is that the participants were people living at home. Those living in nursing homes, hospitals or residential care were excluded, and therefore, the factors important in their QOL are likely to differ substantially and merit further investigation (Clark & Bowling, 1989). Engaging in hobbies, leisure activities, and/or social activities, and retaining a role in society may help older people in wheelchairs to enjoy their lives in residential care. But despite the above research findings indicating the significant role activities and social activities play, there has been little exploration of the QOL of older people who are frail and whose impaired mobility requires them to use a wheelchair.

There is evidence demonstrating that health status, social relationships, functional ability, and activities affect the QOL of older people. It is important for this current study to take into account the characteristics of older people in wheelchairs—they also have functioning, independence, and mobility problems that need to be considered.
In Britain, Bowling (2008) surveyed 337 older people regarding their perceptions of active ageing and QOL using a cross-sectional, open-ended questionnaire with a self-rating scale. The most common responses about what active ageing involved were: having/maintaining physical health and functioning (e.g. by exercising) (43%); leisure and social activities (e.g. going out, keeping busy, attending clubs, and so on) (34%); mental functioning and activity (e.g. exercise/activities to maintain an active mind) (18%); and social relationships and contacts (15%). The participants were aware of the importance of health and also of the effects their physical condition had on their mental activity, for instance, increased frailty and loss of dexterity made it more difficult to do crosswords, puzzles, and crafts. Bowling’s (2008) findings suggest that active ageing “influences” how older people view their QOL and that active ageing may enhance this view.

Chen (2004) found that appropriately arranged activities can help older people (aged over 65) who have to face the reality of attenuated physical and mental abilities reevaluate their life priorities and rebuild their confidence and self-efficacy. Chen discussed what leisure activities mean to older people and suggested that promoting leisure activities could assist Taiwanese older people to recreate their self-respect rather than having to resign themselves to a lesser role in society. Similarly, Ku, Fox, and Chen (2009) found that physical leisure activities are associated with decreased risk of significant depressive symptoms in Taiwanese older people. Ku and colleagues analyzed nationally representative data from a longitudinal Survey of Health and Living Status of the Elderly undertaken by the Bureau of Health Promotion. The survey was conducted from 1989-2003, using a three-stage equal probability sampling
design, and household interviews. The strength of Ku et al.’s study is that it was the first prospective study assessing the associations between leisure-time physical activity and depressive symptoms in older Taiwanese adults (aged 50 and above). The information obtained was limited to self-reports of frequency of leisure-time physical activity; it did not provide information about physical activity duration, intensity, or type.

Although encouraging older people to participate in activities provides an opportunity to improve well-being, it is extremely important to consider the individual’s health situation, and think about how to provide activity programs specifically designed for older people that aim to improve their QOL.

Most studies reviewed indicate that health status, social relationships, functional ability and activities affect the QOL of older people. Therefore understanding what opportunities may enhance the QOL of this population is important and in particular, in settings where older people are using wheelchairs to mobilize. Furthermore, how such activities may be safely undertaken by older people, and how doing so influences their confidence, self-efficacy, health status, and social relationships, and therefore affects their QOL, all need to be considered, especially for older people in LTC, who depend on others for their involvement in activities. The QOL of older people in LTC in Taiwan is explored in the next section.
2.2.3 QOL and older people in long-term care in Taiwan

The Taiwanese gerontology literature has focused on the QOL of older people living in residential care in Taiwan. Tsai and Tsai (2008) explored the lived experiences of older residents in nursing homes there. Participants (n = 33 older residents) from eight nursing homes in north Taiwan were interviewed in focus groups. Residents were asked to express “what is important to you?” and “what impresses you most in your daily lives in your nursing home?”. They described the difference between “good care” and “bad care”. Good care involved providing nursing care on time, helping residents as soon as possible, and providing whatever was needed; bad care involved a lack of respect for residents, a poor attitude, and a lack of patience while caring. Four subthemes were identified: highly structured lifestyle, restricted activities, safety concerns, and social interactions concerning everyday experiences (Tsai & Tsai, 2008). These LTC residents had four concerns: (1) The highly structured lifestyle which was described as “living here is like living in the army”, because someone assisted them in all activities of daily living, such as bathing and preparation of meals; (2) Activities were restricted because of institutional rules. In addition, there was a lack of activity programs, limitations were imposed by the environmental design (for example there were barriers to activities in the available space), and other personal limitations of living in a LTC facility. Such factors resulted in residents feeling they had nothing to do and/or that nothing was happening, even if they were sometimes wheeled outside of the LTC environment; (3) Safety issues consisted of concerns about the safety of their personal belongings; finances and personal possessions such as clothes and money; the cost of living in LTC; falls; and potential natural disasters
(such as earthquakes); and (4) Social interactions incorporated concerns about whether residents felt loved and valued through their interpersonal relationships with family, LTC staff, and/or other residents. In particular, they had concerns about the frequency of family visits and whether staff respected residents (Tsai & Tsai, 2008).

The strength of Tsai and Tsai’s study (2008) is that they gained an understanding of the lived experiences of older nursing home residents in Taiwan; nevertheless, it has limitations. The participants were referred by the LTC staff, and this may have introduced participant bias. Additionally, information about these experiences was limited to that from those who were able to share their views: people with a history of severe mental illness and those with severe cognitive or language deficits were excluded.

Research on the QOL of older people living in residential care in Taiwan has reported a number of elements: quality of care, institutional lifestyle, activities, and environment (Tsai & Tsai, 2008); and social interactions, family and social support, respect, social-policy environment and social-welfare as being essential for the QOL of the older population (Hsu, 2007). Older people living in LTC identified the provision of an activity program as being important for their QOL (Hsu, 2007; Tsai & Tsai, 2008).

There has been some discussion of activities in relation to the QOL of older people living in LTC but none of the activity programs specifically target improving QOL, especially for those residents in wheelchairs. There is a lack of information about
specific activities—which may enhance QOL—and about activities, which may influence the institutional lifestyle and environment of older people in wheelchairs in LTC, and thereby influence their views of their QOL. Participating in activities may help older people to evaluate their life experience, and build their confidence, self-efficacy, and psychological well-being, and thereby improve their QOL. The literature on relationships between self-efficacy, QOL and engagement in physical activities is discussed in the next section.

2.3 Self-Efficacy

The association between self-efficacy and QOL has been examined in older adults, in relation to improving their confidence and attitude during participation in physical activities. The following section explores the association between self-efficacy and QOL, and self-efficacy and physical activities.

2.3.1 Self-efficacy theory

Self-efficacy is a core construct of Bandura’s (1977) Social Cognitive Theory (SCT), which has been widely reported in the health and social science literature. SCT depicts learning in terms of interrelationships between behaviour, environmental factors, and personal factors. Each of these three uniquely influences an individual’s behaviour (Bandura, 1977). Bandura’s self-efficacy theory provides an analysis of behaviour change in a person’s confidence about being able to perform a specific task (Bandura, 1986). Self-efficacy is concerned with behaviour-change approaches, and it is a
common consideration in rehabilitation counseling because a person’s self-efficacy develops as a result of their history of achievement in a particular area, from experiences of successes, failures and faith, and from their own physiological state (such as emotional stimulation, nervousness, or anxiety) while performing a behaviour. For this reason self-efficacy is commonly used across disciplines to evaluate the relationship between an individual’s beliefs and their probability to engage in certain behaviours (O’Sullivan & Strauser, 2009). Self-efficacy is an important consideration for clinical practice and research, especially its effect on engagement in health promoting behaviours such as physical activities, emotional management, functional capacity, social networks, and QOL (Chang, Crogan, & Wung, 2007; Huang, Shyu, Chen, & Hsu, 2009; Kwong & Kwan, 2007; Lee, Arthur, & Avis, 2008; Lee et al., 2007; Lev et al., 2007). The relationship between physical activities and self-efficacy may have an affect on QOL. Research into the relationship between self-efficacy and QOL is discussed in the next section.

2.3.2 Self-efficacy and QOL

Bandura (1997) demonstrated that an individual’s self-efficacy influences QOL during chronic illness; and enhancing self-efficacy will improve patient’s QOL (Lev et al., 2007). Part of the challenge to preserving QOL after a diagnosis of a chronic disease, for example, is exercising control over the emotional distress connected with the individual’s physical circumstances. Active participation in activities is a good solution to distress, and to feelings of despondency and futility. This is an effect of the relationship between cognitive beliefs about a particular behaviour performance and
the performance of that behavior as self-efficacy builds. Personal behaviour strategies that can be used to manage distress during illness, and the ability to control emotional reactions are both related to QOL (Bandura, 1986, 1997). In particular, a higher level of self-efficacy has been associated with perceptions of higher QOL (Lev et al., 2007). There is empirical evidence that a relationship between self-efficacy and QOL exists, so the questions of how to improve individual self-efficacy, and of whether engaging in physical activity is an appropriate solution, both need to be addressed.

2.3.3 Self-efficacy and engagement in physical activity

It is important to consider how to better help older people remain healthy and active, especially by encouraging them to engage in health-promoting behaviour in the domains of physical activity, enhancing functional capacity, improving social networks, and improving QOL (Kwong & Kwan, 2007). Kwong and Kwan undertook individual face-to-face interviews with 896 community-dwelling older Chinese people in Hong Kong from 2002 to 2003. Their study found that perceived self-efficacy is associated with explaining and predicting health-promoting behaviour (Kwong & Kwan, 2007). Understanding what influences the older population’s participation in health promotion interventions is a first step in encouraging their involvement. Perceived self-efficacy may influence an individual’s judgment of their ability to perform a course of action.

Several studies all identified perceived self-efficacy as having a positive effect on the QOL in older people, as a result of improving their attitude, managing distress and
emotional reactions, remaining healthy and active, and/or engaging in health-promoting interventions (Chang et al., 2007; Kwong & Kwan, 2007; Lev et al., 2007). Understanding how to assist older people improve perceived self-efficacy is thus also an essential consideration because it may result in a greater participation in exercise programs, and thereby improve QOL.

A number of studies have explored self-efficacy and exercise among older people (Lee et al., 2007; Lee et al., 2009; Mancini, 2007; Perkins, Multhaup, Perkins, & Barton, 2008; Umstatt & Hallam, 2007). Lee et al. (2009) demonstrated that older people’s confidence may influence them to engage in exercise interventions and motivate them to commence and continue doing exercise regularly. A total of 192 Taiwanese older people were assessed using the Self-Efficacy for Exercise Scale (SEE) and health status was found to predict exercise self-efficacy, and exercise self-efficacy predicted physical activity. The 102 older people who exercised regularly had a higher mean SEE score (5.3) than those who did not (2.9, n = 90). The study provided evidence for the reliability and validity of the Chinese version of the SEE scale, but whether the outcomes can be generalized for older people with different characteristics still needs to be confirmed.

Nevertheless, there is evidence that personal beliefs can influence one’s ability to carry out a specific behaviour successfully. This supports the idea that helping individuals to understand their progress and improving their self-efficacy by supporting their confidence and highlighting their ability are also essential components of exercise participation. Exercise is consistently linked with physical
and psychological health benefits in the older population and self-efficacy is also associated with the continuation of regular exercise (Umstattd & Hallam, 2007).

A study by Umstattd and Hallam (2007) based on Bandura’s social-cognitive theory (SCT), sought to understand and predict exercise behaviour. They recruited 98 older people through local community seniors’ organizations and groups in Mississippi using convenience sampling. Participants were randomized into either a regularly active group or an inactive group. Regular exercise was defined as moderate to vigorous daily exercise of 30 minutes on three or more days a week. The study found all three SCT variables—self-efficacy \( (p < .01) \), self-regulation \( (p < .01) \) and outcome-expectancy \( (p < .01) \)—were significantly correlated with regular exercise participation in older people.

Perkins et al. (2008) found self-efficacy predicted both physical and social activity. They reported on 53 older people in Spain and 55 in the United States who completed questionnaires about self-efficacy and participation in physical and social activity. This study suggests that it is necessary to increase and enhance the development of self-efficacy interventions for both physical and social activity. Programs to assist older people to enhance their confidence, and to provide mechanisms for improving the positive benefits of physical and social activity are also necessary.

Prior studies have suggested that self-efficacy theory may be useful for encouraging participant involvement (Kwong & Kwan, 2007); improving participants’ attitude and emotion, (Chang et al., 2007; Kwong & Kwan, 2007; Lev et al., 2007); and
supporting participants’ confidence and highlighting their ability (Umstattd & Hallam, 2007). Lee et al. (2007) evaluated the role of self-efficacy in initiating and maintaining regular walking as exercise for 22 older Taiwanese people with moderate hypertension. Participants reported that they gained enjoyment and a sense of achievement from being a regular walker through learned and shared experiences with other walkers, and that they had a sense of well-being during the period of regular walking. A limitation of the study was the small number of people interviewed, but a strength was that it clearly identified self-efficacy as a factor influencing whether older people continued regularly exercising.

In summary, self-efficacy is an important factor related to behaviour-change approaches commonly used in rehabilitation and counseling interventions because perceived self-efficacy is connected to an individual’s judgment of their ability to perform a course of action. There is evidence of a relationship between self-efficacy and exercise for an older population. As well, studies have found a positive effect of perceived self-efficacy being reported in relation to QOL in older groups. Measuring the self-efficacy of older people in wheelchairs participating in a Tai Chi exercise program is therefore an important aspect of this current research study. Psychological well-being is another important consideration and the significant aspects of this are discussed in the next section.
2.4 Depression and mood states

Depression has been shown to be an important factor influencing the QOL of older people in LTC in Taiwan (Chan, Chiu, Chien, Thompson, & Lam, 2006; Lin et al., 2007). Depression and mood states, and QOL and physical activities are discussed in the following sections.

2.4.1 Depression among older people in Taiwan

Depression among the older population of Taiwan has become a major healthcare concern but the associated symptoms in older people in LTC facilities have not been well addressed. A major proportion, 81.8 %, of older people in LTC facilities suffer depressive symptoms which correlate to their length of residency, the number of chronic conditions they have, their perceived health status, and the amount of social support they receive (Lin et al., 2007). Lin et al. found that older people living in LTC facilities suffer depressive symptoms more than those living in the community (Lin et al., 2007). They argue that healthcare institutions need to develop effective health promotion programs to maintain higher levels of psychological well-being for older people in LTC facilities. Chan et al.’s finding that depression has a negative association with how older people perceive their QOL supports their argument (Chan et al., 2006). Improving depression among older people in LTC is one of the issues of concern addressed by this current study.
Depression may be caused by individual psychological factors, for example as a result of ageing, or by environmental factors, such as poor social conditions and distressing situations (Townsend, 2000), and it can be affected by both external and internal factors. For older people in LTC the external factors include psychological problems such as being unable to meet staff expectations, the side-effects of using many different drugs, loneliness, illness, bereavement, poverty or financial loss, breakdown of relationships, and loss of status or self-esteem as a result of the giving up of independence which occurs when living in LTC. Internal factors include hereditary susceptibility, hormonal imbalances or disturbances, changes in brain chemistry, and severe physical illness that may also influence depressive symptoms (Waughfield, 2002). Other factors can be a lack of friends, widowhood, a recent death or news of an accident among relatives and friends, and entering a care home (Waughfield, 2002). Given so many external and internal factors associated with depression it is not difficult to see why there is a high incidence of depressive symptoms in older people, especially in people in institutions where there are more of these associated factors.

Lin et al. (2007) argued that frail older people in LTC have a higher prevalence of depression because they experience many of the identified external and internal factors: having been residents in LTC for a particular length of time; having a particular perception of their own health status (as being bad, poor, fair, good or excellent); having a number of chronic conditions; and having limited social support from their family and relatives. Older people in LTC who had a shorter length of residency but more chronic conditions, perceived their own health status as poor, and those who had a lower level of social support from their family had more depressive
symptoms (Lin et al., 2007). These predictive factors indicate that provision of suitable health promotion activity programs is essential to improve depression in institutionalized older people. How to provide suitable programs needs to be better understood, particularly programs to meet the needs of those with multiple chronic conditions who have only recently begun living in LTC; those who consider their own health status to be poor; and institutionalized older people with relatively little family or social support.

Tsai and Tsai (2008) strongly emphasize the importance of understanding the lived experience of older people living in LTC facilities, and of the development of exercise programs to improve their well-being. An exercise program can enhance residents’ interactions with other residents, family members, and staff members, and thereby also provide social support; improve their physical state; reduce stress; and improve residents’ living experiences and satisfaction with their LTC environment.

In Taiwan, a high percentage of older people living in LTC have depression and frail older people are less engaged in social interactions (Lin et al., 2007). Consideration of how to improve such people’s psychological well-being is extremely important, and an exercise program may provide a way to do so. Whether reducing depression and mood states through exercise programs can affect QOL is discussed in the next section.
2.4.2 Depression, mood states and QOL

There is a correlation between depression and mood states, and these are also associated with the perception of poorer QOL in older people (Kerse et al., 2008). Negative late life events are factors contributing to depression but not the only factors. Physical factors also have an effect, and as Kerse et al., 2008 point out, complicated circumstances surrounding disability from depression, mortality, and being medically unfit can as Townsend, 2000 found, result in older people presenting with multiple mood states, such as: being anxious or easily upset and moved to tears, and having feelings of guilt, low self-esteem, helplessness, and/or hopelessness. This population might show no interest in activities; have suicidal tendencies with or without open expression; be unable to achieve social function; and may express a variety of somatic symptoms such as chest pains, headache, loss of appetite, weight loss, constipation and/or hypochondriasis (Waughfield, 2002). Kerse et al. (2008) therefore argue that if mood states in older people can be successfully improved, there will be a potential increase in health benefits and QOL. Providing an interesting exercise activity, such as Tai Chi, to assist older people with depression living in LTC to maintain their social interactions and/or to enhance their interest in activities may be helpful.

Depression can affect communication and an individual’s motivation to engage with others. Older people with depression express their thoughts and feelings less often, and as a result more easily experience frustration and may become socially isolated (Townsend, 2000; Waughfield, 2002). It is important to consider depressive symptoms and mood states of older people in wheelchairs in LTC because as Lin et al., point out
this population has a higher prevalence of depression (Lin et al., 2007). The next section discusses whether Tai Chi is a suitable health activity for older people.

### 2.5 Tai Chi for exercise

Many studies in the past few decades have reported on Tai Chi. This section focuses on describing the theoretical basis for Tai Chi, its benefits, and the surrounding debate.

#### 2.5.1 Theoretical basis of Tai Chi

Tai Chi has been described in many studies as an ancient Chinese martial art (e.g. Adler & Roberts, 2006; Chen et al., 2007; Chen et al., 2008; Greenspan, Wolf, Kelley, & O'Grady, 2007; Thornton, Sykes, & Tang, 2004; Tsang & Hui Chan, 2005; Wang et al., 2008). From a philosophical perspective, Tai Chi is based on the Chinese philosophical principle of opposites, Yin and Yang: Yin representing female and inactivity; Yang representing male and activity.

These factors represent negative and positive concepts from which complexity in worldly matters are manifest. In Traditional Chinese Medicine, health is contingent upon the balance between Yin and Yang. Imbalances in these energy forces are thought to produce physical dysfunction that may lead to poor health. If nutritional intake is poor, the environment is unpleasant, mental attitude is contaminated, and lifestyle is corrupted, the ability to satisfactorily replenish the energy sources and assure a balanced flow throughout the body is compromised (Wolf, Coogler, & Xu, 1997, p. 886).
Tai Chi is a 300-year-old Chinese mind-body exercise, which millions of older Chinese adults practice (Tsang & Hui-Chan, 2005). Tai Chi is also popular in Western society (Adler & Roberts, 2006; Greenspan et al., 2007; Thornton et al., 2004; Wang et al., 2008).

The characteristics of Tai Chi provide a holistic approach to exercise, one combining mind and body experiences (Chen et al., 2007; Greenspan, et al., 2007; Thornton et al., 2004), and developing balance and coordination (Thornton et al., 2004). It is low-intensity exercise with slow, smooth, rhythmic movements. It is performed in a series of fluid, continuous, graceful, gentle dancing movements (Chen et al., 2007; Thornton et al., 2004; Wang et al., 2008).

According to Plummer (1983), Tai Chi involves two pathways that affect the mind and body, mind concentration and breathing control (see Figure 1). By focusing on these two major tenets of Tai Chi practice, participants experience physical and psychological relaxation and then enhanced balance and coordination (Plummer, 1983). Tai Chi affects the body by the practice of movements involving the musculoskeletal system (Chewning, Yu, & Johnson, 2000). The movements involve continuous body and trunk rotation, flexion, extension of the hips and knees, postural alignment, and with particular attention to coordination of the arms (Chen et al., 2008). Tai Chi also affects the mind because concentration is an essential component of practice, and concentration involves the nervous system and brain (Chewning et al., 2000). Breathing control is also important while doing this mind and body exercise (Chen et al., 2008, Chewning et al., 2000), in particular diaphragmatic breathing.
characterized by expansion of the abdomen rather than the chest (Li, Hong, & Chan, 2001).

The goal of Tai Chi is to integrate the mind with the body, integrating meditation and body movement by means of the following elements:

- Bringing attention into the present moment
- Feeling the movement in the body as you breathe, and maintaining this awareness for several breaths
- Relaxing
- Noticing the position of the body, and keeping the body upright and naturally aligned
- Bringing awareness into the hands and fingers, then into the feet
- Relaxing and once again checking your breathing, and the position of your head, hands, and feet
- Noticing any sounds, sights, and smells, and being aware of the surrounding environment. (Chewning et al., 2000).
Figure 1 Diagram of the pathways of the effects of Tai Chi

Tai Chi

Mind

Body

Concentration
(Nervous system/ and Brain)

Breathing Control
(Diaphragmatic Breathing)

Movement
(Musculoskeletal System)

Meditation

Integrated Body Movement

Psychological Relaxation

Physical Relaxation

Balance and Coordination
- Nervous System and Brain
- Immune System
- Endocrine System
- Musculoskeletal System
- Cardiovascular Circulation System
- Respiratory System
Tai Chi is like a slow-moving dance routine: the hands, wrists, elbows, knees, hips, and ankles move continuously. The softly flowing movements are derived from animal postures, such as those of the snake, crane, dragon, and tiger. The movements are done in a relaxed state with deep breathing throughout the routine (Lumsden, Baccala, & Martire, 1998). When practicing Tai Chi with a peaceful, focused mind and incorporating smooth breathing into each movement, a person will experience physical and psychological relaxation (Chen, Snyder, & Krichbam, 2002; Li et al., 2001; Plummer, 1983; Wang, 2009; Wolf et al., 1997), and then enhanced balance and coordination (Hong, 2006; Plummer, 1983).

Tai Chi is an important aspect of the traditional Chinese approach to enhancing a sense of health and well-being (Wolf et al., 1997). All Tai Chi movements seek to balance the chi (氣, also commonly transcribed as ‘qi’). According to Traditional Chinese Medicine chi is the vital energy in the body's meridians, and continued practice strengthens this vital energy. All Tai Chi exercises work on three basic principles: (1) the body must be extended and relaxed, and learners need to have an awareness of their trunk alignment and deep breathing before they practice forms; (2) the mind must be alert and calm and focused on the presence and movement of the body within one’s body space; (3) all body movements require a well-coordinated sequence of segments (Wolf et al., 1997).

As a result, as diagrammatically illustrated in Figure 1, Tai Chi affects the body environment through physical relaxation, and the interrelationships between the autonomic nervous system, the pituitary gland, and adrenalin levels. These help to
maintain both physical and psychological health homoeostasis and the immune and endocrine systems (Li et al., 2001; Wang, 2009), the musculoskeletal system, cardiovascular circulation, and the respiratory system (Hong, 2006).

Tai Chi is therefore a way to promote the smooth and balanced flow of energy throughout the body, and help people experience better control of bodily movements and be more aware of space through their movements, both during practice and in real life situations (Wolf et al., 1997). The specific benefits of Tai Chi are discussed next.

2.5.2 The benefits of Tai Chi exercise

Some studies have shown the benefits of Tai Chi for maintaining physical function (Adler & Roberts, 2006; Chen et al., 2008; Greenspan et al., 2007; Rogers, Larkey, & Keller, 2009), psychological function (Wolf et al., 1997; Chen et al., 2002), and general improvements in health status (Chen et al., 2002; Chen et al., 2008; Greenspan et al., 2007). This section addresses the significance and influence of Tai Chi on health and well-being of older adults.

There is evidence for the physiological benefits of Tai Chi in older populations. Studies indicate that Tai Chi has effects enhancing musculoskeletal functions (Li et al., 2001); and on balance (Lin et al., 2006; Tsang & Hui-Chan, 2005; Wang, Collet, & Lau, 2004); on gait (Lin et al., 2006); on movement (Choi et al., 2005; Greenspan et al., 2007; Wolf et al., 2006); on flexibility (Adler & Roberts, 2006; Chen et al., 2008; Choi et al., 2005; Wang et al., 2004); and on muscle strengthening (Adler & Roberts,
Beneficial effects include an improvement in posture control capacity (Li et al., 2001); a decreased risk of falls (Chen et al., 2002; Lin et al., 2006; Li et al., 2001; Low, Ang, Goh, & Chew, 2009; Rogers et al., 2009; Wolf et al., 2006); and reduced fear of falling (Choi et al., 2005). Practicing Tai Chi is also beneficial for arthritis and lower back pain (Chen et al., 2008). It has been found to affect cardiovascular function (Chen et al., 2008; Li et al., 2001; Wolf et al., 2006; Wang et al., 2004) and respiratory function (Chen et al., 2008; Wang et al., 2004), in particular, lowering blood pressure (Chen et al., 2002; Chen et al., 2008; Rogers et al., 2009; Thornton et al., 2004).

Furthermore, practicing Tai Chi can also play an important role in the control of symptoms such as heart rate, pulmonary function, and abnormal blood pressure in older people with chronic illnesses (Wang et al., 2004). Another beneficial aspect is that Tai Chi is suitable for older people with chronic illness because it is a slow and gentle exercise, which provides the benefits of flexibility and muscle strengthening (Adler & Roberts, 2006).

Some studies report Tai Chi as beneficial for enhancing psychological health, for example by reducing depression and anxiety (Rogers et al., 2009); lessening mood disturbances, and improving positive mood states (Chen et al., 2002); and increasing social functioning (Chen et al., 2007). But there is still a lack of evidence about its psychological and emotional benefits for older people living in LTC and in wheelchairs, and about its effect on their QOL.
The studies discussed above reported various benefits of Tai Chi, but there is also, however, some limited evidence that Tai Chi does not make any significant difference to physical or psychological health. The following section outlines this.

2.5.3 The debate about Tai Chi

Some studies have presented evidence that Tai Chi does not significantly influence general improvement in health status in the older population. Some, for example, have found no significant change in people’s fear of falling (Lin et al., 2006) or fall episodes (Choi et al., 2005; Woo et al., 2007). Woo et al. found no difference in the balance and flexibility among the Tai Chi participants (Woo et al., 2007): it is possible that the exercise in their study was not of sufficient high intensity to lead to an improvement in strength, balance, and/or flexibility. The studies also had some limitations: for example, the Woo et al. (2007) study excluded subjects with chronic disease, and their subjects were therefore in good health. In addition, other influences on the control group were not excluded: for example, the subjects separately participated in health education in a health centre and were given health promotional information, and the control subjects may have therefore altered their lifestyle accordingly.

There seems to be a paucity of studies exploring the relationship between Tai Chi and the psychological health of older people. Psychological well-being is particularly relevant to the QOL of older people (Kerse et al., 2008) and needs to be explored
further.

2.6 Research on Tai Chi and QOL of older people

The influence of Tai Chi has been explored in older populations in particular. Most studies support the idea that Tai Chi positively affects the health of older people, rather than reporting on any effect on their QOL (Adler & Roberts, 2006; Choi et al., 2005; Greenspan et al., 2007; Lin et al., 2006; Low et al., 2009; Roger et al., 2009; Tsang & Hui-Chan, 2005; Wu & Ren, 2009; Wolf et al., 2006; Woo et al., 2007; Yao, Giordani, & Alexander, 2008).

Studies using Tai Chi as an intervention with the aim of improving the QOL, psychological well-being (i.e. depression or mood states), and self-efficacy of the elderly were included in the review with the goal of retrieving information about research design and content.

A total of 25 studies were retrieved and reviewed (see Table 1), of which 22 were published papers and 3 were theses (Chen, 2000; Jao, 2006; Hong, 2006). Three had a cross-sectional design (Chen, 2000; Chen et al., 2002; Ho et al., 2007); nine had a quasi-experimental design (Chen et al., 2007; Chen, Yen, Fetzer, Lo, & Lam, 2008; Chen et al., 2008; Jao, 2006; Lee et al., 2009; Lee, Lee, & Woo, 2010; Taylor-Piliae, Haskell, Waters, & Froelicher, 2006; Toda, Den, Hasegawa-Ohira, & Morimoto, 2011; Hong, 2006); and thirteen were randomized controlled trials (Audette et al., 2006; Caminiti et al., 2011; Chou et al., 2004; Dechamps et al., 2009; Dechamps et al., 2010;
Eight studies were carried out in Taiwan, one in Australia, two in France, three in Hong Kong, two in Japan, and nine in the United States of America (USA).

Seventeen studies investigated the effect of Tai Chi on the QOL of older people (Audette et al., 2006; Caminiti et al., 2011; Chen, 2000; Chen et al., 2002; Chen et al., 2007; Chen et al., 2008; Dechamps et al., 2009; Dechamps et al., 2010; Ho et al., 2007; Hong, 2006; Lavretsky et al., 2011; Lee et al., 2009, 2010; Li et al., 2001; Li et al., 2001; Tsang et al., 2007). Four examined the effect of Tai Chi on physical and psychological health (Frye et al., 2007; Jao, 2006; Li et al., 2002; Wang et al., 2010), and four focused on effect on psychosocial status (Chou et al., 2004; Taylor-Piliae et al., 2006; Toda et al., 2011; Yeh et al., 2011). Tai Chi trials investigating QOL as the primary outcome mainly used the SF-36, and SF-12 Health Survey to measure the physical health and mental health components. Other psychological health questionnaires used were the Taiwanese Depression Questionnaire (TDQ)\(^1\) and Profile of Mood States (POMS). Secondary outcomes relevant to this current study and the instruments used to measure and assess them are both listed alphabetically in Table 2 (note that the column listings are in one-to-one correspondence).

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\(^1\) 台灣人憂鬱問卷
Table 1 Studies undertaken related to the effect of Tai Chi on the QOL, depression, mood states, and self-efficacy of older people – alphabetically listed

<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Purpose</th>
<th>Participants (n)</th>
<th>Methodology</th>
<th>Tai Chi style</th>
<th>Outcome Measurements</th>
<th>Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audette et al. (2006) USA</td>
<td>To compare the effects of a short style of Tai Chi (TC) versus brisk walking training (BWG)</td>
<td>Mean age 71.4±4.5 Healthy older women from the community (n=27)</td>
<td>TC and BWG groups were randomized; sedentary control group (SCG) was not TC: n=11 BWG: n=8 SCG: n=8 12 weeks: 60 mins / three times weekly</td>
<td>A modified Yang style (10 forms) taught by a Tai Chi instructor</td>
<td>Measurement at: baseline, week 12 Profile of Mood States Short-Form (POMS-SF) SF-36 Health Survey (SF-36)</td>
<td>No significant changes were found in the psychological status or QOL scores in all three groups.</td>
</tr>
<tr>
<td>Caminiti et al. (2011) New York</td>
<td>To assess whether CT (Tai Chi and ET) is more effective than endurance training (ET) alone in improving exercise tolerance and QOL</td>
<td>Mean age 73±6 People with chronic heart failure (CHF) at New York Heart Association (NYHA) (n=60)</td>
<td>An open randomized pilot study CT: n=30 ET: n=30 12 weeks: 50 mins /4 sessions weekly</td>
<td>A modified Yang style (10 forms) taught by a Tai Chi instructor</td>
<td>Measurement at: baseline, week 12 MacNewDLMI, QOL questionnaire</td>
<td>Tai Chi with ET (the CT group) improved QOL (i.e. physical perception, p=.026) for participants in the CT group more efficiently than in the ET group.</td>
</tr>
<tr>
<td>Chen (2000) Taiwan (thesis)</td>
<td>To compare the effects of Tai Chi on well-being</td>
<td>Mean age 74.4±5.9 Community population (n=80)</td>
<td>A cross-sectional, comparative descriptive design, using a convenience, snowball sampling strategy TC: n=40 CG: n=40</td>
<td>Unspecified</td>
<td>SF-36 Health Survey (SF-36) Profile of Mood States Short-Form (POMS-SF)</td>
<td>The Tai Chi group was found to have a significantly better physical and mental health status, less mood disturbance, and more positive mood states than the control group (all p values &lt;.05).</td>
</tr>
<tr>
<td>Authors</td>
<td>Year</td>
<td>Area</td>
<td>Study Design</td>
<td>Setting</td>
<td>Age Mean</td>
<td>Group Details</td>
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<tr>
<td>Chen et al.</td>
<td>2002</td>
<td>Taiwan</td>
<td>Cross-sectional</td>
<td>People from the community (n=80)</td>
<td>74.4±5.9</td>
<td>TC: n=40; CG: n=40</td>
</tr>
<tr>
<td>Chen et al.</td>
<td>2007</td>
<td>Taiwan</td>
<td>Longitudinal, time-series, one-group, quasi-experimental, convenience sampling</td>
<td>Institutionalized older people (n=28)</td>
<td>75±5.9</td>
<td>TC: n=28; 6 months: 60 mins /twice weekly</td>
</tr>
<tr>
<td>Chen et al.</td>
<td>2008</td>
<td>Taiwan</td>
<td>A single group design with multiple time points</td>
<td>People from veteran homes and LTC facilities (n=41)</td>
<td>77.6±4.5</td>
<td>TC: n=41; 6 months: 50 mins /3 times weekly</td>
</tr>
<tr>
<td>Chen et al.</td>
<td>2008</td>
<td>Taiwan</td>
<td>A longitudinal, repeated, one group design</td>
<td>People with osteoarthritis (OA) at a community teaching hospital in southern Taiwan (n=13)</td>
<td>68.5±3.6</td>
<td>TC: n=13; 2 years: 50 mins / 3 times weekly</td>
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<tr>
<td>Study</td>
<td>Country</td>
<td>Research Question</td>
<td>Sample Characteristics</td>
<td>Randomization</td>
<td>Intervention Details</td>
<td>Measurement Points</td>
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<tr>
<td>Chou et al. (2004) Hong Kong</td>
<td>To examine the effect of Tai Chi on depressive symptoms in people with depression in the community (n=14)</td>
<td>Mean age 72.6±4.2</td>
<td>RCT</td>
<td>Yang style (18 forms)</td>
<td>Measurement at: baseline, week 12</td>
<td>Center for Epidemiological Studies Depression Scale (CES-D)</td>
</tr>
<tr>
<td>Dechamps et al. (2009) France</td>
<td>To explore the clinical effects of cognition-action intervention and Tai Chi on health-related QOL</td>
<td>Mean age 80.7±8.9 People from geriatric institutions (n=52)</td>
<td>Randomized comparison interventions</td>
<td>Yang style</td>
<td>Measurement at: baseline, and 24 weeks</td>
<td>Physical Component Summary-Short Form 12 (PCS-SF-12) Mental Component Summary-Short Form 12 (MCS-SF-12) Geriatric Depression Scale (GDS-SF) Exercise self-efficacy scale Mini Mental State Score (MMSE)</td>
</tr>
<tr>
<td>Dechamps et al. (2010) France</td>
<td>To examine the effects of cognition-action intervention and Tai Chi on health-related QOL</td>
<td>Mean age 82.3±9.1 People from 3 nursing homes and 1 long-term care facility (n=160)</td>
<td>RCT</td>
<td>Yang style</td>
<td>Measurement at: baseline, 6 &amp; 12 months</td>
<td>Mini Mental State Score (MMSE) Geriatric Depression Scale (GDS-SF) Activities of Daily Living (ADL)</td>
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<tr>
<td>Study</td>
<td>Location</td>
<td>Objective</td>
<td>Population</td>
<td>Intervention</td>
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<tr>
<td>Frye et al. (2007)</td>
<td>New Jersey</td>
<td>To examine the effects of Tai Chi and low impact exercise (LIE) on physical functioning and psychological well-being</td>
<td>Mean age 69.2±9.2 Community population (n=84)</td>
<td>RCT TC: n=31 LIE: n=30 CG: n=23</td>
<td>Yang style (10 forms)</td>
<td>Measurement at: baseline, week 12 Center for Epidemiological Studies Depression Scale (CES-D)</td>
</tr>
<tr>
<td>Ho et al. (2007)</td>
<td>Taiwan</td>
<td>To investigate the effects of Tai Chi on health-related QOL</td>
<td>Mean age 53.7 Community population (n=700)</td>
<td>Cross-sectional TC: n=140 CG: n=560</td>
<td>Unspecified</td>
<td>SF-36 Health Survey (SF-36)</td>
</tr>
<tr>
<td>Hong (2006)</td>
<td>Taiwan (thesis)</td>
<td>To examine the effects of STEP in promoting health</td>
<td>Mean age 68.9±6.3 Urban population (n=75)</td>
<td>Quasi-experimental TC: n=39 CG: n=36</td>
<td>STEP</td>
<td>Measurement at: baseline, 4, 8 &amp; 12 weeks Physical Component Summary-Short Form 12 (PCS-SF-12) Mental Component Summary-Short Form 12 (MCS-SF-12) Taiwanese Depression Questionnaire (TDQ)</td>
</tr>
<tr>
<td>Study</td>
<td>Design/Location</td>
<td>Participants</td>
<td>Methodology</td>
<td>Measurements</td>
<td>Findings/Results</td>
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<tr>
<td>Jao (2006) Taiwan (thesis)</td>
<td>To examine the effects of STEP on physical and psychological well-being</td>
<td>Mean age 80.1±7.5 People from veteran homes and LTC facilities (n=51)</td>
<td>A time-series, quasi-experimental, a convenience sampling</td>
<td>STEP (12 forms) Measurement at: baseline, 2 and 14 weeks</td>
<td>No significant difference was found in physical and psychological well-being.</td>
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<tr>
<td>Lavretsky et al. (2011)</td>
<td>To compare the effects of Tai Chi with the effects of health education (HE) on depression symptoms</td>
<td>Mean age 69.1±7.0 (TC) 72.0±7.4 (HE) People with depression from the community (n=73)</td>
<td>RCT all participants were treated with escitalopram for 4 weeks then assigned to groups (while continuing to receive escitalopram daily)</td>
<td>TC protocol from the Stone manual (Stone, 1996) Measurement at: baseline, week 14</td>
<td>A significantly greater depression remission (p=.01), improvements in SF-36 physical functioning (p=.02), and role-emotional (p=.003) were found in the Tai Chi group.</td>
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<tr>
<td>Lee et al. (2009) Hong Kong</td>
<td>To examine the effects of Tai Chi on health-related QOL</td>
<td>Mean age 82.7±7.1 People from 6 nursing homes (n=139)</td>
<td>Non-equivalent pretest-post-test control-group</td>
<td>Chen-style Measurement at: baseline, 6 &amp; 12 weeks</td>
<td>A significant difference (p &lt; .05) was found between groups, in the physical and mental component summaries.</td>
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<tr>
<td>Study Authors</td>
<td>Study Details</td>
<td>Study Design</td>
<td>Intervention Details</td>
<td>Measurement Measures</td>
<td>Results</td>
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<tr>
<td>Lee et al.</td>
<td>To examine the psychosocial effects of Tai Chi</td>
<td>RCT</td>
<td>TC: n=66, CG: n=73, 26 weeks: 60 mins /3 times weekly</td>
<td>Physical Component Summary-Short Form 12 (PCS-SF-12)</td>
<td>A significant improvement (p &lt; .05) in health-related QOL (SF-12), in the physical and mental components and a significant increase (p &lt; .05) in self-esteem was found in the Tai Chi group.</td>
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<td>(2010) Hong</td>
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<td>Mental Component Summary-Short Form 12 (MCS-SF-12)</td>
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<td>Kong</td>
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<td>State Self-Esteem Scale (SSES)</td>
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<td>Social Support Questionnaire-Short Form (SSQ6)</td>
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<td>Satisfaction with the Nursing Home Instrument (SNHI)</td>
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<tr>
<td>Li et al.</td>
<td>To examine the relationship between changes in self-efficacy and</td>
<td>RCT</td>
<td>TC: n=49, CG: n=45, 6 months: 60 mins / twice weekly</td>
<td>Short-Form General Health Survey (SF-20)</td>
<td>A positive association was found in the Tai Chi group between self-efficacy and physical function (p &lt; .05).</td>
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<tr>
<td>(2001) Oregon</td>
<td>physical function</td>
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<td></td>
<td>Self-efficacy (a 3 item task-specific, time-based performance efficacy scale)</td>
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<tr>
<td>Li et al.</td>
<td>To examine the effects of Tai Chi on psychological well-being</td>
<td>RCT</td>
<td>TC: n=53, CG: n=45, 6 months: 60 mins / twice weekly</td>
<td>Center for Epidemiological Studies Depression Scale (CES-D)</td>
<td>A significant improvement on QOL (p &lt; .05), reduction in depression, negative affect and psychological distress (p &lt; .05), and increase of life satisfaction, positive affect and overall health (p &lt; .05) was found in the Tai Chi group.</td>
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<tr>
<td>(2001) Oregon</td>
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<td>Positive and Negative Affect Schedule (PANAS)</td>
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<td>Subjective Exercise Experiences Scale (SEES)</td>
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<td>Satisfaction with Life Scale (SWLS)</td>
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<td>SF-36 Health Survey (SF-36)</td>
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<tr>
<td>Study</td>
<td>Country</td>
<td>Objective</td>
<td>Study Design</td>
<td>Tai Chi Style</td>
<td>Measurement at:</td>
<td>Findings</td>
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<tr>
<td>Li et al.</td>
<td>Oregon</td>
<td>To examine precisely the impact of Tai Chi on physical function</td>
<td>RCT</td>
<td>Yang</td>
<td>TC: n=49, CG: n=45</td>
<td>A significant improvement in perception of health (p=.001), depression (p=.001), self-efficacy (p=.04) and class attendance (p=.001) was found in the Tai Chi group.</td>
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<td>6 months: 60 mins / twice weekly</td>
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<tr>
<td>Taylor-Piliae et al. (2006)</td>
<td>USA</td>
<td>To examine change caused by Tai Chi on psychosocial status</td>
<td>Quasi-experimental</td>
<td>Yang</td>
<td>TC: n=39, 12 weeks: 60 mins / 3 times weekly</td>
<td>A significant reduction on the Tension-Anxiety (p &lt;.05) and Confusion-Bewilderment (p &lt;.05) dimensions and a higher self-efficacy (p &lt;.05) was found in the Tai Chi group.</td>
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<tr>
<td>Toda et al.</td>
<td>Japan</td>
<td>To investigate the influence of personal patterns of behavior on change in mood status after a brief period of Tai Chi exercise</td>
<td>A pilot study</td>
<td>Yang</td>
<td>TC: n=22, Type A behavior pattern (n=14), Type B behavior pattern (n=8), Tai Chi for 20 minutes</td>
<td>A significant reduction after Tai Chi in the Type A group on depression-dejection (p &lt;.05), anger-hostility (p &lt;.001), fatigue-inertia (p &lt;.01), confusion-bewilderment (p &lt;.05), and total mood disturbance (TMD) (p &lt;.05) was found.</td>
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<tr>
<td>Authors</td>
<td>Location</td>
<td>Study Objective</td>
<td>Mean Age</td>
<td>Study Design</td>
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<tr>
<td>Tsang et al.</td>
<td>Australia</td>
<td>To test the efficacy of Tai Chi on mobility, physical function, and health-related QOL</td>
<td>65±8</td>
<td>RCT</td>
<td>Community older patients with type 2 diabetes (n=38)</td>
<td>SF-36 Health Survey (SF-36)</td>
</tr>
<tr>
<td>Wang et al.</td>
<td>Japan</td>
<td>To examine the effects of Tai Chi on cognitive mental health</td>
<td>76.5±9.7</td>
<td>RCT</td>
<td>Tai Chi: 12 weeks: 60 mins / once weekly CG (Rehabilitation): 12 weeks: 80 mins / once weekly</td>
<td>General Health Questionnaire (GHQ)</td>
</tr>
<tr>
<td>Yeh et al.</td>
<td>Boston</td>
<td>To determine whether Tai Chi improves exercise capacity and QOL</td>
<td>67±11</td>
<td>RCT</td>
<td>Tai Chi movements adapted from Master Chen Manching’s Yang-style short form</td>
<td>Minnesota Living With Heart Failure Questionnaire (MLHFQ)</td>
</tr>
<tr>
<td>Area</td>
<td>Outcome</td>
<td>Measure Instrument – alphabetical order</td>
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<td>Cardiac Exercise Self-efficacy Instrument (CESEI)</td>
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<td>Self-efficacy for exercise (SEE)</td>
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<td>Self-efficacy to overcome barriers to Tai Chi (TCSE - barriers)</td>
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<td></td>
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<td>Self-efficacy to perform Tai Chi (TCSE - performance)</td>
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<td>Subjective Exercise Experiences Scale (SEES)</td>
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<td>Depression</td>
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<td>Center for Epidemiological Studies</td>
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<td>Depression Scale (CES-D)</td>
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<td>Hamilton Depression Rating Score (HDRS)</td>
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<td>Psychological well-being</td>
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<td>Minnesota Living With Heart Failure Questionnaire (MLHFQ)</td>
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<td>Satisfaction with Life Scale (SWLS)</td>
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<td>Short-Form General Health Survey (SFGHS)</td>
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<td>Social support</td>
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<td>Satisfaction with the Nursing Home Instrument (SNHI)</td>
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<td>Satisfaction of living</td>
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Most studies report that participating in Tai Chi significantly improved both physical and psychological components of health-related QOL (Chen, 2000; Chen et al., 2002; Chen et al., 2007; Dechamps et al., 2009; Ho et al., 2007; Hong, 2006; Lee et al., 2009, 2010; Li et al., 2001). Some studies found a significant effect on physical functioning (Chen et al., 2007; Chen et al., 2008; Lavretsky et al., 2011); role limitations due to physical health (Chen et al., 2008); social functioning (Chen et al., 2007; Chen et al., 2008; Tsang et al., 2007); and role limitations due to emotional health (Lavretsky et al., 2011). In contrast, Chen et al. (2008) and Audette et al. (2006) report that participating in Tai Chi did not have any effect on health-related QOL. In particular, the physical, psychological and social health QOL outcomes of these two Tai Chi trials contradict the other findings just listed.

Some studies report the effect of Tai Chi as improvements to physical health (Caminiti et al., 2011; Dechamps et al., 2010; Frye et al., 2007; Li et al., 2001) and many report improvements to psychological health (Chou et al., 2004; Dechamps et al., 2010; Frye et al., 2007; Li et al., 2001; Taylor-Piliae et al., 2006; Toda et al., 2011; Wang et al., 2010; Yeh et al., 2011). In contrast, a trial by Jao (2006) did not demonstrate any significant improvement in physical or in psychological health.

The effects of Tai Chi on the QOL of older people still needs further examination because of this inconsistency in the results, especially regarding its effect on the physical, psychological, and social health QOL domains. Additionally, no studies have provided evidence about the effect of Tai Chi on how people interact with the environmental domain of QOL and this needs further exploration.
Ho et al. (2007) used a cross-sectional design to compare the demographic characteristics and SF-36 scores of a Tai Chi group and a comparison group. The researchers surveyed 140 older Taiwanese people who regularly practiced Tai Chi (TC) and compared them to 560 subjects from the general population using the SF-36 to evaluate participants’ health-related QOL. This has eight component scales: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE), and mental health (MH). The Tai Chi group showed significantly higher QOL scores than the comparison group: physical functioning (PF, \( p = .007 \)), role-physical (RP, \( p < .001 \)), general health (GH, \( p < .001 \)), vitality (VT, \( p < .001 \)), social functioning (SF, \( p < .001 \)), role-emotional (RE, \( p < .001 \)), and mental health (MH, \( p = .04 \)) scores were all significantly higher.

A study by Chen et al. (2002) using a cross-sectional research design similarly found evidence of significant effects on health-related QOL and mood changes during exercise. Chen et al., (2002) explored the effect of Tai Chi on health-related QOL among older people and used the SF-36 Health Survey (SF-36) (Ware, Snow, Kosinski, & Gandek, 1993) to measure both physical health and mental health components. The Chen et al. (2002) study also explored the effect of Tai Chi on older people’s mood states using the Profile of Mood States Short-Form (POMS-SF) (McNair, Lorr, & Droppleman, 1992) to measure six dimensions: Tension-Anxiety, Depression-Dejection, Anger-Hostility, Vigor-Activity, Fatigue-Inertia, and Confusion-Bewilderment. The results found were that 80 Taiwanese community-dwelling older people who practiced Tai Chi had significantly less mood
Chen et al. (2002) also investigated the differential effects of practicing Tai Chi and not practicing Tai Chi on community-dwelling older people. Details of the particular Tai Chi style or styles were not provided but an effect of Tai Chi on both the physical health components ($p < .05$) and mental health components ($p < .05$) of health-related QOL was evidenced. The Chen et al. (2002) study used the POMS-SF to measure the effect of Tai Chi on mood states, and found evidence of such an effect.

Chen (2000) used a cross-sectional, comparative descriptive design, and a convenience, snowball sampling strategy to explore whether Tai Chi has an effect on the well-being of Taiwanese community-dwelling older people. A sample of 80 was recruited; 40 who practiced Tai Chi in one group (intervention group), and 40 who did not (control group). SF-36 and POMS-SF (within the past year - based on self-reports) were used to determine outcomes. The Tai Chi group was found to have had a significantly better physical and mental health status within the past year, less mood disturbance, and more positive mood states than the control group (all $p$ values $< .05$). Tai Chi was found to particularly benefit the well-being outcomes. Chen’s (2000) study had several limitations related to the sample selection process, the generalizability of the results, and the design of the study. A further RCT study is needed with a large sample to enhance the generalizability of the findings, and more in-depth exploration is needed of how Tai Chi is perceived by the elderly; and its possible benefits, harm, and contraindications. Tai Chi appears to benefit well-being but whether it would be equally effective for the older population especially those using wheelchairs for mobility, still needs to be confirmed.
A number of different Tai Chi styles were used in the studies examining the effect of Tai Chi. Fourteen used Yang style, two used Chen style, one used a combination of Sun and Yuan styles, one used a TC protocol from the Stone manual (Stone, 1996), one used a TCEA modified Sun style, and three used a STEP approach. Differences associated with these various styles are summarized below.

**Yang style Tai Chi**

Fourteen studies used Yang style Tai Chi (Audette et al., 2006; Caminiti et al., 2011; Chen et al., 2007; Chou et al., 2004; Dechamps et al., 2009; Dechamps et al., 2010; Frye et al., 2007; Li et al., 2001; Li et al., 2001; Li et al., 2002; Taylor-Piliae et al., 2006; Toda et al., 2011; Wang et al., 2010; Yeh et al., 2011) as an intervention for examining the effect of Tai Chi on people’s health-related QOL, depression, self-efficacy, and mood states. All of these trials had limitations and their outcomes were inconsistent.

A Yang style Tai Chi program has potential for improving health-related QOL, and both physical and mental health, and self-efficacy of frail older people living in LTC (Dechamps et al., 2009). A total of 52 older people in Bordeaux, France were randomly assigned to one of two groups; one group of 26 older people (mean age=80.8, SD=8.7) took part in a 24-week Tai Chi (TC) program for 30 minutes, 4 days a week. A comparison group of another 26 older people (mean age=80.6, SD=9.2) undertook a cognition-action (CA) exercise program (doing predominantly lower
body muscle exercises, arm and abdominal reinforcement, ankle and wrist exercise, and deep abdominal breathing and relaxation for 30 minutes, twice a week). The trial found that those who received the Yang style Tai Chi intervention had significant improvement in health-related QOL (i.e. physical component summary, \( p < .001 \); mental component summary, \( p < .002 \)), depression (\( p = .005 \)) and higher self-efficacy (\( p = .003 \)). A statistically significant difference within participants was found at baseline and 24 weeks. No significant (\( p = .60 \)) difference was found between the two interventions (Tai Chi and cognition-action). To enable enrolment of enough participants, the inclusion criteria were broad, resulting in more physically and psychologically impaired participants. Nevertheless, the sample size was small (\( n = 52 \)) and the participants were frail. The results should therefore be interpreted with caution. There is a need for a study to identify the effect of Tai Chi on self-efficacy that includes a control group receiving usual care.

Taylor-Piliae et al. (2006) conducted a 12-week Tai Chi intervention to explore its effect on the mood states of 39 Chinese people in the United States with cardiovascular disease risk factors. They used Yang style with 24 forms. This study also found a statistically significant improvement in total mood state (POMS): a significant reduction was reported on both the Tension-Anxiety (\( p < .05 \)) and Confusion-Bewilderment (\( p < .05 \)) dimensions. There were no significant differences in the Depression-Dejection, Anger-Hostility, Vigor-Activity, and Fatigue-Inertia dimensions. The study reported that groups who did 60 minutes of this Yang style Tai Chi three times a week for 12 weeks had higher self-efficacy (\( p < .05 \)), but it had a number of limitations. It was limited by its small sample size (\( n = 39 \)) and the lack of
a control group. In addition, the study was conducted among a mainly healthy older population. Perhaps only people who considered themselves in good health and with an interest in Tai Chi were motivated to volunteer to participate in the study. In a similar vein, the results of the Taylor-Piliae et al. study were influenced by participants’ low educational background and their Chinese cultural background. This resulted in their having difficulty reading the questionnaires, and possibly difficulties expressing their mood states. Their mood states may have been influenced by personal beliefs, and a desire to give socially desirable answers, a pervasive cultural norm among ethnic Chinese people. Therefore, the findings of this study cannot be assumed to be representative of all Taiwanese and Chinese older people living in the community. Adding a control group will help this current study obtain clearer evidence of whether Tai Chi has any advantageous effect on depression and mood states. Randomization of participants into groups to avoid personal differences influencing the results is also important.

The Chen et al. (2007) study that used Yang style found physical health \( p < .05 \) was significantly improved but no effects were seen on mental health, except for social functioning \( p < .005 \). Their study has methodological limitations: it lacked a control group, randomization, and blinding. Moreover, the generalizability of their results is limited because the sample size was small \( n=28 \) and the trial was limited to a single treatment. These factors could cause the outcomes to be overrated or underrated. The findings indicating effectiveness of the Tai Chi intervention are open to question because the research design had no control group, making it difficult to exclude other factors affecting outcomes. Other aspects of this study also had limitations. The
attendance rate was reported as not optimal during important Chinese holidays, such as Mid-Autumn Festival and Chinese New Year, and/or because of participants needing time for visitors and doctors. A suitable exercise period free from the interruption of any important traditional holiday period is essential in order to minimize and avoid non-adherence to the intervention. The study finally suggested allowing several breaks during the Tai Chi classes or designing frequent short practice schedules, such as 30-minute sessions three times a week, as more suitable for the participants’ health.

Caminiti et al. (2011) used Yang style Tai Chi combined with endurance training (ET) to assess whether this is more effective than ET alone for improving exercise tolerance and the QOL of 60 older people (mean age=73.6, SD=6) with chronic heart failure (CHF) in New York. Thirty participants were randomized to CT (Tai Chi and ET) and 30 to ET only. All undertook 4 exercise sessions for 12 weeks. All participants were assessed at baseline and 12 weeks, in relation to QOL using the MacNewDLMI, QOL questionnaire that comprises physical, emotional and social domains. The study concluded that Tai Chi associated with ET improves QOL (i.e. physical perception, \( p=.026 \)) for older people with CHF more efficiently than ET alone.

Li et al. (2001) used Yang style Tai Chi to examine the association between self-efficacy and physical function in older people (mean age=72.8, SD=5.1) from a community in Oregon. This study used an RCT design, randomly assigning participants into either a Tai Chi group (n=49) or a control group (n=45). Participants
in the Tai Chi group practiced Yang style Tai Chi (24 forms) for 60 minutes twice a week for six months. Their self-efficacy was measured and a Short-Form General Health Survey (SF-20) was done at baseline, and weeks 12 and 24. A positive association was found between self-efficacy and physical function \((p < .05)\), indicating an improvement in older people’s movement self-efficacy as a function of Tai Chi related to increased levels of perceived physical capability. Li et al.’s study also uncovered a need for further research of the relationship between exercise self-efficacy and physical function for improving health-related QOL in older people. Li et al.’s study (2001) was the first study attempting to analyze concomitant change between two important psychological and physical outcome variables of exercise for self-efficacy. The study recruited volunteers using advertising in local newspapers, flyers at a senior center; and notices in a retirement community, and this may have introduced a selection bias, thus its generalizability is limited. It provides evidence of a relationship between self-efficacy and perceived physical function, but there is still a need to explore whether these findings can be replicated with a frail older population.

Li et al. (2002) undertook an extension of a Tai Chi intervention study they had carried out in 2001 (Li et al., 2001). Participants’ perception of health was assessed using Short-Form General Health Survey (SFGHS); depression was assessed using the Center for Epidemiological Studies Depression Scale (CES-D); and self-efficacy was assessed using the Confidence scale; and their class attendance was recorded. The Tai Chi group was reported to show significant improvements in perception of health \((p=.001)\), depression \((p=.001)\), self-efficacy \((p=.04)\) and class attendance \((p=.001)\) compared to those in the control group. The study indicates that Tai Chi mainly
affected physical function in the older population and its effects were most beneficial in participants who had low physical functioning at baseline.

Another study, by Li et al. (2001), used an RCT to examine whether six-months of Yang style Tai Chi would enhance the psychological well-being of 98 older people recruited to participate (mean age=73.2, SD=4.9). The participants were randomized into either a Tai Chi group (n=53), or a control group (n=45), and the intervention group had a 60-min Tai Chi session twice weekly for 24 weeks. CES-D, Positive and Negative Affect Schedule (PANAS), Subjective Exercise Experiences Scale (SEES), Satisfaction with Life Scale (SWLS) and SF-36 were used to measure participants’ depression, positive and negative affect, positive well-being and psychological distress, life satisfaction, and perceptions of health at baseline, and at weeks 12 and 24. Tai Chi was found to significantly improve QOL (p < .05), reduce depression, negative affect, and psychological distress (p < .05), and increase life satisfaction, positive affect and overall health (p < .05).

Further studies are needed to follow up the studies of Li et al., 2001; Li et al., 2001; Li et al., 2002, outlined above and examine the association between 1) physical function and perception of well-being; and 2) social environment and physical activity participation, and social interaction. How the social environment and Tai Chi interact and influence well-being, and exercise behavior and if and how the psychological effects of Tai Chi vary as a function of age, and gender expectations also need to be further researched.
Chou et al. (2004) used an RCT to examine the effect of Tai Chi on depressive symptoms amongst older Chinese patients (mean age=72.6, SD=4.2) with depressive disorders in Hong Kong. Their trial had 14 participants: 7 in the Tai Chi group and 7 in the control group. The Tai Chi group practiced 45-minute sessions of Yang style Tai Chi (18 forms) three times a week for 12 weeks. GES-D was used to assess both groups at baseline and week 12. Results of the GES-D showed a significant effect ($p < .05$) on all four subscales: somatic ($p < .05$), negative affect ($p < .01$), interpersonal ($p < .05$), and well-being ($p < .05$). Although this study found Tai Chi improved well-being and reduced negative effects, it has limitations which make its results suggestive only, particularly its very small sample size. Further research is suggested, including comparison with a control group doing other forms of aerobic exercise of the effect on depressive symptoms.

Dechamps et al. (2010) used an RCT to examine the effect of two exercise programs and usual care on the health-related QOL of older people at three nursing homes and one LTC facility in France. Participants (n=160) were randomized into a Tai Chi group (n=51), a Cognition Action Program group (CA) (n=49), and a usual care group (CG) (n=60). The Tai Chi group practiced 30-minute sessions of Yang style Tai Chi four times a week for 24 weeks, and the CA group did 40-minute physical activities training sessions twice a week for 24 weeks; the CG group simply received usual care with no additional attention, and no exercise or cognitive training. MMSE, GDS and ADL tests were used to assess all groups at baseline, and at 6 and 12 months. Depression symptoms on the GDS at 6 months were reduced in all 3 groups. This reduction was maintained at 12 months in both intervention groups, but there was a
significant difference ($p=.02$) on the GDS over the 12-month period between the three groups. The study provides evidence that adapted exercise programs can slow down the decline in health-related QOL among heterogeneous institutionalized elderly persons, especially given that 5 out of the 6 basic ADL scores significantly worsened ($p<.001$) in the control group. No cost-effectiveness analysis for nursing care was undertaken by the study.

Toda et al. (2011) investigated the influence of individual patterns of personality and behaviour on the change in mood status after a brief period of Tai Chi. In a pilot study on 22 healthy female participants (mean age=68.9), 14 were classified as having a Type A behavior pattern and 8 as having a Type B behavior pattern. The 22 women were evaluated before and after a period of Yang style Tai Chi exercise. POMS scores were taken for all participants during the experimental period. There were significant reductions after Tai Chi in the Type A group on their scores for depression-dejection ($p<.05$), anger-hostility ($p<.001$), fatigue-inertia ($p<.01$), confusion-bewilderment ($p<.05$), and total mood disturbance (TMD) ($p<.05$). There was no such change in the type B group. The study found that a brief period of 20 minutes of Tai Chi was mentally beneficial, particularly to type A individuals, those with a behaviour pattern associated with higher coronary risk.

Yeh et al. (2011) used a single-blinded, multisite, parallel-group RCT to evaluate whether Tai Chi, as an adjunct to standard care, improved the functional capacity and QOL of 100 older people (mean age=67, SD=11) with chronic heart failure (CHF). Participants were randomly assigned into either a Tai Chi group (TC, n=50) or an
education control group (EC, n=50). Participants in the TC intervention had 1-hour group classes twice weekly for 12 weeks; the EC group attended education sessions of the same duration and frequency as the TC group’s Tai Chi classes. All were assessed using the Minnesota Living With Heart Failure Questionnaire (MLHFQ), POMS and Cardiac Exercise Self-efficacy Instrument (CESEI) at baseline and week 12. TC group participants had significantly greater improvements in QOL (MLHFQ, \( p = .02 \)); exercise self-efficacy (CESEI, \( p < .001 \)); and mood states (POMS, TMD \( p < .001 \); depression-dejection, \( p = .004 \); vigor-activity, \( p < .001 \)). This was the first large-scale clinical trial of Tai Chi in a CHF population to provide data. The results indicate that Tai Chi may improve QOL, exercise self-efficacy; and mood states but Yeh et al.’s study has a number of limitations. First, patients were not masked regarding assignment or non-assignment to the intervention group, although Yeh et al. attempted to minimize the potential effects of disappointment in the education group by offering Tai Chi courses at the end of the six-month follow-up period. Secondly, its sample of 100 patients represents only a small proportion of eligible patients in the trial, and this could introduce selection bias. Moreover, Yeh et al.’s study was unable to provide a definitive physiological mechanism related to Tai Chi’s effects, so the effects of Tai Chi on physiological and psychological health and self-efficacy still need to be established, particularly possible effect of improving the QOL of older people.

Audette et al. (2006) compared the effects of a short style of Tai Chi (TC) with those of a brisk walking program (BWG) on the psychological status, and the QOL of 27 elderly women living in the community. In this trial, 19 sedentary participants (mean
age=71.4, SD=4.5) were randomly assigned to a TC (n=11) or a BWG (n=8) group. A separate group of eight elderly women were recruited from the same population to form a sedentary comparison group (SCG). Participants in the TC group did three 60-minute sessions of Yang style (10 forms) each week for 12 weeks. The BWG group did a walking protocol weekly of the same duration and frequency as the Tai Chi activity. No significant changes were found in the psychological status or QOL scores in any of the three groups.

Wang et al. (2010) used a prospective, single-blinded RCT to investigate the effect of Tai Chi on the cognitive mental health of elderly people with cerebral vascular disorder (CVD) in Japan. A total of 34 patients with CVD recruited from Akistu-Kounoike Hospital were randomly assigned to do either Tai Chi (n=17, mean age=76.5, SD=9.7) or rehabilitation (control group) (n=17, mean age=77.5, SD=12.33). Those in the Tai Chi group participated in 12 weeks of a 60-minute session of Yang style Tai Chi once a week; the control group undertook 12 weeks of rehabilitation, doing one 80-minute session each week. Wang et al. examined the time courses of each score (General Health Questionnaire, GHQ); repeated-measures analysis of variance was used with groups and time as factors. There were significant time-by-group interactions on their GHQ total score \((p=.005)\), anxiety/insomnia score \((p=.034)\), and severe depression score \((p=.02)\). Their findings suggest that Tai Chi is a suitable exercise for the elderly to improve anxiety/insomnia, and severe depression. The study had some limitations: the sample size was small and intervention was one long session only.
Frye et al. (2007) used an RCT to examine the effects of Tai Chi (TC) and low impact exercise (LIE) interventions on the physical functioning and psychological well-being of older people. Eighty-four older people (mean age=69.2, SD=9.2) were recruited from the community in New Jersey and randomly assigned to a TC (n=31), LIE (n=30), or control group (CG) (n=23). The TC group did 60-minute sessions of Yang style (10 forms) Tai Chi three times a week for 12 weeks. The LIE group did physical fitness activity of the same duration and frequency as the TC activity for 12 weeks, to improve the strength, flexibility, endurance and balance aspects of their physical functioning. Depression was assessed at baseline and week 12 using the CES-D. Frye et al.’s study suggests that Tai Chi and low impact exercises are safe, cost-effective ways to improve both the physical and psychological functioning of older people. The limitations of the study were that the researcher, project coordinator and instructors were not blinded to the intervention groups, and most participants had been fairly inactive prior to beginning the intervention, which may account for some of the dramatic changes evident in the data.

There are significant differences among the studies. The number of forms of Yang style Tai Chi, the length of the exercise period, the frequency of exercise activity, the intensity of the exercise, and the instruments used to measure outcomes all differed and therefore this makes synthesis of the evidence difficult. Unfortunately, the studies by Chen et al. (2007) and Dechamps et al. (2009) did not provide details of the number of forms used. A factor that must be considered is whether the number of forms used is too high making the activity too complicated for older people to learn and remember. The study by Taylor-Piliae et al. (2006), for example, reported on the
24-form Yang style, a relatively large number of forms for people to master. The studies by Chen et al. (2007) and Dechamps et al. (2009) involved exercises for a total of 48 hours over six months with different frequencies. The Taylor-Piliae et al. (2006) study involved a total of 36 hours of exercise over three months. Furthermore, different outcome instruments were used to reflect the effect of Tai Chi on QOL. Chen et al. (2007) and Dechamps et al. (2009) used Health Survey-Short Form 36 as an outcome measure, but Taylor-Piliae et al. (2006) used POMS. The study designs also varied, and the evidence provided by some studies would have been more persuasive if their design had included a control group to compare the results of the Tai Chi group against. It is essential for further studies to clearly identify the form of Tai Chi used for older people, including the frequency and length of exercise sessions, the intensity of the exercise, and an appropriate instrument for measuring older persons’ QOL.

Chen style Tai Chi

Two studies by Lee et al. examined the effect of Chen style Tai Chi on health-related QOL in six LTC facilities in Hong Kong, and found that Chen style Tai Chi improved both physical and mental health components of the SF-12 (Lee et al., 2009, 2010). A total of 66 residents joined a 26-week Tai Chi program, and 73 residents in the control group continued with their usual daily activities. Participants were surveyed using the SF-12 questionnaire (Ware, Kosinski, Turner-Bowker, & Gandek, 1996), which comprises physical and mental component scores. The physical component of the SF-12 indicates physical functioning, roles-physical, bodily pain and general health.
The mental component of SF-12 indicates vitality, social functioning, roles-emotional and mental health. The Tai Chi program sessions were held three times a week, each session lasting for one hour. The inclusion criteria were: participants needed to be Chinese, >65 years of age, have intact cognitive function (Abbreviated Mental Test score >6/10), able to walk independently, and able to communicate in Cantonese. The exclusion criteria were: having acute symptoms or a pre-existing psychological disorder; and having previously had Tai Chi training. The findings showed a statistically significant difference ($p < .05$) between the Tai Chi group and the control group in the physical and mental component scores of the SF-12. In particular, Tai Chi was reported as a suitable exercise to recommend to LTC residents to improve their health-related QOL.

Lee et al. (2010) also used the Social Support Questionnaire-Short Form (SSQ6) to assess participants’ social support network, and the Satisfaction with the Nursing Home Instrument (SNHI) to assess participants’ social support and satisfaction. No significant differences were found regarding the effect of Tai Chi on either social support network or social support satisfaction.

The trial by Lee et al. (2010) was based on their 2009 trial, Lee et al. (2009). The later study focused on an exploration of health-related QOL, state self-esteem scale, social support, and satisfaction using the nursing home version of the instruments. Both trials (Lee et al., 2009, 2010) reported a significant improvement in health-related QOL (SF-12), in both the physical and psychological health components. The second trial also highlighted a significant increase in self-esteem ($p < .05$). Both trials by Lee
et al. (2009, 2010) had methodological similarities: both used a non-equivalent pretest-posttest, control group design, a 60 minute Tai Chi intervention three times a week for 26 weeks, and assessment at baseline, and weeks 6 and 12. Both studies also had limitations in their methodology and participant sampling. The design lacked randomization and blinding to avoid sampling bias. Secondly, both studies recruited participants from six LTC facilities and did not implement any measure to control the potential effect of other factors, such as any impact from the LTC environment. An appropriate instrument should have been included to assess the environmental domain of QOL.

Lee et al. (2010) concluded that there is a need for further studies using a randomized controlled trial design to identify the social effects of Tai Chi, and a need for an innovative, appropriate Tai Chi program appealing to older people (Lee et al., 2009, 2010).

Sun and Yang styles Tai Chi

A different Tai Chi style intervention was designed for a study by Tsang et al. (2007), which used a combination of the Sun and Yang styles (12 forms): it was a single-blinded randomized, sham-exercise controlled trial. There were two 60-minute Tai Chi interventions, twice a week for 16 weeks, with assessment at baseline and at the completion of the 32 sessions. Tsang et al. (2007) reported a significant improvement in the health-related QOL (SF-36) social functioning sub-scale score ($p=.04$) of the psychological health component. There was some differences in the
sample of this trial: it selected older patients with type 2 diabetes, aged 50 or over from the community. This population has specific physiological characteristics and a different age criterion compared to the other Tai Chi trials. Unfortunately, although it used a single-blinded design, the blinding was not well carried out at the post-test stage. In addition, this was the only trial that used a combination Sun and Yang style-12 form, making it hard to compare with other trials. Tsang et al. (2007) suggest that spending more time guiding the internalization of the exercises would help participants’ physical and psychological functions improve.

Other Tai Chi programs

Lavretsky et al. (2011) used an RCT design to examine whether Tai Chi could be used to augment the treatment of geriatric depression to achieve symptomatic remission, and improvements in health functioning and cognitive performance. The study was conducted with 73 older people with depression living in the community in California. Participants were treated with an antidepressant (escitalopram) for 4 weeks then randomly assigned to 10 weeks of complementary intervention (they continued to receive escitalopram daily) in either a Tai Chi group (TC, n=36) doing Tai Chi for 2 hours once a week, or in a health education group (HE, n=37) receiving health education for 2 hours a week. All underwent evaluations of depression, anxiety, resilience, cognition, and health-related QOL at baseline and week 14. The Hamilton Depression Rating Score (HDRS) was used to assess depression; and the SF-36 for QOL. The reported results indicate that participants in the TC group had achieved greater depression remission (HDRS, p=.01) compared with those in the HE group.
They also showed significant greater improvements in SF-36 physical functioning \((p=.02)\) and role-emotional \((p=.003)\).

Lavretsky et al.’s (2011) study was the first to compare the efficacy of the complementary use of TC against HE as an adjunct to standard antidepressant medication treatment of geriatric depression. The study had some limitations: a small sample, and brief follow up. Most participants had moderate to major depression, so the findings may not be generalizable to more severely depressed and/or disabled older people. Lavretsky et al. also suggested using a usual care control group to compare the Tai Chi intervention against in further studies.

Chen et al. (2008) examined the effects of Tai Chi on the physical status and QOL of older people with osteoarthritis (OA) in a community teaching hospital in Southern Taiwan. The study had a longitudinal repeated measures one group design, with 13 people (age range 60-74 years, mean age=68.5, SD=3.69) participating in a Tai Chi for Arthritis (TCEA) exercise class three times a week for two years. Participants’ physical status—body mass index (BMI), lean body mass (LBM), hand grasp strength, flexibility and balance, (SF-36)—and their QOL were measured at baseline, and 3 months, 1 year, and 2 years after joining the TCEA exercise class. There were significant improvements in physical function \((p<.05)\), role limitations \((p<.05)\), and social functioning \((p<.05)\) in the QOL domains. The strength of Chen et al.’s (2008) study is that it was a longitudinal study evaluating the effects of Tai Chi over 2 years. The reported effects suggest that Tai Chi helps older people with OA to maintain their physical function and improves their QOL. The high drop-out rate limits the study
findings; lack of interest was a common reason for withdrawal and the attrition rate was over 50%, although no one dropped out after participating for one year. This indicates that identifying how to improve older people’s interest in joining exercise programs and then supporting them and maintaining their interest are also important considerations.

**Simplified Tai Chi Exercise Program (STEP)**

Three studies used STEP as an intervention for examining health-related QOL, and physical and psychological health (Chen et al., 2008; Hong, 2006; Jao, 2006), but they had very different findings. A variety of physical performance indicators—such as blood pressure, muscle strength, flexibility, range of motion (ROM), body weight, percentage of body fat and BMI—and psychological performance, such as mood states, were examined. Two trials—those by Chen et al. (2008) and Jao (2006)—reported improved physical health after participating in Tai Chi; but they did not report any improvement in psychological health. Only the trial by Hong (2006) found significant differences for both physical and psychological health. These three studies also had inconsistencies, which are discussed below.

Hong (2006) used a quasi-experimental design to investigate whether the Simplified Tai Chi program (STEP) had any effect on promoting the health of urban older people (mean age=68.9, SD=6.3) in Taiwan. The authors used a STEP program that was developed by Professor Chen Kuei-Min of Fooying University, Taiwan and her colleagues to cater to older people’s physical condition. The 39 people in the Tai Chi
group participated in 50 minutes of STEP three times a week for 12 weeks. The 36 people in the control group did not participate in any Tai Chi training. SF-12 and Taiwanese Depression Questionnaire (TDQ) were measured at baseline, and weeks 4, 8, and 12. The STEP group had significant improvements in their physical status ($p < .0001$), and psychological health status ($p < .0001$), and reduced state of depression ($p < .0001$). Generalizability of the study results is limited, however, as Hong’s (2006) study had a number of serious limitations. There was no randomization, and participants were unhappy about multiple measurements and many therefore withdrew from the study. The Tai Chi sessions were in the morning and this affected attendance because participants sometimes had other personal commitments such as going to the hospital or family responsibilities. Moreover, the researchers found it difficult to control the quality, quantity and intensity of exercise, and the participants’ individual health situations. Personal background and understanding level, generational, and language differences, such as some participants not understanding Taiwanese, may have affected data collection and introduced bias.

The study by Jao (2006) reports that participating in a STEP program for 50 minutes three times a week for 14 weeks did not lead to improvements in physical and psychological health. The study involved people aged 65 or over from veteran homes and LTC facilities. The trial only selected older people in wheelchairs as participants (n=51). It used a quasi-experimental design with repeated measures, convenience sampling, and collected data at baseline, the second week, and week 14. The effect of Tai Chi on QOL was not clearly evident, but the study had several limitations concerning the environmental aspects of the trial: significantly, other people or
activities were also in the public common room and outside ground when the sessions were being conducted and therefore easily interrupted participants and their concentration. Concentration on breathing and co-ordination are essential aspects of Tai Chi body-mind interaction, so arranging a good quality environment for participants to practise in an isolated location, to avoid interruptions and to exclude other possible external influences is essential. The author suggested using open questions or other complementary measures such as a visual analogue scale (VAS) to collect data after the intervention, and to incorporate ways to assist participants to continue doing Tai Chi regularly after the study completion.

Chen et al. (2008) report that using the STEP program for 50 minutes three times a week for six months did not change health-related QOL (SF-36) on physical health components (PHC). The study included participants (n=41) aged 65 years or over from veteran homes and LTC facilities. The trial used a single group quasi-experimental design with repeated measures and convenience sampling. Data were collected at three pre-test times (one, two, and three months before the intervention) and four post-test times (at one, two, three and six month after the invention). Randomization, blinding, and a parallel control trial group are suggested for future studies by the authors. They also suggest that a longer intervention period might also be needed to see any effect. In addition, Chen et al. recommend that further studies explore the most suitable intensity of Tai Chi practice.

There were methodological differences among the three trials (Chen et al., 2008; Hong, 2006; Jao, 2006), regarding their population, sampling, duration of exercise,
and follow up. Their different inclusion criteria probably introduced a homogeneity bias, because there is a need to judge whether participants’ different ages, different backgrounds, or different characteristics resulted in any effects observed. Using non-probability sampling is more convenient and economical, but its weakness is that serious sampling bias may be introduced. There is a need for concern that non-probability sampling may result in some persons being more likely than others to be chosen, thereby under-representing or over-representing certain sample characteristics. Different durations of exercise in their designs may also have resulted in differences in effectiveness.

Using STEP may have lead to finding significant differences in effects on physical health, but still there is a lack of evidence to explain these effects and to rule out other causes. These studies’ methodological differences may have had an influence on the accuracy of their outcomes.

Several previous studies (Chen et al., 2007; Jao, 2006; Tsang et al., 2007), indicate that participants’ thoughts, cognition, and motivation in relation to participation affect how they perceive the effects of Tai Chi. This current study has taken account of this and the need to pay attention to the self-efficacy aspect of exercise when participants practice Tai Chi.

The outcomes of studies investigating the effects of Tai Chi on QOL and/or psychological well-being and self-efficacy (Audette et al., 2006; Chen et al., 2007; Frye et al., 2007; Jao, 2006) are not consistent. The studies by Chen et al. (2007) and
Jao (2006) also had methodological limitations. Nevertheless, the evidence found by undertaking the literature review suggests that Tai Chi may be beneficial in improving QOL, and/or improving psychological well-being (i.e. may improve depression and mood states), and self-efficacy. High quality RCT studies with high efficacy are essential if clear conclusions are to be drawn regarding the effect of Tai Chi on the QOL, psychological well-being (i.e. improved depression and mood states), and self-efficacy of older people.

**Summary**

The results of the studies discussed above should be regarded with caution for several reasons. The studies by Chen (2000), Chen et al. (2002) and Ho et al. (2007) gave no information on the type of Tai Chi performed. Some used STEP, a newly developed Tai Chi program for older people (Chen et al., 2008; Hong, 2006; Jao, 2006), and various traditional types of Tai Chi were used in the other studies. It is essential that researchers specify which type of Tai Chi is being performed when evaluating its effectiveness. Secondly, many forms of Tai Chi were used in the different studies. There is a question about whether the form selected should be based on traditional Tai Chi theory, and perhaps more practically when investigating effects on older people, is the question of whether having multiple Tai Chi movements is more effective than using fewer, simple Tai Chi movements for older people. Thirdly, the intervention methodologies varied. Clarification is needed regarding the length and frequency of each exercise session, the intensity of the exercise, and the overall length of the exercise program, to ensure comparability of results. Furthermore, it is important that
a professional instructor conduct the Tai Chi sessions to optimize good quality learning in the classes and to improve study credibility. Finally, selection of a suitable Tai Chi style and form that a particular group can cope with and learn is the best way to ensure they can properly engage with learning it. Selection of a suitable outcome instrument or instruments to measure the effect on the QOL of the older people is also required.

Although the physical benefits of Tai Chi are widely recognized, there is only a small body of evidence about its psychological benefits. This area of research has yielded no persuasive evidence about adaptations, feasibility, and/or effectiveness of a Tai Chi program for older people in wheelchairs. The population for this current study, older people in wheelchairs, is similar to the population found in the Yao et al. (2008) study of Tai Chi. Yao et al.’s study however, was of older people suffering from dementia who may have had difficulty following instructions, verbalizing their needs, and initiating activities on their own, thus creating challenges for engaging and maintaining them in an exercise program. Thus, for older people in wheelchairs it is necessary to take into consideration selecting a suitable Tai Chi program, having a professional instructor for the Tai Chi classes, and providing good support to have people engage in the program and then ongoing good support to maintain their participation. The current study will therefore reflect the need to not only improve opportunities for health professionals to provide an intervention to improve the QOL of older people in wheelchairs, but to also provide older people in wheelchairs with an integrated, supportive approach, including consideration of the potential beneficial effects of seated Tai Chi on their QOL. As already indicated, QOL not only involves
physiological and psychological dimensions, it is also influenced by social and environmental dimensions and these need to be considered in future research.

The current study focuses on whether seated Tai Chi exercise affects: (1) QOL (2) depression (3) mood states, and (4) self-efficacy of older people in wheelchairs. The research hypotheses are that:

1. Participants in the seated Tai Chi group will have a significant increase in QOL, in the physical, psychological, and social and environment domains, compared with participants in the control group who receive usual standard care without Tai Chi exercise intervention.

2. Participants in the seated Tai Chi group will have a significant reduction in depressive symptoms compared with participants in the control group who receive usual standard care without Tai Chi exercise intervention.

3. Participants in the seated Tai Chi group will have significantly improved mood states compared with participants in the control group who receive usual standard care without Tai Chi exercise intervention.

4. Participants in the seated Tai Chi group will have a significant increase in self-efficacy compared with participants in the control group who receive usual standard care without Tai Chi exercise intervention.
2.7 Conclusion

Consideration of the QOL of the older population in LTC facilities includes the dimensions of good health promotion, social interaction, activities, and the environment (Hsu, 2007; Tsai & Tsai, 2008). Tai Chi may be appropriate for influencing QOL as Tai Chi has been reported to enhance physical function (Adler & Roberts, 2006; Chen et al., 2008; Greenspan et al., 2007; Rogers et al., 2009); psychological function (Wolf et al., 1997; Chen et al., 2002); and social functioning (Chen et al., 2007). None of the studies reviewed, however, explicitly explored the relationship between Tai Chi and improving QOL, especially in relation to the psychological, social, and environmental health of older people in wheelchairs living in LTC.

In addition, depression is a challenge for the frail older population in LTC facilities (Lin et al., 2007). There is a correlation between depression and QOL (Chan et al., 2006; Lin et al., 2007) but there is little understanding of depressive symptoms in older people in wheelchairs living in LTC, and little understanding of the therapeutic use of Tai Chi (i.e. an exercise which involves body and mind interaction) to improve depression and mood states in this population.

Studies exploring the enhancement of self-efficacy conclude that using individual strategies leads to an ability to control emotional reactions, and this is associated with a higher QOL (Lev et al., 2007). No studies were found that focus on the relationship between self-efficacy and Tai Chi in older people in wheelchairs. Whether Tai Chi
affects individual self-efficacy in older people in wheelchairs, positively or negatively, is not yet clear. A positive effect of perceived self-efficacy while participating in exercises has been reported in relation to QOL in older people (Dechamps et al., 2009; Lee et al., 2007; Lee et al., 2009; Umstattd & Hallam, 2007), but again, it is not clear whether Tai Chi is suitable for enhancing self-efficacy, something which has been reported to influence QOL.

The QOL outcomes of previous studies investigating effects of Tai Chi on physical, psychological; and social health are contradictory. The effects of Tai Chi on the QOL of older persons still needs to be explored further, particularly in the physical, psychological and social domains. Additionally, there is no evidence about the effect of Tai Chi on the environmental domain of QOL, and this too needs further exploration because QOL is also affected by the environment.

Tai Chi may affect the QOL of older people but there are various Tai Chi exercises, and there is still a need to identify a helpful and suitable Tai Chi program for older people in wheelchairs living in LTC. The specific style of Tai Chi, and the duration, time and frequency need to be designed thoughtfully. A powerful methodology to examine the effect of Tai Chi is also necessary. This study has therefore attempted to explore the effect of Tai Chi for older people in wheelchairs in regard to QOL (in the psychological health, social relationship and environment domains), self-efficacy, and depression and mood states. The methodology will be discussed in Chapter 3.
CONCEPTUAL FRAMEWORK

The conceptual framework for this study, set out in Figure 2, outlines the influence of Tai Chi on the four dimensions of QOL (psychological, social, environmental and physical), as well as psychological well-being (depression and mood states) and self-efficacy, for older people in wheelchairs in Taiwan. It is based on a modification of the two tenets of Tai Chi (mind concentration and breathing control) described by Plummer (1983), discussed under 2.5.1 Theoretical basis of Tai Chi above.

Figure 2 Conceptual framework: The combination of Plummer’s Two Tenets of Tai Chi (Plummer, 1983) and QOL.
Tai Chi’s emphasis on mind concentration and breathing control promotes psychological and physical relaxation that results in a sense of well-being (Plummer, 1983; Wolf et al., 1997) which may lead to a person perceiving an enhanced QOL in the physical, psychological, social, and environmental domains. Figure 2 also illustrates how practicing Tai Chi may foster the development of self-efficacy and therefore help participants to continue to practice Tai Chi and improve QOL.

It is therefore hypothesized that Tai Chi will lead to an improved QOL, reduced depression, improved mood states, and increased self-efficacy in older people in wheelchairs when compared to the results from usual standard care without Tai Chi.

Furthermore, reciprocal interpersonal relationships are also believed to increase positive feelings for older people as a result of the practice of Tai Chi (Chen et al., 2002), which may benefit the social and environment domains of QOL. This is because a Tai Chi exercise program may enhance resident’s interactions with other residents, family, the Tai Chi instructor, and staff members, and such a program improves residents’ living experiences and their satisfaction with their LTC environment. This study argues that by having the instructor delivering Tai Chi in a group setting there is provision for social activities and for participants to improve their social relationships. This is as a result of the communication, encouragement, and interaction required between the Tai Chi instructor, staff and participants, and between the participants themselves.
Figure 2 also illustrates the outcome measures (WHOQOL-BREF, GDS, POMS-SF and SEE) that will be used in this study to examine the effect of Tai Chi exercise on QOL, depression, mood states, and self-efficacy of older people in wheelchairs. These measure instruments are detailed in the next chapter.

In summary, the conceptual framework clarifies the relationship existing between Tai Chi, QOL, and self-efficacy. Using a theoretical understanding of Tai Chi based on Plummer’s model, this study examines the effect of seated Tai Chi exercise on improving QOL, reducing depression and improving mood states, and increasing self-efficacy in older people in wheelchairs. In Taiwan, investigating variables that have an effect on the QOL of older people in LTC settings should be prioritized to help identify means of improving care outcomes. Social relationships, functional ability, and activities can affect QOL in older people as much as they affect their health status, and as such they need to be considered. Specifically, there is evidence supporting a positive relationship between self-efficacy and exercise. Much, however, about the effect of Tai Chi exercise on the QOL of older people in wheelchairs is unknown. There is considerable evidence regarding the relationship between Tai Chi and physiological health status, but little is known about its relationship to psychological, social, and environmental health. In particular, there is a paucity of evidence about how Tai Chi exercise influences the QOL of the older population in wheelchairs in LTC facilities. A conceptual framework has been developed to guide this study which uses a randomized control trial (RCT) to explore the effects of Tai Chi exercise on QOL, depression, mood states, and self-efficacy of older people in wheelchairs. The methodology will be discussed in the next chapter.
CHAPTER THREE

METHODOLOGY

This chapter describes and justifies the use of a randomized controlled trial (RCT) design in the study. The study design, sampling, randomization, and blinding processes are outlined, and details relating to the intervention, data collection procedure and outcome measurements are presented. Last, the data analysis and handling of research-related ethical issues are discussed.

3.1 Randomized Controlled Trial (RCT)

This study adopted a randomized controlled trial (RCT) study, guided by the Consolidated Standards of Reporting Trials (CONSORT) guidelines (Moher et al., 2010), to avoid the methodological limitations of previous studies on the effect of Tai Chi for older people which were outlined in Chapter 2.

The RCT research approach, introduced in the mid 20th century, has had a profound effect on researchers’ capacity to determine whether a cause-effect relationship exists between treatment and outcome and it is an integral component in the hierarchy of evidence which guides the practice of health research (Nichol, Bailey, & Cooper, 2010). An RCT design tests the efficacy or effectiveness of therapies or interventions (Nichol et al., 2010). RCTs are particularly important in health research as they provide a source of important evidence for practice (Cheng, 2006; Greene, 2009;
Howard, Salis, Tomlin, Thornicroft, & Donovan, 2009; Moher et al., 2010; Nichol et al., 2010; Richards & Hamers, 2009a, 2009b; Shields & Twycross, 2005).

Doganet et al. (2004) point out that “The power of the RCT rests on its use of the experimental method to identify causation” in that “the manipulation of the independent variable has caused a measurable change in the dependent variable” (Dogan et al., 2004, p31). RCT is a research design with three components: manipulation, control, and randomization (Polit & Beck, 2008). Manipulation involves the introduction of an intervention to participants by researchers. A control (i.e. comparison) group of participants who do not receive the intervention is always included. The other important component is the randomization or random assignment of participants, where they are either assigned to the intervention or control group on a random basis (Polit & Beck, 2008).

Blinding is another essential component of an RCT design because it prevents systematic biases, stemming from foreknowledge of group allocations and research aim outcomes. For example, such a bias can result from participants having an awareness of the research hypothesis and/or the assigned intervention or treatment (Polit & Beck, 2008). Blinding includes concealing information from participants, data collectors, care providers, intervention agents, and data analysts (Polit & Beck, 2012). If for example, participants are not aware of whether they are getting an experimental drug, then their outcomes cannot be influenced by expectations they may have about its efficacy (Polit & Beck, 2012). But unlike allocation concealment, blinding is not always possible: drug studies often lend themselves to blinding, but
many nursing interventions do not (Polit & Beck, 2012). The interpretation of terms such as ‘single-blinded’ and ‘double-blinded’ vary greatly (Devereaux et al., 2001), and for this reason an important aspect of reporting RCTs is the explicit identification of the groups blinded and how they are blinded (Moher, Schulz, & Altman, 2001).

Lastly, the intention to treat analysis (ITT) approach is also used to avoid various misleading biases. Every participant allocated to a treatment group is considered to be part of the trial. ITT is used as an attempt to avoid potential bias and identify the true effect of the intervention, if the research design is based on the principles of randomization (Nichol et al., 2010).

A variety of experimental study designs are used, from relatively simple parallel trials, to other more complex designs such as crossover, cluster randomized, factorial and split body trials (Hopewell, Dutton, Yu, Chan, & Altman, 2010). A parallel group design is a simple and commonly used clinical design which compares two treatments, with two groups which are typically called the ‘treatment group’ and the ‘control group’. A crossover design is one in which the subjects get both treatments in sequence. This is the most common type of repeated measures design, ensuring that all of the subjects receive all of the treatments. A cluster randomized controlled trial is a type of RCT in which groups of subjects (e.g. hospitals, villages and schools) are randomized. A factorial design is one where the experiment allows study of the effect of each factor on the response variable, and of the effects of interactions between factors on the response variable. Such a design is sometimes therefore more complex than a 2×2 design. Split body trials are those that separate parts of the body of each participant
(e.g. the left and right sides of the face) and these are then randomized to receive (or not receive) an intervention (Hopewell et al., 2010; Jones, Byron, Kenward, & Michael, 2003; Polit & Beck, 2008, 2012; Watson, McKenna, Cowman, & Keady, 2008).

The benefits and limitations of RCT

Although the RCT design is very powerful, it is a very rigid approach to experimental research. Nurse researchers often want to study the effects of more than one variable on a range of other variables, and in the context of nursing research when working with human subjects, this design may therefore have some weaknesses. It may, for example, be difficult to maintain the integrity of the intervention and control conditions if the study period extends over time (Polit & Beck, 2012). Moreover, clinical research is conducted in environments in which researchers may have little control, and control is a critical factor in RCTs (Polit & Beck, 2012). However, some situations probably are not feasible for nursing research projects, for example in situations where it is impossible to isolate a control group and to give no treatment to participants (Polit & Beck, 2012).

Another concern related to experimental studies is the potential contamination of results by the researchers’ or subjects’ awareness of the nature of the study; this relates to an experience known as the “Hawthorne effect”. The Hawthorne effect was identified by a research study in the 1920s which demonstrated a positive effect on employee productivity when lighting was improved, but productively then still increased when lighting was decreased to the original level (Watson et al., 2008). The
study helped to illustrate that personal factors were important influences and that people, unlike machines, behave differently when they are being watched.

Using a double-blind approach may avoid the Hawthorne effect in randomized controlled trials because double-blinding ensures that both the researcher and the participant are unaware of the study intervention and of which participants are in the intervention and the control group. A potential shortcoming is that it also raises ethical issues related to the level of information which is provided to participants when they give informed consent (Watson et al., 2008). Moreover, some clinical interventions cannot be blinded from the participants. Therefore, if participants are aware of their participation in a study it may be difficult for the results to be generalized (Polit & Beck, 2012).

3.2 Study design

This study was designed to take into account the essential components of RCTs outlined in the previous section, and also the consolidated Consort Statement (Moher et al., 2010) and guidelines developed to ensure quality reporting of RCTs.

This study selected the use of a repeated measures, placebo-controlled parallel-randomized trial (RCT) design to determine the effect of a 26-week seated Simplified Tai Chi Exercise Program (STEP) (Chen et al., 2006) on the QOL of older Taiwanese people in wheelchairs living in LTC, and on their depression, mood states, and self-efficacy. The definition of QOL adopted for the purpose of this study is the
WHO definition (stated on p.15) which incorporates a person’s physical health, psychological status, social relationships, and their relationships to their environment (WHOQOL group, 1998). There are many advantages in using an RCT design and it is an extremely powerful method by which causal-relationships can be inferred (Polit & Beck, 2010), and this was the approach selected to investigate the effect of seated Tai Chi exercise on older people in wheelchairs.

An intervention group undertook a seated Tai Chi exercise protocol, while a control group received usual care. Baseline tests were performed on all participants in each group before randomization to treatment groups, and then follow-up tests were carried out on all participants in weeks 13 and 26 of the intervention period (see Figure 3). This allowed the effect on the participants’ variables after the seated Tai Chi intervention to be compared with the same variables measured in a similar group residing in the same environment who had received usual care.
Figure 3 Trial Design

3.3 Sample

Convenience sampling was used in this study. All older people residing in the Jen-Tao LTC facility who met the following inclusion criteria for the study were invited to participate:

Inclusion criteria
1. people in wheelchairs aged 65 years or over
2. willingness to participate in the study
3. able to speak and understand Chinese or Taiwanese and with no severe hearing
impairment
4. able to use and raise both arms while sitting in a wheelchair
5. able to provide informed consent
6. cognitive function established through Mini Mental State Examination $> 24/30$

The following exclusion criteria were used:

**Exclusion criteria:**

1. symptoms of acute pain or infection
2. any lower extremity infection
3. older people in palliative care
4. older people with blindness
5. documented or observable psychiatric or neurological disorders that might interfere with participation (for example dementia, or psychosis).

**Sample size**

The sample size for this study was calculated to achieve a power of 0.80 with an alpha significance of 0.05 and an effect size of 0.80. It was calculated that a total sample size of 50 participants (i.e. 25 participants in the control and 25 in the intervention group) would be needed, based on a previous study by Lee et al. (2009), using G-Power to detect an effect size of 0.8 with 80% probability at 0.05. Lee et al. explored the effectiveness of Tai Chi exercise interventions for older people in LTC facilities, using the health-related QOL (SF-12) (Ware et al., 1996) to assess QOL. The researcher recruited 60 participants for this study, to allow for possible attrition. This resulted in 30 people being randomized to the intervention group and 30 people
to the control group.

**Setting**

Participants were recruited for this study from among older people using wheelchairs for mobility and living in a LTC facility in the Changhua region of Taiwan. According to the Taiwanese Government Department of Household Registration (2009b) statistics, Changhua has a population of about 1,313,000 people. In 2008, there were over 154,900 people, aged 65 and over, at that time accounting for 11.8% of the population in Changhua County (Department of Household Registration, 2009c). The percentage of people aged 65 and over in Changhua was higher than that of people aged 65 and over in Taiwan as a whole (10.2%) (Department of Household Registration, 2009c). The study was conducted in the Jen-Tao LTC facility in Changhua (see Figure 4). This facility provides 24-hour residential care for approximately 150 older people from Changhua, and more than 60% of the residents use a wheelchair for mobility.
Recruitment

The following procedure was used to recruit participants. The researcher first contacted the administrator of the LTC facility to obtain permission to undertake the research. The administrator asked the researcher to speak with residents who indicated that they might be interested in participating in the study following a brief outline of the study by the administrator. A meeting was convened to inform potential participants about this research project at which the administrator introduced the researcher who then told the older people present about herself and her research, including an explanation of the study inclusion and exclusion criteria (see Appendix A also). The administrator was given a copy of the inclusion and exclusion criteria,
and the nursing staff were asked to assist in the recruitment of participants by identifying potential participants who met the inclusion criteria from among those who indicated they were willing to take part in the study.

The researcher then assessed the cognitive function of those participants who were identified by staff as potential participants and who volunteered. At the time of the cognitive assessment, the researcher also confirmed that potential participants met all of the inclusion criteria. Potential participants meeting the criteria were then once more given a verbal explanation of the study before they were asked to sign the consent form giving informed, written consent (see Appendix B). Finally, the director of the facility’s medical professional team gave permission (see Appendix D) for each of the selected residents to participate in the study. The director signed a document confirming that each participant had no medical condition precluding his or her participation.

3.4 Randomization

Demographic details and all baseline measures were collected before the 60 participants were randomly allocated to either the intervention group or the control group. The time between completion and collection of the baseline data and the randomization and allocation of participants to either the control or intervention groups was no longer than 48 hours.

Participants were randomly assigned into one of two parallel groups, either to an
intervention group to receive the intervention or to a control group to receive usual care, in a 1:1 ratio. Randomization was conducted as follows:

(1) **Sequence Generation**: The researcher checked each of the returned baseline data questionnaires to make sure all the forms had been fully completed for each person and then allocated each person’s completed questionnaire set a number from 1 to 60, corresponding to the order in which this checking was done. A consultant statistician provided a computer-generated randomization list using the Excel Randomization Function, using a 1:1 allocation ratio. The list generated consisted of the participant numbers (1–60) and a number indicating which group that participant had been randomly allocated to: “0” indicated the control group; “1” indicated the intervention group.

(2) **Allocation Concealment**: This group allocation list was concealed from those involved in the research and placed in an opaque and sealed envelope until the allocation of participants to their groups was fully completed.

(3) **Implementation**: The next stage of the randomization was conducted by a third party, someone who was not one of the personnel at the facility and not involved in the enrolment, screening, or outcome assessment processes. This person opened the sealed envelope and interacted with the facility staff so that the staff could inform the participants which group they had been allocated to, and could prepare those in the intervention group for their first session.
3.5 Blinding

The research assistants who performed the outcome assessments were blinded to the group assignment of participants. The importance of blinding was explained to the research assistants and they were explicitly instructed not to ask participants which group they had been assigned to during data collection. Blinding of participants was not feasible given the nature of the intervention; but participants were also instructed not to discuss their study treatment with anyone. The Tai Chi exercise program was performed in a separate room, not the conventional activities area, so as to not un-blind group assignment.

3.6 Intervention

**Intervention:** Those in the intervention group participated in three 40-minute sessions of seated Tai Chi exercise each week, for 26 weeks. The form of seated Tai Chi exercise selected to use in this study is based on the Simplified Tai Chi Exercise Program (STEP) developed by Professor Chen Kuei-Min of Fooying University in Taiwan (Chen et al., 2006). This program was designed for frail older people, and it was developed for use in Jao’s (2006) study exploring a STEP for older people in wheelchairs. The researcher sought out Professor Chen and was able to undertake a course to learn this form of Tai Chi. The seated movements in the student’s study are the same as those used by Chen et al. (2008), movements which they considered were easy-to-learn and easy-to-perform, and which involve few leg movements. The only difference is that in the Chen et al. study older people who were standing completed
the movements: the older people in this current study did the same movements seated in wheelchairs. A minimal number of adjustments were needed to be made to the movements to allow this, in particular in the very last movement in the program sequence the movements were adjusted so that they could be performed in a wheelchair. The researcher personally undertook a practice session of the seated Tai Chi exercise protocol prior to implementation of the intervention to ensure it was realistic, feasible and acceptable, and to identify any potentially adverse aspects.

A qualified Tai Chi instructor from Taiwan’s Tai Chi Chuan Association conducted the Tai Chi exercise program. The group of 30 people randomized into the intervention group was split into two smaller groups of 15 people. This was done to ensure the safety of the older people in their wheelchairs, and because the space available for group activities in the LTC was limited, having only 15 in the group also ensured a quality learning experience. One group of 15 had their sessions between 2:00 pm and 3:00 pm. The other group of 15 had their sessions between 3:00 pm and 4:00 pm. Time to move participants in and out of the room was factored into these time slots.

**Control group:** The residents allocated to the control group received their usual standard care with no seated Tai Chi exercise. The term ‘usual standard care’ indicates that residents were involved in the 24-hour residential care and activities provided by the facility, including use of machines for rehabilitation, such as a balancer hand trainer; watching TV and DVDs; karaoke singing; playing card games; chess and croquet; throwing activities; listening to music; drawing; arranging flowers; origami; and doing stretching exercises following an instructor on a DVD.
Comparison of Intervention schedule with that of earlier studies

Details of the intervention schedules of a number of previous studies, which used a Tai Chi exercise program intervention, are shown in Table 3 below. The individual sessions of the programs they used range in length from 30 minutes to 60 minutes. The number of sessions each week ranged from two to four. The programs ranged in length from 12 weeks to 26 weeks. The total number of hours of their Tai Chi exercise programs averaged 51.6 hours.

Table 3 Schedule details of Tai Chi intervention in previous studies

<table>
<thead>
<tr>
<th>Author and year</th>
<th>Time (mins)</th>
<th>Sessions (per week)</th>
<th>Duration (weeks)</th>
<th>Total (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chen et al. (2007)</td>
<td>60</td>
<td>2</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>Chen et al. (2008)</td>
<td>50</td>
<td>3</td>
<td>24</td>
<td>60</td>
</tr>
<tr>
<td>Wang et al. (2008)</td>
<td>60</td>
<td>2</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Lee et al. (2009)</td>
<td>60</td>
<td>3</td>
<td>26</td>
<td>78</td>
</tr>
<tr>
<td>Dechamps et al. (2009)</td>
<td>30</td>
<td>4</td>
<td>24</td>
<td>48</td>
</tr>
</tbody>
</table>

Chen et al. (2007) influenced this current project design in that their study argued that because of their poor or compromised health, older people might not be able to tolerate undertaking a 60-minute exercise session twice a week. Chen et al. therefore recommended reducing the length of each session and suggested a reduced exercise
schedule of three 30-minute sessions per week. Based on Chen et al. rationale a decision was therefore made to keep the exercise program close to 30-minutes for this study.

The seated Tai Chi exercise program was designed to consist of a 10-minute warm-up, a 25-minute seated Tai Chi exercise session, and a 5-minute cool-down. The decision to have a 26-week intervention totaling 52 hours was made after consideration of the length and average total number of hours of previous Tai Chi studies. A significant difference in the physical and mental component of health-related QOL was reported between the Tai Chi group and control group in nursing home residents after joining a 26-week Tai Chi program (Lee et al., 2009). Furthermore, Dechamps et al. (2009) used physical activity recommendations (U.S. Department of Health and Human Services, 2000), such as frequency and duration in the Tai Chi group, and their findings indicate that 48 hours of participation in Tai Chi over 24 weeks would improve QOL.

The Tai Chi intervention was held in the mid-afternoon. This was based on the American Council on Exercise (2001) recommendation that the best time to exercise is in the afternoon because that is when the body temperature reaches its peak. This produces better performance and more power as muscles are warm and more flexible. Another consideration was a report by Crombie et al. (2004) that older people in their study significantly disliked participating in physical activity in the evening, due to underlying factors such as depression and a lack of positive attitudes towards physical activity and exercise.
The intervention sessions had three parts:

1. **Warm-up**

The 10-minute warm-up consisted of the following nine movements:

   (1) Nodding the head
   (2) Shrugging the shoulders
   (3) Waving hands
   (4) Swinging arms
   (5) Twisting the waist
   (6) Circling legs
   (7) Jiggling knees
   (8) Raising the feet
   (9) Closing movement.

   The sequence of movements from (1) to (8) was repeated twice, and the warm-up then finished with movement (9).

2. **The STEP sequence**

The main STEP part of the intervention, practiced for 25 minutes, consisted of twelve movements:

   (1) Commencing form
   (2) Curving back arms
   (3) Pushing palms forward
   (4) Wind push the wall
   (5) Holding palms as on horseback
   (6) Palming the energy of the tiger
(7) Energy tower to the sky  
(8) Needle at the sea bottom  
(9) Embracing the moon  
(10) Lifting the moon to the sky  
(11) Punch down  
(12) Closing movement.

The sequence of movements (1) to (11) was done 12 times, and the STEP section then finished with closing movement (12).

3. Cool-down

The 5-minute cool-down consisted of just two movements which were done 8 times:

(1) Heaven and earth  
(2) Rubbing through circulation.

The STEP seated Tai Chi was presented to the participants in two stages (see Table 4). In the first stage, participants learned the STEP seated Tai Chi in six lessons in week 1 and week 2. Except for the very first session, each session included all of the warm-up movements (movements 1–9) and the cool-down movements (1–2).

The very first session in week 1 covered learning and reviewing the first five of the nine warm-up movements. The second session in week 1 covered learning the rest of the warm-up movements (6–9) then reviewing all the warm-up movements (1–9). The third session in week 1 included learning new Tai Chi movements and reviewing new Tai Chi movements (Tai Chi 1-3).
Tai Chi movements 4–7 were introduced in the first session of week 2, and then Tai Chi movements 1–7 were all reviewed. The second session in week 2 introduced new Tai Chi movements (8–12), and then Tai Chi movements 1–12 were all reviewed. The third session in week 2 did not introduce any new movements, but simply reviewed Tai Chi movements 1–12.

The second stage, from week 3 to week 26, was the practice stage: no new movements were introduced. Participants were asked to perform the sequence of all the STEP seated Tai Chi movements (Tai Chi 1–12). The sequence was done 12 times in each session.
Table 4 STEP Seated Tai Chi Schedule

<table>
<thead>
<tr>
<th>STEP Seated Tai Chi</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Warm-up</td>
<td>Learning</td>
<td>Review</td>
<td>Cool-down</td>
</tr>
<tr>
<td><strong>First stage - Learning stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 1 – Session 1</td>
<td>Movements 1 – 5</td>
<td>Warm-up movements 1 – 5</td>
<td>Warm-up movements 1 – 5</td>
<td>Movements 1 – 2</td>
</tr>
<tr>
<td>- Session 2</td>
<td>Movements 1 – 9</td>
<td>Warm-up movements 6 – 9</td>
<td>Warm-up movements 1 – 9</td>
<td>Movements 1 – 2</td>
</tr>
<tr>
<td>- Session 3</td>
<td>Movements 1 – 9</td>
<td>Tai Chi movements 1 – 3</td>
<td>Tai Chi movements 1 – 3</td>
<td>Movements 1 – 2</td>
</tr>
<tr>
<td>Week 2 – Session 1</td>
<td>Movements 1 – 9</td>
<td>Tai Chi movements 4 – 7</td>
<td>Tai Chi movements 1 – 7</td>
<td>Movements 1 – 2</td>
</tr>
<tr>
<td>- Session 2</td>
<td>Movements 1 – 9</td>
<td>Tai Chi movements 8 – 12</td>
<td>Tai Chi movements 1 – 12</td>
<td>Movements 1 – 2</td>
</tr>
<tr>
<td>- Session 3</td>
<td>Movements 1 – 9</td>
<td>-</td>
<td>Tai Chi movements 1 – 12</td>
<td>Movements 1 – 2</td>
</tr>
<tr>
<td><strong>Second stage (Practice stage)</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Week 3 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 4 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 5 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 6 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 7 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 8 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 9 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 10 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 11 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 12 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 13 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 14 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 15 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 16 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 17 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 18 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
<tr>
<td>Week 19 – all sessions</td>
<td>1 – 9</td>
<td>-</td>
<td>Tai Chi 1 – 12</td>
<td>1–2</td>
</tr>
</tbody>
</table>
### Week 20 – all sessions
1 – 9 - Tai Chi 1 – 12 1–2

### Week 21 – all sessions
1 – 9 - Tai Chi 1 – 12 1–2

### Week 22 – all sessions
1 – 9 - Tai Chi 1 – 12 1–2

### Week 23 – all sessions
1 – 9 - Tai Chi 1 – 12 1–2

### Week 24 – all sessions
1 – 9 - Tai Chi 1 – 12 1–2

### Week 25 – all sessions
1 – 9 - Tai Chi 1 – 12 1–2

### Week 26 – all sessions
1 – 9 - Tai Chi 1 – 12 1–2

**After the Intervention**

The following steps were taken at the conclusion of the 26-week intervention and data collection.

(1) The participants were told that the study was now complete and they were thanked for taking part in it.

(2) Each participant (those in the intervention group, and those in the control group also) was given a seated Tai Chi exercise program DVD, after they had undergone the final outcome assessments in week 26.

(3) It was explained to the participants that the researcher would provide them with a lay summary of the findings of the study once the data had been analyzed.

### 3.7 Data collection

Baseline (i.e. pre-intervention) data for all participants was collected by the researcher and three research assistants using the WHOQOL-BREF, GDS-SF, POMS-SF and SEE instruments described below (see 3.8 Outcome data collection). Outcome assessment data was collected again at week 13 and week 26, in the same way as it had been completed at baseline.
Three research assistants who were not staff at the facility assisted in this process. Each of them had a nursing background. Before the intervention began, the researcher gave the research assistants a training session. This involved: (1) explaining how to use the four measurement instrument questionnaires; how to ask the questions, and ensuring that the research assistants had no difficulty understanding the questions; (2) explaining clearly to the research assistants that they could not express their own individual emotions or opinions while collecting data. They were asked to practise on older members of their families to ensure they felt confident and familiar with the task.

Each assessment instrument questionnaire took approximately twenty minutes to complete: the residents were individually asked each question verbally. If someone came to visit a resident during the questioning, then the questioning was simply paused and resumed later that same day (see Appendix E).

3.8 Outcome data collection

Participants’ demographic information

The following demographic details were collected for the 60 participants: their age, gender, ethnicity, religion, level of education, marital status, length of residency in the long-term care facility, length of time using a wheelchair, reason for using a wheelchair, and medical diagnoses (see Appendix C).
The Mini Mental State Examination (MMSE) was used to screen for cognitive function only (see page 119). Standardized instruments (see Table 5) were used to collect the baseline data and study outcomes: the World Health Organization Quality of Life BREF (WHOQOL-BREF) (WHOQOL group, 1998) (see Table 5, Section 1), the Geriatric Depression Scale-Short Form (GDS-SF) (Sheikh & Yesavage, 1986) (see Table 5, Section 2), Profile of Mood States Short Form (POMS-SF) (McNair et al., 1992) (see Table 5, Section 3), Self-Efficacy for Exercise (SEE) Scale (Resnick & Jenkins, 2000) (see Table 5, Section 4). The Chinese versions of all these instruments were used in this study. Each is briefly described in Table 5. The outcomes themselves and their analysis are presented in Chapter 4.

**Table 5 Assessment instruments used**

<table>
<thead>
<tr>
<th>Section</th>
<th>Instrument</th>
<th>Number of items</th>
<th>Reported alpha</th>
<th>Source</th>
<th>Chinese version</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>World Health Organization Quality of Life BREF (WHOQOL-BREF)</td>
<td>26</td>
<td>0.73–0.78</td>
<td>WHOQOL group (1998)</td>
<td>Garcia-Rea and LePage (2010)</td>
</tr>
<tr>
<td>2</td>
<td>Geriatric Depression Scale-Short Form (GDS-SF)</td>
<td>15</td>
<td>0.75–0.81</td>
<td>Sheikh and Yesavage (1986)</td>
<td>Liu et al. (1998)</td>
</tr>
<tr>
<td>3</td>
<td>Profile of Mood States-Short Form (POMS-SF)</td>
<td>30</td>
<td>0.73–0.99</td>
<td>McNair et al. (1992)</td>
<td>Chen (2000)</td>
</tr>
<tr>
<td>4</td>
<td>Self-efficacy for exercise scale (SEE)</td>
<td>9</td>
<td>0.75–0.92</td>
<td>Resnick and Jenkins (2000)</td>
<td>Lee et al. (2009)</td>
</tr>
</tbody>
</table>
Mini Mental State Examination (MMSE)

The Mini Mental State Examination, developed by Folstein, Folstein, and McHugh (1975), is a screening test widely used for assessing six areas of cognitive function: orientation to time, orientation to place, registration, recall, attention and calculation, and language. The maximum score is 30; a score < 24 indicates reduced cognition indicative of dementia, delirium, schizophrenia, and affective disorder. To address the issue of the older Taiwanese generation having a limited educational background, Lee (2010) suggests using the following scoring thresholds to indicate reduced cognition when undertaking the assessment: (1) a score of < 24 if the level of education was over 6 years; (2) a score of < 21 if the level of education is less than 6 years; and (3) a score of < 16 if a person has a background of no education.

World Health Organization Quality of Life BREF (WHOQOL-BREF)

The WHOQOL group (1998) introduced the World Health Organization Quality of Life BREF (WHOQOL-BREF). This is a multidimensional QOL instrument designed to measure four domains: physical capacity (7 items), psychological well-being (6 items), social relationship (3 items), and environment (8 items); and two items which measure overall QOL and general health respectively. The 26-items are rated on a 5-point scale with a higher score representing a higher quality of life. Garcia-Rea and LePage (2010) used the Chinese version of WHOQOL-BREF with 102 homeless veterans and found good reliability with Cronbach’s alpha for the four domains of 0.73–0.78.
Geriatric Depression Scale - Short Form (GDS - SF)

The Geriatric Depression Scale - Short Form (GDS - SF) developed by Sheikh and Yesavage (1986) consists of 15 items from the original 30-item Geriatric Depression Scale (Brink & Yesavage, 1982). GDS-SF has been demonstrated to be a useful tool for detecting depressive symptoms (Greenberg, 2007). It has been used to differentiate between depressed and non-depressed adults with high correlations (Greenberg, 2007; Sheikh & Yesavage, 1986; Liu, Lu, Yu, & Yang, 1998). The GDS-SF consists of 15 items with a score range from 0 to 15. A score of 0 to 4 is in the normal range, 5 to 9 indicates mild depression, and 10 to 15 indicates moderate to severe depression. Friedman, Heisel, and Delavan (2005) used the GDS-SF to examine 960 older people from community dwellings in the United States and the Cronbach’s alpha was 0.75. Liu et al. (1998) used the Chinese version of the Geriatric Depression Scale-Short Form for 187 older Chinese people in Taiwan and found good reliability, with a Cronbach’s alpha of 0.81.

Profile of Mood States Short Form (POMS-SF)

The Profile of Mood States Short Form (POMS-SF) was developed by McNair et al. (1992) and is based on a 65-item questionnaire originally developed by McNair et al. in 1971. It presents 30 adjectives describing feelings and moods that the respondent is asked whether they have experienced during the past week. Subjects respond on a five-point scale ranging from 0 (not at all) to 4 (extremely). The POMS-SF is used to
measure a person’s total mood disturbance and includes six dimensions of mood states: tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment. Each of these six dimensions is defined by the responses to five particular adjectives. Jette et al. (1996) used POMS-SF to examine 102 older people from community dwellings and found good reliability, with Cronbach’s alpha of 0.73–0.89 for the six domains. Chen (2000) developed and used the Chinese version of the POMS-SF with 80 older people from community dwellings in Taiwan with good reliability for the six dimensions scales, with Cronbach’s alpha ranging from 0.98 to 0.99.

*Self-Efficacy for Exercise (SEE) Scale*

Resnick and Jenkins (2000) developed the Self-Efficacy for Exercise (SEE) Scale. This consists of nine items that measure the participant’s perception of their confidence to continue doing exercise in the face of various circumstances, such as bad weather, tiredness, and feeling depressed. The items are scored from 0 (not confident) to 10 (very confident): the higher scores represent greater exercise self-efficacy. Reliability of the Self-Efficacy for Exercise (SEE) Scale was tested with 187 older people from a North American population, and the Cronbach’s alpha was 0.92. Lee et al. (2009) introduced the Chinese version of the Self-efficacy for Exercise (SEE-C) scale using it to assess 192 older Chinese adults in Taiwan, finding good reliability: the Cronbach’s alpha was 0.75.
3.9 Data analysis

The Statistical Package for Social Sciences (SPSS) 18.0 was used for data analysis. As well as checking the completeness of the data collected, all questionnaires were marked with participant identification numbers and these were entered by the researcher. The accuracy of the data coding and entry process was ensured by comparing the computerized data against a random sample (20%) of the original data in the database, and no error was found. Additionally, normal distribution of the data for the outcome variables was examined using probability plots, and Kolmogorov-Smirnov tests. The results showed that the null hypotheses of normal distribution were accepted. Assumptions for all analyses were met for the normal distribution.

An intention-to-treat (ITT) analysis was used. In this approach, the analysis is based on the original treatment intent and not on the final treatment eventually administered. Data missing due to attrition was managed by carrying forward corresponding data for that person from the last observation. Concerns have been raised about the potential for a biased estimate of the treatment effect and an underestimation of the variability of the estimated result (Nichol et al., 2010). Nevertheless, this technique is valid as long as the data is missing completely at random (MCAR) (Little & Rubin, 1987, 2002). Although there is no clear guideline about what the maximum limit of missing data should be (Tsikriktsis, 2005); Cohen and Cohen (1983) suggest that 5 – 10% missing data for a particular variable is acceptable, while Raymond and Roberts (1987) consider that missing data amounting to less than 10% will cause little interference to
the study outcomes. But if the amount of missing data approaches 20%, this may lead to significantly different outcomes for the study (Raymond & Roberts, 1987; Stumpf, 1978).

Seven participants did not or could not continue participating in the study. As the proportion of missing data was only 11.6% and found to be completely missing at random, the last observed data was carried forward and used in place of the missing data (Cohen & Cohen, 1983; Little & Rubin, 1987, 2002; Little & Schenker, 1995; Myers, 2000; Rubin, 1996; Raymond & Roberts, 1987; Tsikriktsis, 2005).

The demographic variables—the MMSE, WHOQOL-BREF, GDS-SF, POMS-SF and SEE scores—were analyzed with descriptive statistics: frequency, percentages, means, and standard deviations. Frequencies and percentages were used to summarize the categorical variables; and means and standard deviations were used to summarize the continuous variables. The demographic characteristics and baseline data of the experimental group were compared with those of the control group, using chi-square test for categorical variables and t-test for continuous variables, and to analyze the homogeneity between the groups. Cronbach’s alpha was used to check the reliability of the instruments.

Repeated multiple analysis of variance (MANOVA) was conducted to determine the effects of Tai Chi for the intervention group compared to the control group, adjusting for baseline difference. Analysis of covariance (ANCOVA) tests were administered to determine the effect of Tai Chi on QOL, depression, mood states, and self-efficacy to
further assess differences between the intervention and control groups at week 13 and week 26. The influence of covariates - the MMSE scores, length of time living in the LTC facility, and the length of time using a wheelchair - on the outcomes of the Tai Chi intervention was also examined. Odds ratios were computed to determine the likelihood of an improvement in outcome measures for the Tai Chi group in comparison to the control group. Odds ratios were computed using Pearson chi-square test with risk estimates as there was generally $\geq 10$ in any cell of the data table unlike Fisher’s Exact test, a more conservative test that is more suited for data tables with small cell counts. The significance level was set at .05 for all analyses.

### 3.10 Ethical considerations

The three primary ethical principles used as a guide for this study are based on the “Belmont Report” (Polit & Beck, 2010): beneficence, respect for human dignity, and justice. The participants were informed about these in the information sheet, which was stapled to the top of each baseline questionnaire package to assist potential participants to understand their rights and the ethical considerations taken into account for this study.

**Beneficence**: In line with the principle of beneficence, all information in the informed consent package highlighted the participants’ right to freedom from harm and discomfort, and the right to protection from exploitation and risk. To help ensure this, the seated Tai Chi exercise program was conducted by a professional instructor. Participants could not take part unless they had obtained permission to do so from
medical professionals at the LTC, and during the intervention they were always accompanied by the nursing staff and the researcher to ensure their safety. Participants were clearly informed that if they did not want to continue the intervention, or if they had any negative response during the seated Tai Chi exercise intervention, they were free to stop immediately. The participants were assured that their rights would not be affected, that if they wished to they could withdraw from the study at any stage without needing to give any explanation and without any penalty, and they were assured that it was anticipated there was no harm associated with or resulting from participating in the study.

**Human dignity:** In line with respect for human dignity, this study adhered to the principle of non-coercion of the potential participants and adhered to respecting their right to self-determination and their right to full disclosure. All participation was voluntary: participants were free to decide whether they participated in this study or did not, and they were free to withdraw from this study at any time. The potential participants were assessed to ensure they were able to comprehend the information they were given about this study, principally to ensure that their rights were protected. The information sheet was given out before participation and this provided a description of the nature of the study, the participants’ right to refuse, the responsibility of the researcher, and the benefits and risks to the participants. As well as each person being provided with an information sheet, the researcher verbally presented information to potential participants to assist them to understand the process of this research and to ensure any questions they might have were addressed before they signed the consent form.
**Justice**: The principle of justice includes participants’ right to fair treatment and to privacy. Participants all received the same fair treatment throughout the entire process of this study. In particular, their health care and health services were not affected by their participation in the study. Both the experimental and control group participants received a seated Tai Chi exercise program DVD upon finishing the intervention. This enabled participants the opportunity to continue or begin practicing the Tai Chi program. All participants’ information was dealt with confidentially to ensure their right to privacy. For example, all questionnaires were identified with identification numbers, and individuals’ data were not shared with others. All data were only accessed by the researcher and stored safely.

All necessary information about any potential harms and benefits of the intervention was made available for potential participants to enable them to make an informed decision about whether to volunteer for the study (see Appendix A). An entire set of information was prepared for the LTC to make available to their ethics committee and their permission was obtained to complete this study (see Appendix F). Ethics approval was also obtained from the Griffith University Human Research Ethics Committee prior to commencement of the study (ethics approval registration number NRS/17/10/HREC).
Summary

This chapter has presented the principal elements of an RCT design and described the specific RCT design used in this study. The trial design, participants, randomization, blinding, intervention, outcome measures, statistical methods, and ethical considerations were outlined. The findings from the seated Tai Chi intervention and its effect on QOL, depression, mood states, and self-efficacy of older people in wheelchairs are reported in Chapter 4.
CHAPTER FOUR

RESULTS

This chapter presents the results of this randomized controlled trial, which examined the effects of a Tai Chi exercise program for older people who use a wheelchair for mobility. A flowchart indicating participant flow through the RCT, recruitment details, participants’ baseline demographic characteristics, participants’ level of cognitive impairment obtained using the Mini Mental State Examination (MMSE), and the self-reported reasons for their wheelchair use are presented. Following this, the findings related to the primary outcome (effects on quality of life) and the secondary outcomes (effects on depression, mood states and self-efficacy) for the control group and for the intervention group are presented.

4.1 Participant flowchart

Figure 5 outlines the flow of the participants in each group through the course of the RCT. It shows how many participants were randomly assigned, how many received the intended treatment, and how many had their outcome data analyzed.
Assessed for eligibility (n=86)

Excluded (n=26)
- Did not meet language criteria (n=3)
- Did not want to complete MMSE (n=12)
- Did not meet the required MMSE score (n=6)
- Did not meet age criteria (n=1)
- Gave no reason (n=3)
- Had a psychiatric diagnosis (n=1)

Completed baseline data collection (n=60)

Allocated to intervention group (n=30)
Allocated to control group (n=30)

Lost to the 13th week follow-up (n=0)
Lost to the 13th week follow-up (n=2)

Intention-to-treat analysis (n=30)
Intention-to-treat analysis (n=30)

Lost to the 26th week follow-up (n=2)
Lost to the 26th week follow-up (n=3)

Intention-to-treat analysis (n=30)
Intention-to-treat analysis (n=30)

Figure 5 Flowchart of participants through the randomized controlled trial
Recruitment

During the recruitment period, between September 2010 and October 2010, 86 of the older people residing in the Jen-Tao LTC facility were using wheelchairs for mobilization. All 86 volunteered to participate in the study and their eligibility was subsequently assessed, after which twenty-six were excluded (see Figure 5). A total of 60 residents met the inclusion criteria and they were randomly allocated into the intervention group or the control group.

The RCT was conducted over a 26-week period from October, 2010 to April, 2011. Figure 5 outlines the flow of participants throughout the RCT and lists the reasons for the incomplete follow-up.

At week 13, no participant (0%) from the intervention group had withdrawn but 2 participants (6.6%) from the control group had died. At week 26, two participants (6.6%) from the intervention group and 5 participants (16.6%) from the control group had died (these 5 included the 2 people who had died in the initial 13 weeks). The remaining 53 participants were included in the final data collection: 28 in the intervention group and 25 in the control group. In line with the ITT approach used for data analysis, the last set of data of the seven participants who could not continue participating in the study was carried forward, and therefore the data from all the baseline participants, 30 in the intervention group and 30 in the control group, was analyzed (see Figure 5).
Compliance

A respective average attendance rate of 85.3% and 93.2% were recorded for both the intervention and control groups, reflecting adherence to study protocol by participants. Specifically, for the intervention group, 76% of participants attended more than 80% out of the total Tai Chi sessions. Reasons for non-compliance included dropout and health issues.

4.2 Baseline data

Demographic Characteristics

The average age of the participants (38 females and 22 males) was 81.25 years, with an age range of 65 to 95 years. Most of the participants in each group were female, and coincidentally comprised an equal percentage, 63.3%. All participants were Asian: of Chinese ethnic background. A large proportion had received no formal education \( n = 39; \ 65\% \). The majority practiced either the Buddhist \( n = 19; \ 31.7\% \) or Taoist \( n = 37; \ 61.7\% \) religion. A very high proportion of participants was either married \( n = 26; \ 43.3\% \) or widowed \( n = 27; \ 45\% \) and a high proportion had been residing in the LTC facility \( n = 47; \ 78.3\% \) and had been using a wheelchair for mobilization \( n = 43; \ 71.7\% \) for at least four months. As the details in Table 6 indicate, and as might be expected given the randomized allocation, at baseline there were no significant differences between the demographic characteristics of participants in the intervention group and those in the control group.
<table>
<thead>
<tr>
<th></th>
<th>Intervention Group</th>
<th>Control Group</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 30)</td>
<td>(n = 30)</td>
<td></td>
</tr>
<tr>
<td>Mean age (SD)</td>
<td>80.73 (9.68)</td>
<td>81.77 (6.32)</td>
<td>0.62&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>11 (36.7%)</td>
<td>11 (36.7%)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>19 (63.3%)</td>
<td>19 (63.3%)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Taiwanese</td>
<td>30 (100.0%)</td>
<td>28 (93.3%)</td>
</tr>
<tr>
<td></td>
<td>Chinese</td>
<td>0 (0.0%)</td>
<td>2 (6.7%)</td>
</tr>
<tr>
<td>Religion</td>
<td>Buddhist</td>
<td>12 (40.0%)</td>
<td>7 (23.3%)</td>
</tr>
<tr>
<td></td>
<td>Taoist</td>
<td>16 (53.4%)</td>
<td>21 (70.0%)</td>
</tr>
<tr>
<td></td>
<td>Christian</td>
<td>1 (3.3%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>1 (3.3%)</td>
<td>2 (6.7%)</td>
</tr>
<tr>
<td>Highest education level</td>
<td>None</td>
<td>18 (60.0%)</td>
<td>21 (70.0%)</td>
</tr>
<tr>
<td></td>
<td>Primary school</td>
<td>6 (20.0%)</td>
<td>7 (23.4%)</td>
</tr>
<tr>
<td></td>
<td>Junior high school</td>
<td>3 (10.0%)</td>
<td>1 (3.3%)</td>
</tr>
<tr>
<td></td>
<td>High school</td>
<td>2 (6.7%)</td>
<td>1 (3.3%)</td>
</tr>
<tr>
<td></td>
<td>College/university</td>
<td>1 (3.3%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Marital Status</td>
<td>Married</td>
<td>13 (43.3%)</td>
<td>13 (43.3%)</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>3 (10.0%)</td>
<td>1 (3.3%)</td>
</tr>
<tr>
<td></td>
<td>Widowed</td>
<td>11 (36.7%)</td>
<td>16 (53.4%)</td>
</tr>
<tr>
<td></td>
<td>Separated</td>
<td>3 (10.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Length of residency</td>
<td>0–3 months</td>
<td>4 (13.3%)</td>
<td>9 (30.0%)</td>
</tr>
<tr>
<td>in long-term care</td>
<td>4–12 months</td>
<td>9 (30.0%)</td>
<td>7 (23.3%)</td>
</tr>
<tr>
<td></td>
<td>≥1–3 years</td>
<td>8 (26.7%)</td>
<td>7 (23.3%)</td>
</tr>
<tr>
<td></td>
<td>&gt;3–5 years</td>
<td>4 (13.3%)</td>
<td>2 (6.7%)</td>
</tr>
<tr>
<td></td>
<td>≥5–10 years</td>
<td>3 (10.0%)</td>
<td>4 (13.4%)</td>
</tr>
<tr>
<td></td>
<td>&gt;10 years</td>
<td>2 (6.7%)</td>
<td>1 (3.3%)</td>
</tr>
<tr>
<td>Period of wheelchair use</td>
<td>0–3 months</td>
<td>9 (30.0%)</td>
<td>8 (26.7%)</td>
</tr>
<tr>
<td></td>
<td>4–12 months</td>
<td>7 (23.3%)</td>
<td>7 (23.3%)</td>
</tr>
<tr>
<td></td>
<td>≥1–3 years</td>
<td>7 (23.3%)</td>
<td>9 (30.0%)</td>
</tr>
<tr>
<td></td>
<td>&gt;3–5 years</td>
<td>3 (10.0%)</td>
<td>3 (10.0%)</td>
</tr>
<tr>
<td></td>
<td>≥5–10 years</td>
<td>2 (6.7%)</td>
<td>3 (10.0%)</td>
</tr>
<tr>
<td></td>
<td>&gt;10 years</td>
<td>2 (6.7%)</td>
<td>0 (0.0%)</td>
</tr>
</tbody>
</table>

<sup>a</sup> t-test, <sup>b</sup> chi-square test
Reasons for Wheelchair Use

A listing of the reasons participants gave for their use of a wheelchair is set out in Table 7 below (participants could indicate more than one reason). The most commonly reported reason was that one or both of the participant’s legs, had degenerated. The next most common reasons were having experienced falls, followed by surgery and/or injury to legs.

Table 7 Reasons for wheelchair use

<table>
<thead>
<tr>
<th>Reason</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leg degeneration</td>
<td>17</td>
</tr>
<tr>
<td>History of falls</td>
<td>13</td>
</tr>
<tr>
<td>Surgery and/or injury to legs</td>
<td>10</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>9</td>
</tr>
<tr>
<td>Surgery to any part of body apart from the legs</td>
<td>5</td>
</tr>
<tr>
<td>Voluntarily</td>
<td>4</td>
</tr>
<tr>
<td>Bone fracture</td>
<td>4</td>
</tr>
<tr>
<td>Herniated Intervertebral Disc (HIVD)</td>
<td>2</td>
</tr>
<tr>
<td>Traffic accident</td>
<td>2</td>
</tr>
<tr>
<td>Joint replacement</td>
<td>2</td>
</tr>
<tr>
<td>Total no. of reasons given</td>
<td>68</td>
</tr>
</tbody>
</table>
Mini Mental State Examination (MMSE)

The mean MMSE score for all participants was 20.50 \((SD = 3.03)\), with a range of 16 to 29. No significant difference (\(t\)-test to compare continuous variables, \(p > .05\)) was found between the cognitive status of those in the control group \((M = 20.50; SD = 3.19)\) and those in the intervention group \((M = 20.50; SD = 2.92)\), following the randomization of participants at baseline.

4.3 Outcomes

As outlined in Chapter 3, four instruments were used to measure outcomes and their reliability was established for this study (see Table 8). The Cronbach’s alpha for the primary outcome measurement (WHOQOL-BREF) was 0.79. The Cronbach’s alpha for the secondary outcome measurement (GDS) was 0.76; the Cronbach’s alpha was 0.70 for the POMS-SF; and 0.66 for the SEE.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Reported alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>World Health Organization Quality of Life BREF</strong></td>
<td></td>
</tr>
<tr>
<td>WHOQOL-BREF</td>
<td>0.79</td>
</tr>
<tr>
<td>Overall</td>
<td>0.85</td>
</tr>
<tr>
<td>General Health</td>
<td>0.85</td>
</tr>
<tr>
<td>Physical Health</td>
<td>0.77</td>
</tr>
<tr>
<td>Psychological Health</td>
<td>0.77</td>
</tr>
<tr>
<td>Social Relations</td>
<td>0.81</td>
</tr>
<tr>
<td>Environment</td>
<td>0.81</td>
</tr>
<tr>
<td><strong>Geriatric Depression Scale - Short Form (GDS - SF)</strong></td>
<td>0.76</td>
</tr>
<tr>
<td><strong>Profile of Mood States - Short Form (POMS - SF)</strong></td>
<td>0.70</td>
</tr>
<tr>
<td>Tension – Anxiety</td>
<td>0.71</td>
</tr>
<tr>
<td>Depression – Dejection</td>
<td>0.71</td>
</tr>
<tr>
<td>Anger – Hostility</td>
<td>0.73</td>
</tr>
<tr>
<td>Vigor – Activity</td>
<td>0.91</td>
</tr>
<tr>
<td>Fatigue – Inertia</td>
<td>0.75</td>
</tr>
<tr>
<td>Confusion – Bewilderment</td>
<td>0.74</td>
</tr>
<tr>
<td><strong>Self-efficacy for exercise scale (SEE)</strong></td>
<td>0.66</td>
</tr>
</tbody>
</table>
As indicated by Box’s test of equality of covariance matrices (p > .05), the assumption of homogeneity of covariances for repeated multiple analysis of variance (MANOVA) was not violated. Multivariate tests revealed significant differences (F(1, 53) = 3.8, p < .05) between the intervention and control groups across different time points on QOL, depression, fatigue-inertia mood state and self-efficacy. Levene’s test of equality of error variances reflected non-violation of homogeneity of variances (p > .05) for all outcomes variables. Univariate tests revealed that grouping has statistically significant effect on QOL (F(1, 58) = 6.89, p < .05), depression (F(1, 58) = 4.39, p < .05), fatigue-inertia mood state (F(1, 58) = 5.71, p < .05) and self-efficacy (F(1, 58) = 3.89, p = .05).

4.3.1 Primary outcome - Quality of Life

Baseline
Using the World Health Organization Quality of Life Scale Brief Version (WHOQOL-BREF), only one significant difference (ANOVA, p < .05) was found at baseline between the intervention group and the control group regarding their overall QOL and associated domains. This was the General Health domain (F (1, 58) = 4.70, p < .05) where participants in the intervention group had significantly higher scores compared to participants in the control group (see Table 9). To control for this significant baseline difference between groups, the General Health domain was included as a covariate in ANCOVA.
Week 13

At week 13, significant differences (ANCOVA) were found in the Physical Health ($F(1, 58) = 6.97, p < .05$) and the Psychological Health ($F(1, 58) = 5.64, p < .05$) domains. Participants in the control group recorded lower Physical and Psychological Health scores than those in the intervention group. No other significant differences were found (see Table 9).

Week 26

At week 26 statistically significant differences (ANCOVA) were found between the control group and the intervention group in their overall QOL, General Health and all associated domains. In comparison with those in the control group, participants in the intervention group registered higher scores (see Table 9) across overall QOL ($F(1, 58) = 4.68, p < .05$), General Health ($F(1, 58) = 4.09, p < .05$), and the associated domains: Physical Health ($F(1, 58) = 9.19, p < .005$), Psychological Health ($F(1, 58) = 5.68, p < .05$), Social Relations ($F(1, 58) = 8.14, p < .01$), and Environment ($F(1, 58) = 7.31, p < .01$).

Analysis of covariance (ANCOVA) indicated that participants’ baseline data, MMSE scores, length of long-term care stay, and period of wheelchair use did not affect the primary outcome measurements in the Tai Chi group. A further QOL analysis of within-group difference for the intervention group was undertaken, comparing the week 13 and week 26 data with the corresponding baseline data. This showed no significant differences ($p > .05$) in the overall QOL, General Health, and the Physical Health and Psychological Health domains. Nevertheless, significant within-group
differences were found in both the Social Relations domain ($F(1, 29) = 4.67, p = .03$) and the Environment domain ($F(1, 29) = 11.30, p = .00$). The mean scores, mapped in Figure 6, indicate that in the Social Relations domain the mean score was higher at week 26 ($M=1.30, SD=3.20$) than at week 13 ($M=0.40, SD=3.42$), indicating that the Social Relations domain was increasing over time. Similarly, in the Environment domain, scores were higher at week 26 ($M=3.23, SD=6.15$) than at week 13 ($M=-0.36, SD=8.56$), indicating that the Environment domain was also improving over the period of time practicing Tai Chi.

Given the above results, this current study accepts the hypothesis that a seated Tai Chi exercise intervention for older people in wheelchairs significantly improved QOL, General Health and all associated domains.

Figure 6 Mean scores: Social Relations & Environment domain outcomes at weeks 13 and 26 of the intervention
<table>
<thead>
<tr>
<th>Table 9 World Health Organization Quality of Life Scale Brief Version</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intervention (n =30)</strong></td>
</tr>
<tr>
<td>Mean± SD</td>
</tr>
<tr>
<td><strong>Overall QOL</strong></td>
</tr>
<tr>
<td>Baseline</td>
</tr>
<tr>
<td>Week 13</td>
</tr>
<tr>
<td>Week 26</td>
</tr>
<tr>
<td><strong>General Health</strong></td>
</tr>
<tr>
<td>Baseline</td>
</tr>
<tr>
<td>Week 13</td>
</tr>
<tr>
<td>Week 26</td>
</tr>
<tr>
<td><strong>Physical Health</strong></td>
</tr>
<tr>
<td>Baseline</td>
</tr>
<tr>
<td>Week 13</td>
</tr>
<tr>
<td>Week 26</td>
</tr>
<tr>
<td><strong>Psychological Health</strong></td>
</tr>
<tr>
<td>Baseline</td>
</tr>
<tr>
<td>Week 13</td>
</tr>
<tr>
<td>Week 26</td>
</tr>
<tr>
<td><strong>Social Relations</strong></td>
</tr>
<tr>
<td>Baseline</td>
</tr>
<tr>
<td>Week 13</td>
</tr>
<tr>
<td>Week 26</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
</tr>
<tr>
<td>Baseline</td>
</tr>
<tr>
<td>Week 13</td>
</tr>
<tr>
<td>Week 26</td>
</tr>
</tbody>
</table>

*Significant at \( p < .05 \); **Significant at \( p < .01 \); ***Significant at \( p < .005 \)
Odds ratios (Pearson’s chi-square) were also computed to determine the likelihood of an improvement in overall QOL, general health, and all associated domains for the intervention group, in comparison to the control group. The result was that participants in the Tai Chi group were 4.13 times more likely to show an improvement on the Social Relations domain than those in the control group. A significant difference ($p < .01$, $1.38 < 95\% \text{ CI} > 12.27$) was found between the improvements in the Social Relations domain of those in the intervention (Tai Chi) group (18/30, 60.0%) and those in the control group (8/30, 26.7%) (see Table 10). No other significant odds ratios were found (see Table 10).

The magnitude of change in the QOL for participants in the Tai Chi intervention is demonstrated by the moderate to strong effect sizes (Cohen’s $d$) ranging from 0.52 to 0.78 for statistically significant domains (see Table 9) as well as the positive odds ratio for Social Relations domain in the WHOQOL-BREF. This suggests potential promising clinical significance of the intervention on QOL.

**Table 10 Odds ratio for Social Relations domain for those in the intervention & control groups**

<table>
<thead>
<tr>
<th>(WHOQOL-BREF)</th>
<th>Intervention ($n = 30$)</th>
<th>Control ($n = 30$)</th>
<th>Odds Ratio (95% CI)</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>An improvement in social relations</td>
<td>N (%)</td>
<td>N (%)</td>
<td>4.13 (1.38 to 12.27)</td>
<td>.00**</td>
</tr>
<tr>
<td>Yes</td>
<td>18 (60.0%)</td>
<td>8 (26.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>12 (40.0%)</td>
<td>22 (73.3%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Significant at $p < .01$
4.3.2 Secondary outcome measurements

Depression

No significant difference (ANCOVA, \( p > .05 \)) was found between the depression scores of those in the intervention group and those in the control group at either baseline or at week 13, as indicated in Table 11. A significant difference (\( F (1, 58) = 12.01, \ p < .005 \)) was, however, found at week 26. This outcome showed no correlation with participants’ MMSE scores, length of long-term care stay, or period of wheelchair use. Comparison of the mean scores at week 26 shows that participants in the intervention group (\( M=3.76, SD=3.65 \)) had lower depression scores than those in the control group (\( M=7.76, SD=5.15 \)). Within-group analysis for the intervention group showed no statistically significant difference (\( p > .05 \)) in their depression scores at baseline, week 13 and week 26. Given the above results, this current study accepts the hypothesis that a seated Tai Chi exercise intervention for older people in wheelchairs reduced depression scores on the GDS.

Odds ratio estimation (Pearson’s chi-square, see Table 12) also indicated that participants who practiced Tai Chi were 5.2 times more likely to have a reduction in their depression scores than participants who did not take part in the Tai Chi practice. Between-group analysis showed a significant difference (\( p < .005, 1.66 < 95\% \ CI > 16.52 \)) between the reductions in the depression scores of those in the intervention (Tai Chi) group (17/30, 56.7%) and those in the control group (6/30, 20.0%).

Promising clinical significance of the Tai Chi intervention on depression is reflected by the large effect size (Cohen’s \( d \)) of 0.89 at week 26 (see Table 11) and the positive
odds ratio for depression scores in the GDS-SF.

Table 11 Geriatric Depression Scale

<table>
<thead>
<tr>
<th></th>
<th>Intervention (n =30)</th>
<th>Control (n =30)</th>
<th>p value</th>
<th>Effect Size (Cohen’s d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean± SD</td>
<td>Mean± SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>4.40±3.41</td>
<td>4.27±4.76</td>
<td>.90</td>
<td>0.03</td>
</tr>
<tr>
<td>Week 13</td>
<td>4.93±4.24</td>
<td>6.66±4.71</td>
<td>.14</td>
<td>0.38</td>
</tr>
<tr>
<td>Week 26</td>
<td>3.76±3.65</td>
<td>7.76±5.15</td>
<td>.00***</td>
<td>0.89</td>
</tr>
</tbody>
</table>

*** Significant at p < .005

Table 12 Odds ratios of depression scores of those in the intervention & control groups

<table>
<thead>
<tr>
<th>(GDS-SF)</th>
<th>Intervention (n =30)</th>
<th>Control (n =30)</th>
<th>Odds Ratio (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A reduction in depression scores</td>
<td>N (%)</td>
<td>N (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>17 (56.7%)</td>
<td>6 (20.0%)</td>
<td>5.23 (1.66 to 16.52)</td>
<td>.00***</td>
</tr>
<tr>
<td>No</td>
<td>13 (43.3%)</td>
<td>24 (80.0%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*** Significant at p < .005
Mood States

No significant differences (ANCOVA, $p > .05$) were found between the overall mood state levels of those in the intervention group and those in the control group at baseline, week 13, and week 26 (see Table 13). A significant difference was, however, found between the intervention group and the control group at week 26 in the fatigue-inertia dimension ($F(1, 58) = 7.15, p < .05$). Comparison of the mean scores at week 26 indicates that the intervention group ($M = 3.56, SD = 3.71$) had a lower mood state on the fatigue-inertia dimension than the control group ($M = 7.16, SD = 6.36$). Participants’ MMSE scores, length of long-term care stay, and period of wheelchair use showed no correlation with this significant outcome. Within-group analysis for the intervention group showed no statistically significant difference ($p > .05$) in the overall mood state levels and fatigue-inertia dimension scores at baseline, week 13, and week 26.

Given the above results, this current study rejects the hypothesis that a seated Tai Chi exercise intervention for older people in wheelchairs significantly improves mood states. This current study does, however, accept that a seated Tai Chi exercise intervention for older people in wheelchairs reduced the fatigue-inertia dimension of the POMS-SF.

Odds ratio estimation (Pearson’s chi-square) indicated no significant differences between the odds ratios of the mood states of those in the intervention group and those in the control group.
Although no significant differences were found for the overall mood state levels between the intervention and control groups, the fatigue-inertia dimension of the POMS-SF did achieve statistical significance with a large effect size (Cohen’s $d$) of 0.69 at week 26 (see Table 13). This suggests potential clinical effect of the intervention for only the fatigue-inertia dimension.

Contradictory finding relating to depression

The mean GDS score was statistically significantly different between the intervention group and control group at week 26. However, a contradictory result is reflected in the depression-dejection dimension of the POMS-SF where no significant difference between the two groups was found. Inspection of the means for POMS-SF in Table 13 indicates that the intervention group has lower depression-dejection scores at both week 13 ($M = 4.96, SD = 5.79$) and week 26 ($M = 4.43, SD = 4.93$) in comparison to the control group at week 13 ($M = 5.96, SD = 5.53$) and week 26 ($M = 6.33, SD = 5.60$). Although statistical significance for the depression-dejection dimension of POM-SF was not attained, the trend for the mean scores suggests that feelings of depression and dejection were decreasing over time for participants in the intervention group when compared to those in the control group.
<table>
<thead>
<tr>
<th></th>
<th>Intervention ($n=30$)</th>
<th>Control ($n=30$)</th>
<th>p value</th>
<th>Effect Size (Cohen’s d)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean± SD</td>
<td>Mean± SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tension-anxiety</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>4.36±5.26</td>
<td>3.90±4.29</td>
<td>.70</td>
<td>0.09</td>
</tr>
<tr>
<td>Week 13</td>
<td>3.86±4.09</td>
<td>4.73±4.71</td>
<td>.44</td>
<td>0.19</td>
</tr>
<tr>
<td>Week 26</td>
<td>4.36±4.90</td>
<td>5.20±5.37</td>
<td>.53</td>
<td>0.16</td>
</tr>
<tr>
<td><strong>Depression-dejection</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>4.90±4.77</td>
<td>4.36±4.61</td>
<td>.66</td>
<td>0.11</td>
</tr>
<tr>
<td>Week 13</td>
<td>4.96±5.79</td>
<td>5.96±5.53</td>
<td>.49</td>
<td>0.17</td>
</tr>
<tr>
<td>Week 26</td>
<td>4.43±4.93</td>
<td>6.33±5.60</td>
<td>.16</td>
<td>0.36</td>
</tr>
<tr>
<td><strong>Anger-hostility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>3.40±4.43</td>
<td>2.46±3.84</td>
<td>.38</td>
<td>0.22</td>
</tr>
<tr>
<td>Week 13</td>
<td>3.00±3.71</td>
<td>2.93±4.01</td>
<td>.94</td>
<td>0.01</td>
</tr>
<tr>
<td>Week 26</td>
<td>3.53±3.74</td>
<td>3.53±4.17</td>
<td>1.00</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Vigor-activity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>8.96±5.21</td>
<td>6.53±5.44</td>
<td>.08</td>
<td>0.45</td>
</tr>
<tr>
<td>Week 13</td>
<td>7.93±4.72</td>
<td>6.26±5.39</td>
<td>.20</td>
<td>0.32</td>
</tr>
<tr>
<td>Week 26</td>
<td>7.76±6.17</td>
<td>6.06±6.19</td>
<td>.29</td>
<td>0.27</td>
</tr>
<tr>
<td><strong>Fatigue-inertia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>3.93±4.36</td>
<td>4.70±5.47</td>
<td>.55</td>
<td>0.15</td>
</tr>
<tr>
<td>Week 13</td>
<td>4.03±4.45</td>
<td>6.80±6.31</td>
<td>.05</td>
<td>0.50</td>
</tr>
<tr>
<td>Week 26</td>
<td>3.56±3.71</td>
<td>7.16±6.36</td>
<td>.01</td>
<td>0.69</td>
</tr>
<tr>
<td><strong>Confusion-bewilderment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>5.56±4.42</td>
<td>3.90±3.40</td>
<td>.10</td>
<td>0.42</td>
</tr>
<tr>
<td>Week 13</td>
<td>4.80±3.32</td>
<td>4.76±3.18</td>
<td>.96</td>
<td>0.01</td>
</tr>
<tr>
<td>Week 26</td>
<td>4.30±3.16</td>
<td>4.76±2.87</td>
<td>.55</td>
<td>0.15</td>
</tr>
</tbody>
</table>

*Significant at $p < .05$
Self-efficacy

No statistically significant difference (ANCOVA, \( p > .05 \)) was found between the self-efficacy for exercise levels of those in the intervention group and those in the control group at baseline and week 13 (see Table 14). A significant difference (\( F (1, 58) = 6.05, \ p < .05 \)) was, however, found between the intervention group and the control group at week 26. Comparison of the mean scores at week 26 indicates that those in the intervention group (\( M = 35.66, \ SD = 36.83 \)) had higher levels of self-efficacy for exercise than those in the control group (\( M = 15.30, \ SD = 26.43 \)). Participants’ MMSE scores, length of long-term care stay, and period of wheelchair use showed no correlation with this significant outcome. Within-group analysis for the intervention group showed no statistically significant difference (\( p > .05 \)) in the levels of self-efficacy for exercise levels at baseline, week 13 and week 26. Given the above results, this current study accepts the hypothesis that a seated Tai Chi exercise intervention for older people in wheelchairs increased self-efficacy scores on the SEE.

Odds ratio estimation (Pearson’s chi-square) indicated that participants in the intervention group were 2.9 times more likely to show an improvement in their self-efficacy for exercise levels than those in the control group (see Table 15). A significant difference (\( p = .05, \ 0.94 < 95\% \ CI > 8.71 \)) was found between the improvement in the self-efficacy for exercise levels of the intervention (Tai Chi) group (14/30, 46.7%) and the control group (7/30, 23.3 %) when the two groups were compared (see Table 15).
Promising clinical significance of the Tai Chi intervention on self-efficacy is evidenced by the large effect size (Cohen’s $d$) of 0.63 at week 26 (see Table 14) and the positive odds ratio for self-efficacy scores on the SEE.

**Table 14 Self-Efficacy for Exercise**

<table>
<thead>
<tr>
<th></th>
<th>Intervention $(n=30)$</th>
<th>Control $(n=30)$</th>
<th>$p$ value</th>
<th>Effect Size (Cohen’s $d$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean± SD</td>
<td>33.26±32.13</td>
<td>27.16±29.06</td>
<td>.44</td>
<td>0.19</td>
</tr>
<tr>
<td>Baseline</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 13</td>
<td>32.73±31.54</td>
<td>23.30±27.84</td>
<td>.22</td>
<td>0.31</td>
</tr>
<tr>
<td>Week 26</td>
<td>35.66±36.83</td>
<td>15.30±26.43</td>
<td>.01*</td>
<td>0.63</td>
</tr>
</tbody>
</table>

*Significant at $p < .05$

**Table 15 Odds ratio for Self-efficacy for those in the intervention and control groups**

<table>
<thead>
<tr>
<th>(SEE) An improvement in Self-efficacy</th>
<th>Intervention $(n=30)$</th>
<th>Control $(n=30)$</th>
<th>Odds Ratio (95% CI)</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14 (46.7%)</td>
<td>7 (23.3%)</td>
<td>2.87</td>
<td>.05*</td>
</tr>
<tr>
<td></td>
<td>(0.94 to 8.71)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>16 (53.3%)</td>
<td>23 (76.7%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at $p \leq .05$
Summary of outcomes

This study sought to investigate the effect of Tai Chi for older people living in LTC and using a wheelchair for mobility, and the results using the World Health Organization Quality of Life BREF (WHOQOL-BREF) indicate a significant improvement in QOL at week 26. The results also reveal changes that occurred in the following secondary outcomes: a reduction in depression scores using the Geriatric Depression Scale-Short Form (GDS-SF); a lower mood state in the fatigue-inertia dimension using the Profile of Mood States Short Form (POMS-SF); and an improvement in self-efficacy level using the Self-Efficacy for Exercise (SEE) Scale from baseline to 26 weeks. These findings and their implications are discussed in the following chapter.
CHAPTER FIVE

DISCUSSION

This chapter begins with a discussion of the findings of this study, and these are then compared with those of previous studies. Methodological considerations, the implications of these results for health promotion in LTC, and public health policy, practical issues associated with conducting an RCT in LTC, and the limitations of the study are also presented.

As indicated in the previous chapter, the 26-week Tai Chi intervention had significant effects on the QOL, depression, mood states, and self-efficacy of the older people in wheelchairs in LTC. The discussion below first addresses each of these outcomes and the support for the conceptual framework.

5.1 QOL

The primary aim of the seated Tai Chi intervention was to improve the QOL of residents living in LTC and using wheelchairs for mobility. The results of this study indicate that the Tai Chi intervention had a significant effect on improving perceptions of QOL: namely overall QOL, General Health and all associated domains (physical and psychological health, social relations and the environment) of the WHOQOL-BREF. This finding supports those of previous studies that indicate that Tai Chi significantly improves QOL (Chen, 2000; Chen et al., 2002; Chen et al., 2007; Chen et al., 2008; Dechamps et al., 2009; Ho et al., 2007; Hong, 2006; Lee et al.,
2009, 2010; Tsang et al., 2007; Li et al., 2001; Lavrestsky et al., 2011). The findings are also in agreement with those of other studies (Ho et al., 2007; Li et al., 2001; Wang et al., 2010) that indicate a significant improvement in General Health as a result of participation in a Tai Chi intervention. The findings of this study also agree with studies (Chen et al., 2000; Chen et al., 2002; Dechamps et al., 2009; Hong, 2006; Lee et al., 2009, 2010; Li et al., 2001) that found significant improvement in both physical health and psychological health associated with Tai Chi exercise. The findings corroborate the ideas of Lavrestsky et al. (2011) and Li et al. (2001), who suggest that Tai Chi significantly improves psychological well-being. Further, the findings are in agreement with the findings of Chen et al. (2007), Chen et al. (2008), Ho et al. (2007) and Tsang et al. (2007), that all found significant improvements in the social domains of QOL. The studies by Chen (2000), Chen et al. (2002), Hong, (2006) and Lee et al. (2009, 2010) were also undertaken with an older population in Asia; this current study provides valuable evidence regarding the benefits of seated Tai Chi exercise on QOL, specifically for older people using wheelchairs for mobility.

The review of the literature did not reveal any reports of an association between Tai Chi and the environmental aspect of QOL. This current study, however, shows that participating in a 26-week STEP seated Tai Chi intervention had a positive effect on the QOL environment domain. This result provides new information about the potential effectiveness of a seated Tai Chi intervention for older people in wheelchairs living in LTC: namely on the perceived environmental QOL. A Tai Chi exercise program may enhance residents’ interactions with other residents, the Tai Chi instructor, and staff members, and as such can improve residents’ living experiences.
and their satisfaction with their LTC environment. This is a particularly important finding given that many older people are dissatisfied with their LTC environment (Cooney et al., 2009; Tsai & Tsai, 2008).

5.2 Depression

The seated Tai Chi intervention also aimed to reduce depression in participants undertaking the Tai Chi intervention. Participants in the seated Tai Chi intervention had a significant reduction in depression scores compared to those in the control group. This finding supports previous studies that indicate Tai Chi has a positive effect on depression (Chou et al., 2004; Dechamps et al., 2010; Hong, 2006; Lavrestsky et al., 2011; Lee et al., 2009, 2010; Li et al., 2001; Li et al., 2002; Wang et al., 2010).

These results differ from those of the studies of Frye et al. (2007) and Jao (2006). This may be the result of some limitations in their studies. Most participants in the Frye et al. study had been fairly inactive prior to beginning the intervention, and there was a large range in the physical fitness levels of the participating individuals at baseline, which may also have critically influenced their findings. In Jao’s 2006 study, participants’ concentration could have easily been interrupted because the activities were held in the public common room and in a public outside area. This current study excluded the potential influence of such environmental factors by conducting the exercise program in an area separate from the conventional activities area. This was an important consideration of this current study because Tai Chi is also a body-mind
exercise, so concentration on breathing and co-ordination are essential. For this reason an area in the LTC environment for participants to exercise in where they would not be interrupted and other possible external influences were excluded was arranged.

5.3 Mood states

The current study found that the seated Tai Chi exercise intervention significantly reduced the fatigue-inertia dimension of participants’ mood state as measured by the POMS-SF. This result is consistent with those of previous studies that also indicate an association between Tai Chi and reduced fatigue-inertia in older people (Chen, 2000; Chen et al., 2002; Toda et al., 2011).

The other five dimensions of the POMS-SF did not yield any significant associated changes. This finding does not support a number of previous studies that found that participation in some form of Tai Chi was associated with less mood disturbance and more positive mood states, finding an effect on one or more of the other five dimensions of mood states: tension-anxiety (Li et al., 2001; Taylor-Piliae et al., 2006; Wang et al., 2010); depression-dejection (Toda et al., 2011; Yeh et al., 2011; Wang et al., 2010); anger-hostility (Toda et al., 2011); vigor-activity (Yeh et al., 2011); and confusion-bewilderment (Taylor-Piliae et al., 2006; Toda et al., 2011). This result is, however, consistent with the results identified by Audette et al. (2006), Toda et al. (2011), Taylor-Piliae et al. (2006) and Yeh et al. (2011). None of these studies was able to demonstrate any significant effect on the various mood state dimensions as a result of a Tai Chi intervention.
There are several possible explanations for the finding that the fatigue-inertia dimension of participants’ mood state showed significant changes in this current study. Previous studies offer some possible explanation. Chen et al. (2002) and Chen et al. (2008) found that practicing Tai Chi positively enhances health status, especially that of older people with chronic illness. According to Adler and Roberts (2006), Tai Chi provides the benefits of flexibility and muscle strengthening because it is a slow and gentle form of exercise. Such a view may partially explain this particular finding of this study; for example, participants may have felt improvement in their muscle strength as a result of the Tai Chi exercise and then reported this as a lower level of fatigue-inertia. A number of studies indicate that Tai Chi affects the body through physical and psychological relaxation, and through the interrelationship between the autonomic nervous system and the musculoskeletal system, and that this enhances musculoskeletal functioning (Li et al., 2001; Hong, 2006; Wang, 2009). Consequently, the older people in wheelchairs in this current study may have experienced physical and psychological relaxation, flexibility and muscle strengthening through the slow and gentle Tai Chi exercise. Indeed the positive effects of the interrelationship between the autonomic nervous system and musculoskeletal functions, can result in the person achieving a positive health status and therefore a reduction in the sense of fatigue-inertia.

The current study, however, found no significant differences in the vigor-activity dimension of POMS-SF of participants in the Tai Chi group. There are a number of possible explanations for this. A factor that may have exerted a critical influence is the
participants’ physical condition; they had various health conditions at the time of the study, and their frailty and physical deterioration had resulted in their use of a wheelchair for mobility. The way participants perform and respond to the seated Tai Chi activity can be very individual because of differences in their baseline health status (Hong, 2006). For example, differences in such things as the extent of leg degeneration, experience of falls, and/or injury; and cardiovascular disease may limit a person’s ability to undertake the full extent of the Tai Chi exercise intervention. Medications such as antidepressants (i.e. escitalopram) for geriatric depression may also have some influence on concentration, alertness, and/or co-ordination (Lavretsky et al., 2011). These factors therefore may have influenced the response of the participants in this current study in relation to the vigor-activity dimension.

Another possible reason for the finding of no significant difference in vigor-activity is that the intensity of the exercise experienced and/or the length of the intervention might not have been sufficient to result in a noticeable improvement in strength, balance, and/or flexibility. Those with cardiovascular disease, for example, may need further practice and participation to result in their cardiovascular circulation and respiratory system functioning noticeably and measurably better, to reach an extent that in turn would give them a more positive mood state, which would then be reflected in their responses to questions measuring the vigor-activity dimension of the POMS-SF.

Nevertheless, encouraging regular seated Tai Chi exercise is important as participating in an activity like this may help participants to maintain physical function (Adler &
Roberts, 2006; Chen et al., 2008; Greenspan et al., 2007; Rogers et al., 2009), and thereby improve their mood states (Wolf et al., 1997; Chen et al., 2002) and influence general improvements in health status (Greenspan et al., 2007).

It is difficult to explain the finding of no significant difference between the two groups regarding their perceptions of the other negative mood states: the tension-anxiety, depression-dejection, anger-hostility, and confusion-bewilderment dimensions on the POMS-SF. This may be related to whether participants were willing to express negative mood states openly, especially as these were older Chinese participants and traditional Chinese culture and social norms would be expected to strongly influence their expression of negative mood states (Taylor-Piliae et al., 2006). Although this current study did not find significant differences between the two groups for the other negative mood states, a trend was noticed: the seated Tai Chi group’s findings indicate lower negative mood states than the control group. This suggests that the other negative mood states in the seated Tai Chi group may still have been positively influenced by the intervention.

Taylor-Piliae et al.’s study (2006) may partially explain this particular finding, as participants’ expressing themselves in the Chinese language was also more likely to have been influenced by the pervasive cultural and social norms, and made the participants reluctant to express their emotions. It maybe useful to examine the different items in the Chinese language version of the measurement instrument to consider whether they accurately assess the mood states of older people with a Chinese background. A more challenging but essential need is to further take into
account the influence of traditional culture and people’s resultant strong reservations about expressing negative emotions, even when the Chinese language accurately reflects the range covered by each negative mood state. One would expect these factors may exert a stronger effect in older people but they could also exercise an influence in other age groups.

5.4 Self-efficacy

The seated Tai Chi exercise intervention was found to be associated with significantly increased self-efficacy of older people in wheelchairs in LTC. This finding is consistent with those of at least six previous studies which measured a significant improvement in the self-efficacy of older people who did some form of Tai Chi (Dechamps et al., 2009; Li et al., 2001; Li et al., 2001; Li et al., 2002; Taylor-Piliae et al., 2006; Yeh et al., 2011).

Lee et al. (2010) also found a significant increase ($p<.05$) in self-esteem in their Tai Chi group, as well as a significant improvement ($p<.05$) in health-related QOL (SF-12), in the physical and mental components. This finding is also consistent with the findings of Mancini (2007) whose qualitative grounded theory study explores the factors, which influenced the recoveries of 15 psychiatric survivors. Mancini’s findings indicate that an efficacious or competent sense of self contributed to recovery and was associated with engagement in positive treatment choices, such as an exercise intervention, and presumably this positively affected their motivation to exercise. It is also in agreement with the findings of Perkins et al. (2008) that self-efficacy
significantly predicted participation in activities, both physical and social, regardless of individuals’ overall health.

This study found increased enjoyment and a sense of achievement was associated with the regular seated Tai Chi intervention offered. The seated Tai Chi activity provided participants a shared experience, the opportunity to learn something new with other participants, and a sense of well-being during the 26-week intervention period. These positive results corroborate the earlier findings of Lee et al. (2007), which identified self-efficacy as a factor influencing whether older people continued regular exercise. Seated Tai Chi exercise is an accessible intervention that can positively influence the self-efficacy of older people in wheelchairs.

This study confirms findings of earlier studies (Chang et al., 2007; Kwong & Kwan, 2007; Lev et al., 2007) that indicate a positive perception of self-efficacy, which may in turn influence an individual’s judgment of their ability to perform a course of action and thus influence whether they are willing to try it. It also supports the findings of Bandura (1997) that an individual’s self-efficacy supports physical activity to address feelings of distress, despondency, and futility. Active personal behaviour strategies can positively contribute to managing psychological and emotional distress during illness and help people ease and control their emotional reactions, both of which are related to QOL (Bandura, 1986; 1997).
5.5 Support for the conceptual framework

The study’s conceptual framework was based on a modified form of Plummer’s description of the two tenets of Tai Chi; mind concentration and breathing control (1983). Tai Chi has been recognized as a mind-body exercise (Chen et al., 2007; Greenspan, et al., 2007; Thornton et al., 2004) and a means of developing balance and coordination (Thornton et al., 2004). This study further indicates that performing this low-intensity exercise with its slow, smooth, rhythmic movements, in a series of fluid, continuous, graceful, gentle and dance-like movements helps older people, to experience psychological and physical relaxation and a sense of psychological and physical well-being.

The study findings provide evidence supporting the hypothesis that, by integrating body movements and focused breathing, seated Tai Chi exercise can improve psychological and physical relaxation (i.e. their psychological well-being and/or physical capacity) of older people in wheelchairs in LTC, a group of people with relatively limited health and very limited mobility. As the conceptual framework discussion in Chapter 2 points out and describes, integrating body movements and focused breathing is a component of an interrelationship between the autonomic nervous system, the pituitary gland and adrenalin secretion. The results indicating an improved perception of the QOL of the intervention group therefore supports and corroborates the conceptual framework.
5.6 Methodological considerations

This was an RCT study with a repeated measure, placebo-controlled parallel-randomized design. The sample size of this study, 60 older people in wheelchairs, 30 in the intervention group and 30 in the control group, was larger than that of previous studies examining the effects of a Tai Chi intervention on the QOL of older people, and was sufficient to establish statistical significance. Finding significant results with large effect sizes and the power of all the ANCOVA results being above .80 indicates that the sample size was sufficient to identify differences between the two groups.

Jao (2006) undertook the only study examining the effects on the physical and psychological health of a similar group: namely older people in wheelchairs in LTC facilities. In that much shorter study, of only 14 weeks, the intervention group participated in three 50-minute seated Tai Chi sessions per week, totaling 42 sessions. The researcher Jao delivered the relatively short intervention. In this current study the intervention group participated in a total of 78 40-minute seated Tai Chi intervention sessions. The 40 minutes sessions were conducted three times weekly, and delivered by a qualified Tai Chi instructor for almost twice as long, as the Jao (2006) study over a 26-week period. At week 26 the people in the seated Tai Chi intervention group had a significant reduction in depression, a significant improvement in the fatigue-inertia mood state dimension, and a significant increase in self-efficacy. By the end of the 26-week intervention, there were also significant increases in their physical capacity, and psychological well-being, and in the social relations and environment domains of
their QOL compared to those who received the usual standard care with no seated Tai Chi exercise. This result provides new information: that a 26-week seated Tai Chi exercise intervention delivered by a professional Tai Chi instructor is associated with a significant improvement of the QOL of older people in wheelchairs in LTC facility.

5.7 Health promotion in LTC

Previous studies illustrate that various forms of Tai Chi are associated with positive effects on the QOL of ageing people in communities (Chen, 2000; Chen et al., 2002; Ho et al. 2007; Li et al., 2001); in institutions (Dechamps et al., 2009); and in LTC facilities (Lee et al. 2009, 2010). In this study, the use of a seated Tai Chi exercise program for older people in wheelchairs in LTC facilities was supported as a means of improving health. The results of this study provide evidence that this exercise program helped improve older peoples’ perceptions of the physical, psychological, social and environmental domains of QOL.

The Jao study (2006) also used seated Tai Chi with a similar group; older people in wheelchairs, but it found no significant differences in their psychological health using the TDQ (Taiwanese Depression Questionnaire) nor in physical outcomes, such as resting heart rate, blood pressure, pulmonary function test, or muscle strength, and it did not report any changes in relation to physical or psychological well-being. Jao did, however, find significant differences in the range of motion of shoulder flexion and shoulder abduction of those practicing seated Tai Chi – predominantly because apart from the breathing and concentration aspect, this activity principally requires the
participants to use their arms. While this is an encouraging result, it is possible that Jao might also have found positive effects on aspects of physical and/or psychological well-being if their intervention had been of a similar length to the intervention of this study. This conjecture is supported by the fact that this current study found a significant improvement in the QOL, depression, mood states of the fatigue-inertia domain, and self-efficacy in the second half of the overall intervention, i.e. between week 13 and week 26. Moreover, as mentioned above, the researcher Jao delivered their relatively short 14-week intervention. In contrast, in the current longer study, a professional Tai Chi instructor conducted the seated Tai Chi exercise. The researcher made a conscious decision to conduct the intervention using a professional instructor for this current study, especially given that the participants were older people, many of whom have had to adapt to frailty related to chronic disease, disabilities, and/or physical degeneration. Whether using a professional instructor was a critical factor needs further investigation.

It is essential for staff working in LTC facilities to assist older people to cope with the adjustment of moving into a LTC facility and to ensure they have a good QOL (Wu et al., 2009). Associated with this is an urgent need to identify a variety of programs, which are suitable for LTC facilities in Taiwan to use to help new residents adapt to their environment. The evidence provided by this study could be translated into everyday practice: the research involved developing and testing a seated Tai Chi protocol, and produced a DVD that in future could also be used to train staff and participants, and thus reduce the costs and potential need for a professional instructor. There is also a need for effective health promotion programs to maintain a high level
of psychological well-being of older people in LTC facilities, in particular because a major proportion of this population suffer from depressive symptoms (Lin et al., 2007). There is extensive evidence (Chen, 2000; Chen et al., 2002; Taylor-Piliae et al., 2006; Toda et al., 2011; Yeh et al., 2011) indicating that there are significant mood changes during exercise and that appropriate physical activity offers the potential benefits of reducing depression in older people and improving their mood states. Again, a seated Tai Chi intervention may improve the psychological well-being of those with depression in LTC settings and contribute to reducing associated costs of care.

It is important to point out that adequate preparations and resources are essential if a seated Tai Chi exercise program is to be implemented. The most basic are:

(1) Having or setting up an appropriate environment and space in which to conduct the exercise program. In real life settings it would not be necessary to quarantine such an activity from a control group, as it was for the purposes of this study, but it is still important to provide a large enough space where people can practice uninterrupted and where they can readily view the instructor or the DVD instruction.

(2) Finding a suitably qualified instructor. Having a suitably qualified instructor was an integral element of this study’s design, and a major difference with Jao’s study, which did not result in the same positive outcomes. Nevertheless, this has economic implications and presents a number of significant resource and logistic challenges. If the Tai Chi instructor requires a fee, this may act as a prohibitive feature when people
are seeking the agreement and support of the LTC facilities to put in place such an exercise program. Providing or taking part in a seated Tai Chi exercise program as a component of a health promotion approach is not currently reimbursed by health insurance companies in Taiwan. This situation is something that policy makers could consider improving, and this is further discussed below.

Whether the positive outcomes of this current study would subsequently be maintained or even be enhanced if the older people used the DVDs provided, especially if the care staff gave positive encouragement and assistance, was not investigated by the current study. This is an area for follow-up research. If the older people did indeed continue practicing the seated Tai Chi with the help of the LTC staff and using the DVDs, and the results of doing so were measurably positive, this would then provide evidence that it may only be necessary to have a qualified instructor for the initial set-up stage, and the associated initial costs would be for a limited period. This evidence could be used to promote wider use of a valuable activity to enhance the QOL of a vulnerable frail group of older people.

Following the intervention, DVDs of the seated Tai Chi were provided to participants and this will provide an opportunity for them to continue the activity. Once the seated Tai Chi program has been taught, there is an opportunity to incorporate the program using the DVD with staff assistance, into planned activities and daily care routines. Again, where suitable, nursing staff could also involve members of the residents’ families in implementing ongoing practice of the seated Tai Chi exercise program after it has been learnt. Given the evidence that such an activity is associated with
improving the QOL of older people, these possibilities deserve consideration.

(3) A potential positive side-effect is that if members of staff accompany residents while they are learning and participating in an activity that the residents enjoy, then this also offers members of staff a positive experience and the potential for an increase in job satisfaction as well as the opportunity to see the residents enjoying life. This is an important consideration, given the various demands on the staff of LTC facilities. Close family relationships are traditional in Taiwanese culture and where suitable, nursing staff could also consider involving members of the residents’ families in the implementation of the seated Tai Chi exercise in their LTC facility.

(4) The LTC facilities would need to ensure there is a suitably informed nurse or leader to supervise the implementation of a seated Tai Chi exercise intervention, and assign nursing and/or care staff to be present when LTC residents are practicing seated Tai Chi exercise sequences to ensure their health and safety. Any individual requirements must be catered for, but this should not present a problem. The participants who successfully took part in this study were frail and had very limited movement, nevertheless they participated successfully in the intervention. Moreover, ensuring residents’ safety is a normal duty of care in an LTC and therefore is something the care staff are used to undertaking.
5.8 Policy considerations

Identifying and putting into place effective healthcare programs for older people and frail older people, including evidence-based programs that improve QOL has become an international priority as populations are ageing (Department of Household Registration, 2008; Kim, 2009; Luleci et al., 2008; Rodgers & Neville, 2007; Someya & Wells, 2008; Wang et al., 2010; WHO, 2009b, 2009c). Policy support and strategies are necessary to promote the use of seated Tai Chi exercise for older people in wheelchairs in LTC. Given the results of this current study, Taiwan’s Bureau of Health Promotion (BHP) could consider enhancing its policy and resource support of such programs, including the incorporation of seated Tai Chi for older people in wheelchairs in LTC facilities and in the wider community: there are numerous associated health benefits that could reduce the cost of ongoing health care. As pointed out above, such an activity may well significantly contribute to reducing the treatment costs for depression of those in LTC settings.

In addition, there is another more long-term policy needed: there is a clear need for policy allocating public funding for further research into programs to inform clinical practice, including further research into the relationship between Tai Chi and QOL. Both public and private funding is needed to support further research into verifying and generating more evidence of the effectiveness of a seated Tai Chi program. Reviews of the literature frequently point out the inadequate number of rigorous studies in this area, (for example Caminiti et al., 2011; Chen, 2000; Chou et al., 2004; Dechamps et al., 2009; Frye et al., 2007; Li et al., 2001; Taylor-Piliae et al., 2006; Yeh
et al., 2011; Wang et al., 2010).

Social agencies and policy makers need to increasingly require evidence for the effectiveness of interventions when making decisions about funding intervention programs for the older population, especially those in LTC facilities. For their part consumers also need to increasingly ask whether the care they and family members receive is effectively addressing their problems and meeting their individual requirements. Interventions for which there is evidence of both efficacy and effectiveness, such as use of a seated Tai Chi exercise for improving life experience of older people in wheelchairs living in LTC, should be integrated into clinical use and this should be an integral component of policy for provision of care in LTC facilities.

Regular in-service training, and/or educational conferences and workshops for health care professionals and nursing staff, are needed to disseminate information about and promote the effective use of various forms of Tai Chi exercise, including STEP, seated Tai Chi exercise for older people in wheelchairs.

5.9 Practical issues associated with conducting an RCT in LTC

The various challenges encountered while conducting this RCT trial exploring the effect of seated Tai Chi on the QOL of older people in wheelchairs living in LTC are discussed below. These include but are not limited to the characteristics of frail older people and their living environment, factors which can make conducting research a challenge, particularly research utilizing an RCT design.
Preliminary stage

An initial challenging task was to find a suitable LTC facility in which to conduct the research intervention. This included finding a venue with adequate numbers of people in the target age range using wheelchairs, having an available space separate from where the control group would be, and the facility’s willingness to cooperate and fully support the proposed study. Fortunately the researcher was able to identify a facility that met the requirements and the management where willing to support the project.

Sample

Although the researcher had established the inclusion and exclusion criteria, identifying which residents met the criteria was a challenging task that required the help of the LTC staff. The staff were familiar with the residents’ personal details, details that the researcher could not access due to privacy reasons: for example residents’ health status, whether they were in palliative care, and whether they had a diagnosis of mental illness (e.g. psychosis). This meant that staff identified the potential participants, excluding those who did not meet the inclusion criteria and introduced potential participants to the researcher for screening.

Setting

The facility assisted with the preparation of the environment for doing the Tai Chi exercise. The research design required a space quite separate from the public activities area (see Figure 7). The Tai Chi class was held on the second floor of the facility and the facility staff helped transport the 30 participants to and from their rooms, despite
the many other tasks they also needed to attend to. Pushing the wheelchairs was a quite demanding but well co-ordinated task. The researcher had the task of maintaining good relationships and communication with all the people concerned and with the Tai Chi instructor to optimize the learning experience for all the participants.

![Figure 7 Setting: The Tai Chi exercise environment - photo by Chen-Yuan Hsu 01/09/2010](image)

**Attendance**

Attendance by those in the intervention group was affected by a number of factors. One challenge encountered was a number of health-related events. One participant had chicken pox in week 13 of the intervention period, and as a result, the participant had to be isolated for a week. On several occasions a serious infectious illness occurred in the LTC facility, for example an outbreak of diarrhoea. These circumstances affected the attendance of some participants who had to be isolated and
others who asked to miss a class and to rest.

Another factor that had the potential to affect attendance was the weather, especially as the Tai Chi intervention began during the winter. As a result, there were many cold snaps, which resulted in many complaints from the participants when they were woken from a nap in the afternoon to attend the Tai Chi class. Family and staff support; a caring and friendly atmosphere; and the Tai Chi instructor’s interaction and encouragement all helped to maintain attendance at this time. As such, participants attended despite the cold weather (Figure 8).

![Figure 8 Participants practicing Tai Chi movements](image)

*Figure 8 Participants practicing Tai Chi movements* - photo by Chen-Yuan Hsu 23/3/2011
**Tai Chi instructor’s reflection**

The Tai Chi instructor when asked about her reflection on the intervention mentioned that she had a sense of frustration because this was the first time she had taught seated Tai Chi to older people in wheelchairs. She had been worried about how to interact with this group of people and in particular was concerned in case anything unexpected occurred outside of her experience. She was very relieved that nothing untoward occurred and that she was able to maintain a rapport with the participants. She also expressed feeling challenged by the targets she had set for the level of Tai Chi that participants should achieve during her class and what the participants could actually manage. The researcher found she had to communicate with the Tai Chi instructor about the purpose of this study and to remind her that the purpose of the study was not limited to simply mastering the movements. The instructor acknowledged that over time she came to recognize the achievements of the participants.

The limitations of this study are discussed below.

**5.10 Limitations of this Study**

This study has a number of limitations, which mean its results should be interpreted with some caution. The study used a convenience sample, lacked follow-up assessment, and participants could not be blinded to treatment. It was also hard to monitor the level and extent of the participants’ learning of seated Tai Chi. These limitations are discussed below.
The use of a convenience sample limits the generalizability of the findings. The intervention group and the control group were both recruited from a LTC facility in a rural area of Changhua in the central area of Taiwan; generalising the results to other older populations should therefore be undertaken with caution. Replication of the design with samples of older people in wheelchairs living in other LTC facilities, and from different geographical areas, urban and rural, would help to increase the generalizability of the results.

The other major limitation is the limited timeframe of the assessment of the outcome variables. Participants’ QOL, depression, mood states, and self-efficacy were all measured at baseline, and then midway through the study at week 13, and at the completion of the exercise program at week 26. There was no subsequent follow-up assessment of the participants’ QOL, depression, mood states, and self-efficacy, for example one month or three months after the instructor gave the last guided session. A subsequent follow-up assessment would help to evaluate whether the positive effects were sustained.

Similarly, it would be useful to find out how many people in the intervention group continued practicing, and if so, what difficulties they encountered; what positive comments they made; and whether the positive changes continued at the same level or improved further. Such information would help in promoting and planning of seated Tai Chi activities in LTC settings.
The other limitation of this current study was participants could not be blinded to treatment. Participants were instructed not to discuss their study treatment or the exercise program with anyone but it was simply not possible to control all participants’ communications. Some of the people in the seated Tai Chi intervention group may have discussed their participation with people in the control group. If so, this could potentially have influenced the data collected.

When assessing outcomes it was not possible to quantify what the participants had actually learned from the seated Tai Chi activity; the participants’ attendance record only provides information about the amount of time they spent participating. In any future study monitoring the level and extent of participants’ learning of Tai Chi through both subjective and objective evaluation by the instructor or through video recording, and possibly by interviewing participants and/or regular carers and staff, may yield useful information.

When examining the self-efficacy outcome, this study only measured participants’ self-efficacy for exercise (SEE) and adherence to the seated Tai Chi exercise intervention. Other variables such as self-efficacy to overcome barriers to Tai Chi (TCSE barriers) and self-efficacy to perform Tai Chi (TCSE performance), also need to be investigated further.
Summary

In summary, the seated Tai Chi intervention had a number of significant effects in older people in wheelchairs living in LTC. The seated Tai Chi intervention was associated with increased QOL, a reduction in depression, an improvement of the fatigue-inertia dimension of mood states, and an increase in self-efficacy. The evidence from this study is strong given this study’s RCT design, but it still has the limitations outlined above, principally the use of a convenience sample, short follow-up assessment, and participants could not be blinded to treatment. Several considerations for further research and a brief outline of the rationale that should underpin government policy support have been outlined.
CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

Improving the QOL of all older people living in a LTC setting should be an important goal of health promotion programs. Depression and some mood states in particular can have a negative impact on older people in wheelchairs living in LTC facilities, while self-efficacy can have a positive impact on such people. One such health promotion intervention program, which can be used is seated Tai Chi exercise.

A review of the literature indicated that this study is the first RCT study to examine a seated Tai Chi exercise intervention conducted by a Tai Chi instructor to evaluate the effectiveness of such an intervention on the QOL, depression, mood states and self-efficacy of Taiwanese older people living in a LTC facility who need to use wheelchairs for mobility. The results of this study indicate that older people in wheelchairs living in LTC who undertook the seated Tai Chi intervention for 26 weeks had a significant improvement in QOL, a reduction in their level of depression and in the fatigue-inertia mood domain, and an increase in self-efficacy compared to those who received the usual standard care with no seated Tai Chi intervention.

This study’s results contribute to knowledge about the effectiveness of a seated Tai Chi exercise intervention on the QOL, depression, mood states, and self-efficacy of older people in wheelchairs living in LTC. Providing knowledge and evidence that is clinically relevant can contribute to closing the gap between research and practice.
Given the results of this study, the following recommendations are made regarding suitability of STEP seated Tai Chi, clinical practice and research.

**Recommendations**

**Suitability of STEP seated Tai Chi:** The findings of this current study provide information regarding the important influence of a STEP seated Tai Chi program on the QOL, depression, mood states and self-efficacy of older people in wheelchairs living in LTC. The integrity of the intervention was an important consideration, and this form of Tai Chi was selected as a suitable exercise for people in wheelchairs because it is easy-to-learn and easy-to perform. This minimized the possibility of the participants having a frustrating experience giving them a sense of failure or a heightened sense of their own frailty and limited and/or deteriorating physical and co-ordination abilities. The success of the STEP seated Tai Chi used for this research indicates the LTC facilities should consider providing this form of Tai Chi as an opportunity to increase exercise for older people in wheelchairs with the potential to improve the QOL of residents.

**Clinical Practice:** Practitioners in various clinical practice settings, including institutional and LTC environments, need reliable data and useful guides for creating the contexts that facilitate the health and QOL of their client population. The rigorous evidence provided by the results of this study has implications for clinical practice and policy. The findings of this current study contribute to clinical practice by providing a set of data establishing measured improvement of the QOL of older people in
wheelchairs. As Tsai and Tsai (2008) point out, the development of exercise programs is important for improving the social interactions, physical and psychological well-being, living experience, and satisfaction of older people living in LTC facilities. A seated Tai Chi exercise offers a good opportunity for social activity to improve the QOL of older people in general, and particularly those confined to wheelchairs. In addition, engaging in social activities may help older people to reduce their mortality and cognitive impairment (Bowling, 2008; Chen, 2004; Gabriel & Bowling, 2004; Ku et al., 2009; Netuveli & Blane, 2008; Wilhelmson et al., 2005).

The STEP seated Tai Chi exercise intervention also provided a structured opportunity for care staff to have more social interaction with the older residents. The study has generated new evidence about the effectiveness of a STEP seated Tai Chi exercise intervention on the QOL of older people in wheelchairs in LTC, in particular in the social relations and environment domains. Clinical nursing staff can use the information provided to design and implement a similar seated Tai Chi exercise intervention for older people in wheelchairs living in an LTC facility setting. This study has shown that seated Tai Chi is an effective exercise for increasing older people’s social relations, improving various aspects of QOL, and enhancing how they perceive their living environment.

**Research:** This study has a number of limitations, which are discussed in Chapter 5. Nevertheless the study findings make a clear contribution to a developing field and it raises many further questions, which can be addressed in future research. These are set out below.
It is necessary to further explore the applicability of this study’s finding to older people in wheelchairs living in the community in different care settings, such as day care and community centres, and in different clinical situations and institutional settings. The target group can also be further widened to examine its effects for older people in wheelchairs with different medical conditions, and beyond those people confined to wheelchairs, to include older people who are simply very frail.

This study provides evidence that a STEP seated Tai Chi program can effectively reduce the depression score and mood states of the fatigue-inertia domain, increase self-efficacy, and improve the QOL of older people in wheelchairs living in LTC, but the effects of the seated Tai Chi intervention were only observed immediately after the 26-week intervention ended. A longer follow-up assessment is needed to examine whether there are any long-term effects of the seated Tai Chi intervention on the outcome variables, and whether people continued to practice seated Tai Chi once the instructor no longer conducted the regular sessions. Furthermore, a time series design could be used to examine the trends of any changes in the outcome variables over time.

This study found a significant improvement in the QOL, depression, mood states of the fatigue-inertia domain, and self-efficacy between week 13 and week 26. This indicates that the seated Tai Chi exercise intervention needs to be undertaken for a sufficiently long period to begin to produce noticeable effects. Further research could examine the long-term effects of long-term practice of seated Tai Chi exercise, and
also whether the effects differ if the frequency is increased – i.e. from the three sessions weekly undertaken in this study.

Pharmaceutical treatment is still the main course of action used by medical personnel to treat depression. It was not possible for the researcher to restrict participants’ pharmaceutical treatment, such as medications for depression and pain, and such medications may have influenced intervention outcomes. There is a need for further investigation of the effects of these possible confounding variables.

This study only examined the potential effect of a seated Tai Chi intervention on QOL, depression, mood states, and self-efficacy of older people in wheelchairs living in LTC. It is necessary to further explore and measure related variables of people in LTC, especially the effects of seated Tai Chi on other physiological and psychological indicators, such as vital signs and lung function, treatment of depression, psychological aspects, including fear of falling, fall efficacy, satisfaction with LTC, self-esteem, perceived social support and perceived stress. Furthermore, future research could also compare the effects of combining seated Tai Chi exercise with other complementary interventions, such as massage, aromatherapy, and/or music activities.

Conducting qualitative interviews with study participants to gain an understanding of their perceptions of the seated Tai Chi intervention and better understand their experiences would also be very valuable. Such information would assist in any redesign of the Tai Chi protocol to ensure it meets participants’ needs. Qualitative
interviews might also address the fact that this study found no significant differences between the two groups regarding their *expressed* perceptions of the tension-anxiety, depression-dejection, anger-hostility, and confusion-bewilderment dimensions of the negative mood states. It is hypothesised that as they were all older Chinese people with traditional Chinese cultural and social norms it is expected that this would strongly preclude their willingness to openly express negative mood states. Qualitative interviews would need to be very carefully designed to minimize ‘saving face’ considerations, and in addition, to carefully negotiate what might be a natural disinclination to express negativity about the environment to which they are confined.

The lack of a result for many dimensions of negative mood states might well indicate a need to examine the different items of the Chinese language version of measurement instrument to determine whether they are adequate for accurately assessing the mood states of older people with a Chinese background. A challenging but essential need is to further take into account the influence of traditional culture and people’s resultant strong reservations about expressing negative emotions, and furthermore, assess whether each question is designed to actually elicit the different negative mood states.

A three-group study design in which one group learns the STEP seated Tai Chi from an instructor, one group learns following an instructor on a DVD, and a control group that does no Tai Chi or other additional exercise, is warranted to determine whether such alternative learning methods have any significant difference in the findings. This is critical for informing the future design of health promotion activities designed to enhance the QOL of older people.
In conclusion, this RCT study indicates that a group of older people in wheelchairs living in LTC who undertook a seated Tai Chi intervention for 26 weeks had a significant improvement in their QOL, a reduction in their level of depression and in the fatigue-inertia domain, and an increase in self-efficacy compared to those who received the usual standard care with no seated Tai Chi intervention. These results contribute to a relatively new area of knowledge and offer a practical way to help improve the QOL of older people in wheelchairs living in LTC. The use of a seated Tai Chi exercise program as a psychological health maintenance activity and/or social activity for older people in wheelchairs in LTC facilities should be supported. This will be a valuable option to help maintain the QOL of the increasing numbers of older people.
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APPENDICES

Appendix A: Information Sheet

The Effect of Tai Chi on Quality of Life of Older People Living in Long-Term Care and Using Wheelchairs for Mobility:
A Randomized Controlled Trial (RCT)

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Purpose
This study will explore the influence of a seated Tai Chi exercise intervention on depression, mood states, self-efficacy and quality of life (QOL) for older people in wheelchairs living in a long-term care (LTC) facility in Taiwan. This study is being undertaken by Chen-Yuan Hsu to partially fulfill the requirements for a PhD.

Background
Life expectancy for older people has increased due to improved public health and medical advances. This has also resulted in an ageing of the population and an increase in the frail older population. Despite a trend towards improved care for
older people living in LTC, there is still a need to improve the QOL of this population and in particular, those who use a wheelchair for their mobility. In spite of our increased knowledge about QOL, there is relatively limited research regarding the QOL of older people in wheelchairs. There is evidence which suggests Tai Chi can improve physical, and emotional health in older people but there is limited understanding of Tai Chi in older people in wheelchairs. We aim to explore the impact of seated Tai Chi exercise on the QOL of older Taiwanese people in wheelchairs. The outcomes of this research may be used to develop a program of exercise to improve the QOL of older people in wheelchairs.

What participation in this study involves?
If you agree to participate in this study, you will be randomly assigned to either a seated Tai Chi exercise program or provided with usual standard care without the Tai Chi exercise intervention. The seated Tai Chi exercise program will last 40 minutes during the mid-afternoon, three times a week for 26 weeks, and all seated Tai Chi exercise sessions will be delivered by a qualified Tai Chi instructor who is an expert from the Tai Chi Chuan Association (R.O.C). You will be asked to sign a consent form and be interviewed using four questionnaires three times: at the baseline of the study, and weeks 13 and 26 of the intervention period. The investigator will be present to assist you with any questions. These questionnaires will take approximately 20 minutes to complete each time. All participants (i.e. both in the exercise or usual care group) at the end of the study will be provided with a DVD copy of the Tai Chi exercise program.

Inclusion Criteria
You will be eligible for inclusion in the study; if you are over 65 years of age, willing to participate in the study, speak and understand Chinese or Taiwanese with no severe hearing or cognitive impairment, are able to use two hands and raise your hands while sitting in a wheelchair, and able to provide informed consent

Exclusion Criteria
You will be excluded from the study if you have obvious symptoms of acute pain or lower extremity infection, are receiving palliative care, or have other medical conditions that may interfere with study participation.

Risk
The seated Tai Chi exercise program is not harmful. However, it is important that you can undertake the participation. Therefore, we require participants to receive
permission for participation from their medical professional. If you exhibit negative responses during the seated Tai Chi exercise, we will immediately stop your participation and ask you to see your medical professional or seek medical advice.

**Voluntary Participation**
You are free to decide whether to participate in this study or not, and you are free to withdraw from this study at anytime.

**Confidentiality**
All data will be used only by the researcher and will be stored in a locked confidential file. All questionnaires will be marked with identification numbers. In all publications, your identity will not be exposed and you will not be referred to by name in research reports or study discussions.

**Feedback**
We will present a DVD of the seated Tai Chi exercise program to all participants to show our appreciation to you for your participation in this study.

**Contacting the Investigators**
If you have any questions about this study, please do not hesitate to contact Chen-Yuan (Jean) Hsu at 886-4-8339602. Alternately, if you have any concerns or complaints about any ethical conduct aspects of the research project, you may also contact the manager, Shu-Juan Liu at 886-48738389 or 886-922297217 (Taiwan), and Research Ethics Manager at Griffith University on 617-38755585 or research-ethics@griffith.edu.au

**Privacy Statement**
The conduct of this research will involve the collection, access and /or use of your identified personal information. The information collected is confidential and will not be exposed to third parties without your consent, except to meet government, legal or other regulatory authority requirements. A de-identified copy of this data may be used for other research purposes, but your anonymity will be safeguarded at all times. For further information consult the University’s Privacy Plan at www.gu.edu.au/ua/aa/vc/pp or telephone +617 3733 5585.

Griffith University thanks you for considering participation in this study. Your participation is greatly appreciated.
參與研究說明書

研究主題：台灣老年人以使用輪椅協助活動者之生活品質：運動方案介入之成效探討

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研究目的
本研究目的為探討輪椅太極運動對於台灣長期照護中心之老年人以使用輪椅協助活動者之憂鬱症、情緒狀況、自我效能和生活品質的影響。本研究將由澳洲格里菲斯大學之護理及助產研究所博士候選人許貞媛執行本研究。

研究背景
由於衛生健康和醫療的發達也造成老年人的壽命延長，也因此造成虛弱老人族群增加，儘管長期照護中心的照護有一定改善的趨勢，但仍然缺乏改善虛弱老人族群的生活品質，尤其是使用輪椅協助活動的老人族群。雖然我們對於提高生活品質的知識是增加的，但是對於使用輪椅協助活動的老人們其生活品質的相關研究仍是缺乏。有實證顯示太極運動可以改善身心健康，但卻少有探討於使用輪椅協助活動的老人族群們。因此我們企圖去探討輪椅太極運動對於影響使用輪椅之老人們生活品質的情形。本研究結果將可協助發展一個運動計畫，對於輪椅使用的老人們的生活品質改善方案。

本研究計畫內容包括哪些
若您同意加入本研究計畫，您將會被隨機分配到可能是輪椅太極運動組或者是日常生活照顧組—沒有參與輪椅太極運動。輪椅太極運動組將由專業的教練全程指導輪椅太極運動課程共 26 週 (每週三次，每次四十分鐘)。您需簽寫同意書以及被訪問四種問卷三次 (於輪椅太極運動課程前、輪椅太極運動課程的第十週和第二十週)，問卷採口頭詢問方式 (一問一答)，並由研究人員書寫。所有的參與者包括輪椅太極運動組與日常生活照顧組將會贈送一份輪椅太極運動
動的 DVD 作為紀念。

包含條件
若您符合以下資格者將可以參加此研究：您為六十五歲以上的老人且願意參與此研究者；能聽和說國語或台語者；沒有嚴重聽力和認知障礙；當坐在輪椅時能舉起兩隻手；提交同意書者。

排除條件
若您有以下情況者將被排除參加此研究：您有明顯的症狀像是急性疼痛或是四肢末端感染；正接受安寧照護；其他疾病可能會影響你加入此項研究。

參與研究的危險性
輪椅太極運動是沒有傷害性的，然而對您來說很重要的一件事就是：我們要求您需經由您的專業醫療人員同意後方可參與此研究。假如您於輪椅太極運動課程中出現不適的反應，我們將立即停止你的參與並要求您去見專業醫療人員或尋求醫療諮詢。

自願參與
您是自願決定是否參加本研究，以及您也可於任何的時間點退出本研究。

資料保密
所有的資料將只被研究者使用，並且儲存在機密的資料夾。所有的問卷也將被予以編號，您的身分將不會被洩漏也不會被使用在其他的報告或研究內。

聯繫研究人員
假如您對本研究有疑問，請與許貞媛小姐聯絡，電話號碼是 886-48738389 或 886-922297217(台灣)。也可以聯繫劉淑娟主任聯絡電話號碼是 886-48738389 或 886-922297217(台灣)。以及也可連絡澳洲格里菲斯大學研究倫理委員會於 617-38755585 或 research-ethics@griffith.edu.au。

隱私聲明
本研究的執行將包含資料收集、評估和有關於您的個人的資料，因此資料的收集是保密且不會洩漏給其他人，除非有政府相關的法令規定時，但仍然持續保護研究個案的隱私並以匿名方式使用。若將來對於本研究有關的疑慮也請與澳洲格里菲斯大學研究倫理委員會聯繫，電子信箱為 www.gu.ed.au/ua/aa/vc/pp or 連絡電話 +617 3733 5585。

格里菲斯大學非常感謝您同意參與本項研究！
Appendix B: Consent Form

The Effect of Tai Chi on Quality of Life of Older People Living in Long-Term Care and Using Wheelchairs for Mobility: A Randomized Controlled Trial (RCT)

Student Investigator
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I have read the information form and understand that:

- This research is to explore the impact of a seated Tai Chi exercise intervention on depression, mood states, self-efficacy and QOL of older people in wheelchairs living in LTC in Taiwan.
- I will be either in the seated Tai Chi group to attend 40 minutes three times a week for 26 weeks or be in the usual care group without the seated Tai Chi program.
- I will be interviewed three times using four questionnaires by the investigator: the initial questionnaires, as well as two repeated uses of the four questionnaires at week 13 and week 26 of the intervention. The questionnaires will take approximately 20 minutes to complete each time.
- There is no harm anticipated with my participating in the study, but I have been requested to obtain permission for participation from my medical professional.
- My participation is voluntary and I am free to withdraw at anytime without penalty or explanation.
- The data will only be used by the researcher and will be stored in a locked confidential file. Any publications from this study will not expose my identity and will not refer to my name in research reports or study discussions.
- A report from the study findings may be used in the development of a program to improve QOL of older people in wheelchairs.
- If I have any additional questions, I can contact the student researcher - Ms. Chen-Yuan Hsu on 886-4-8339602 (Taiwan) or email: c.hsu@griffith.edu.au.
- I can contact the Manager, Shu-Juan Liu at 886-48738389 or 886-922297217 (Taiwan), or Research Ethics Manger, at Griffith University Human Research Ethics Committee on + 617 3735 5585 or research-ethics@griffith.edu.au if I have any concerns about the ethical conduct of this study.

I agree to participate in this study.

Signature of participant ___________ Date ___________
Signature of researcher ___________ Date ___________
研究參與同意書

研究主題：台灣老年人於使用輪椅協助活動者之生活品質：運動方案介入之成效探討

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我已經看過本研究相關資料並且了解以下幾點

- 本研究目的是探討輪椅太極運動對於台灣長期照護中心之老年人於使用輪椅協助活動者之憂鬱症、情緒狀況、自我效能和生活品質的影響。
- 我將會被分配到可能是太極運動組參與太極運動一次四十分鐘每週三次為期26週，或者是被分配到日常生活照顧組沒有參與太極運動。
- 我將會被研究員訪談四種問卷三次，於研究前、太極運動課程的第十三週和第二十六週。每次訪談時間大約為20分鐘。
- 我了解參與這研究並沒有傷害，但我知道我被要求要經過我的專業醫療人員同意才能加入此研究。
- 我的參與是自願的，並且知道若退出此研究在任何的時間並不需要解釋也不會受到任何處罰。
- 有關的資料都將只有研究者使用並保密，研究的任何發表或討論都不會暴露我的身分姓名和資料。
- 有關的研究發現也許可以被運用在發展如何改善老年人於使用輪椅協助活動者的生活品質。
- 假如我有任何疑問，我可以聯繫許貞媛小姐，電話號碼是886-4-8339602或電子信箱c.hsu@griffith.edu.au
- 我了解若有與研究相關的問題，我也可以聯繫劉淑娟主任，聯絡電話號碼是886-48738389或886-922297217（台灣），以及也可連絡澳洲格里菲斯大學研究倫理委員會於617-38755585或research-ethics@griffith.edu.au
- 我同意參加這項研究

參與者簽名 ____________________ 日期 ____________________
研究者簽名 ____________________ 日期 ____________________
Appendix C: Demographic Data Form

The following questions ask for some information about you, such as your age, gender, ethnicity, religion, level of education, marital status, and length of residency in the long-term care facility.

1. Age: ________years. (Date of Birth: d/ m/ y/)

2. Gender:
   (1) □ Male
   (2) □ Female

3. Ethnicity:
   (1) □ Taiwanese
   (2) □ Chinese
   (3) □ Ha-Kai (Hakka)
   (4) □ Aboriginal
   (5) □ Other (Specify_______)

4. Religion:
   (1) □ Buddhist  (2) □ Taoist
   (3) □ Christian  (4) □ Catholic
   (5) □ None     (6) □ Other (Specify_______)

5. Highest Education Level:
   (1) □ None
   (2) □ Primary School
   (3) □ Junior High School
   (4) □ High School
   (5) □ College or University

6. Current Marital Status:
   (1) □ Married
   (2) □ Divorced
   (3) □ Single
   (4) □ Widowed
   (5) □ Separated

7. Length of residency in long-term care:
   (1) □ 0–3 months  (2) □ 4–12 months  (3) □ 1–3 years
   (4) □ 3–5 years   (5) □ 5–10 years   (6) □ over 10 years

8. How long have you been using a wheelchair?
   (1) □ 0–3 months  (2) □ 4–12 months  (3) □ 1–3 years  (4) □ 3–5 years
   (5) □ 5–10 years  (6) □ over 10 years

9. The main reason for using a wheelchair: (______________)

10. Medical Diagnoses:
    (1) __________
    (2) __________
    (3) __________
    (4) __________
基本資料
以下的問題為有關詢問你的一些相關資料，例如：您的年齡、性別、種族、宗教、教育程度、婚姻狀況、居住在長期照顧中心的時間，等等。
1. 年齡：________岁，（生日：年 月 日）
2. 性別：（1）男（2）女
3. 種族：（1）閩南人（2）外省人（3）客家人（4）原住民（5）其他（___）
4. 宗教：（1）佛教（2）道教（3）基督教（4）天主教（5）無（6）其他（例如：__________）
5. 教育程度：（1）無（2）小學（3）國中（4）高中（5）專科或大學
6. 婚姻狀況：（1）已婚（2）離婚（3）未婚（4）鰥寡（5）分居
7. 居住在長期照顧中心的時間：（1）0–3個月（2）4–12個月（3）1–3年（4）3–5年（5）5–10年（6）10年以上
8. 使用輪椅的時間有多久了？（1）0–3個月（2）4–12個月（3）1–3年（4）3–5年（5）5–10年（6）10年以上
9. 使用輪椅的主要原因：（________________________）
10. 醫療診斷：（1）________（2）________（3）________（4）________
Appendix D

Permission Statement

Permission is hereby given for __________ to participate in (Simplified Tai-Chi Exercise Program) STEP for a nursing research proposal: “The Effect of Tai Chi on Quality of life of Older People Living in Long-Term Care and Using Wheelchairs for Mobility”.

Signature of a member of the medical professional team in the Jen-Tao LTC facility:

__________________________________________

Date:__________
同意書

茲同意__________________學習銀髮太極健身操(Simplified Tai-Chi Exercise Program; STEP)以參與「台灣老人以使用輪椅協助活動者之生活品質:運動方案介入之成效探討」研究計畫。

仁道護理之家專業醫療團隊者簽名:

____________________________________

日期：________________________
Appendix E

Seated Tai Chi Exercise Protocol

The procedures for the recruitment of participants, the seated Tai Chi exercise intervention, and the data collection are as follows:

**Recruitment of Participants**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Work completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The researcher contacted the administrator of the LTC facility and provided information about the study that can be displayed or given to residents.</td>
<td></td>
</tr>
<tr>
<td>2. The administrator invited the researcher to hold an information session for residents who have indicated their interest in participating in this study. Information regarding the background, aims and objectives, expected involvement and duration of the research study were presented during the information session. Residents are given the opportunity to raise any questions or concerns about the study. Residents were provided with an information sheet (Appendix A) as well as the consent form (Appendix B) are provided to residents during the information session.</td>
<td></td>
</tr>
<tr>
<td>3. The nursing staff identified potential participants according to the inclusion criteria and exclusion criteria.</td>
<td></td>
</tr>
</tbody>
</table>

**Inclusion criteria**

(1) people in wheelchairs aged 65 or over;
**Inclusion criteria**

(2) willingness to participate in the study;
(3) able to speak and understand Chinese or Taiwanese with no severe hearing impairment;
(4) able to use and raise both hands while sitting in a wheelchair;
(5) able to provide informed consent;
(6) cognitive function (Mini Mental State Examination):
- If the level of education is over 6 years, MMSE should be $> 24/30$
- If the level of education is less than 6 years, MMSE should be $> 21/30$
- If no educational background, MMSE should be $> 16/30$.

**Exclusion criteria**

(1) obvious symptoms of acute pain or lower extremity infection;
(2) older people in palliative care;
(3) older people with blindness;
(4) having documented or observable psychiatric or neurological disorders that may interfere with study participation (e.g. dementia, psychosis).

4. Potential participants who agree to participate then have their cognitive function assessed by the principal researcher. The researcher confirmed that they meet the inclusion
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>criteria, using MMSE.</td>
<td></td>
</tr>
<tr>
<td>5. Residents who met the inclusion criteria were invited to participate in this study, and those residents who did not meet the inclusion criteria were informed that they could not participate.</td>
<td></td>
</tr>
<tr>
<td>6. The researcher required participants to receive written permission to participate from their medical professional. Potential participants who do not receive this permission will not be able to participate.</td>
<td></td>
</tr>
</tbody>
</table>
**Intervention**

The seated Tai Chi exercise is based on a Simplified Tai Chi Exercise Program (STEP) developed by Professor Chen Kuei-Min of Fooying University in Taiwan (Chen et al., 2006). The program is designed for older people in wheelchairs. Details of how the intervention was carried out are set out below.

**Setting Up**

1. The control group was to be located on the first floor where they would receive the usual standard care for the same length of time as the Tai Chi group participated in the Tai Chi activity. Standard care included watching TV and DVDs, singing karaoke, playing card games, chess and croquet, throwing games, listening to music, drawing, arranging flowers, origami, and doing stretching exercises following an instructor on a DVD.

2. The researcher prepared the environment for the Tai Chi participants. The Tai Chi class was held on the second floor of the LTC.

3. All staff and the researcher had to check that the Tai Chi participants’ wheelchairs were fixed in place before each class began.
### The Tai Chi Intervention

**Preliminary phase: 3 minutes**

<table>
<thead>
<tr>
<th>Action</th>
<th>Explanation</th>
<th>Time</th>
<th>Conducted by</th>
</tr>
</thead>
</table>
| Welcome questions | How are you today?  
Are you ready to enjoy doing Tai Chi exercise? | 1 min | Tai Chi instructor            |
| Positioning     | 1. Assist the participants to sit comfortably in a wheelchair. The people were positioned in 3-4 rows with 4-5 people in each row.  
2. The Tai Chi instructor stood in front of the participants. All participants could therefore see the upper part of instructor’s body and her movements clearly; staff checked this detail. | 1 min | Researcher and staff present  |
| Explanation given | 1. Explained that the seated Tai Chi exercise will take 40 minutes.  
2. Encouraged participants to learn, and do Tai Chi during the class.  
3. Explained to participants that if they experience any negative responses during the seated Tai Chi exercise, they will need to immediately stop participating and indicate this to the researcher or one of the nursing staff just nearby and then seek medical attention. | 1 min | Tai Chi instructor            |
advice (simply making eye contact would be sufficient to result in someone going over to ask what was troubling them).
The seated Tai Chi exercise phase: 40 minutes, including warm-up

- following the **STEP Seated Tai Chi Schedule**, conducted by Tai Chi instructor

<table>
<thead>
<tr>
<th>Details</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Warm up</strong></td>
<td>10 minutes</td>
</tr>
<tr>
<td>1. This consisted of nine movements:</td>
<td></td>
</tr>
<tr>
<td>(1) Nodding the head,</td>
<td></td>
</tr>
<tr>
<td>(2) Shrugging the shoulders,</td>
<td></td>
</tr>
<tr>
<td>(3) Waving hands,</td>
<td></td>
</tr>
<tr>
<td>(4) Swinging arms,</td>
<td></td>
</tr>
<tr>
<td>(5) Twisting the waist,</td>
<td></td>
</tr>
<tr>
<td>(6) Circling legs</td>
<td></td>
</tr>
<tr>
<td>(7) Jiggling knees,</td>
<td></td>
</tr>
<tr>
<td>(8) Raising the feet,</td>
<td></td>
</tr>
<tr>
<td>(9) Closing movement.</td>
<td></td>
</tr>
<tr>
<td>2. The movements from (1) to (8) were done twice, and then movement (9) was done to finish the warm-up phase.</td>
<td></td>
</tr>
<tr>
<td><strong>STEP</strong></td>
<td>25 mins</td>
</tr>
<tr>
<td>1. This consisted of twelve separate movements:</td>
<td></td>
</tr>
<tr>
<td>(1) Commencing form,</td>
<td></td>
</tr>
<tr>
<td>(2) Curving back of arms,</td>
<td></td>
</tr>
<tr>
<td>(3) Pushing palms forward,</td>
<td></td>
</tr>
<tr>
<td>(4) Wind push the wall,</td>
<td></td>
</tr>
<tr>
<td>(5) Holding palms as on horseback,</td>
<td></td>
</tr>
<tr>
<td>(6) Palming the energy of the tiger,</td>
<td></td>
</tr>
</tbody>
</table>
(7) Energy tower to the sky,
(8) Needle at the sea bottom,
(9) Embracing the moon,
(10) Lifting the moon to the sky,
(11) Punch down,
(12) Closing movement.

2. The movement sequence (1) to (11) was done twelve times, and then movement (12), the Closing movement, finished the activity.

<table>
<thead>
<tr>
<th>Cool down</th>
<th>1. The cool down phase consisted of doing two movements for 5 minutes:</th>
<th>5 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) Heaven and earth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2) Rubbing through circulation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. These two movements are done 8 times.</td>
<td></td>
</tr>
</tbody>
</table>

**After each Tai Chi class**

1. Thank the participants for doing their best.
2. Encourage the participants to drink warm water.
3. Remind the participants to dry their bodies.
4. Remind the participants to come back to the next seated Tai Chi exercise session.
# STEP Seated Tai Chi Schedule

<table>
<thead>
<tr>
<th>STEP Seated Tai Chi Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Warm-up</strong></td>
</tr>
<tr>
<td><strong>First stage - Learning stage</strong></td>
</tr>
<tr>
<td>Week 1 – Session 1</td>
</tr>
<tr>
<td>- Session 2</td>
</tr>
<tr>
<td>- Session 3</td>
</tr>
<tr>
<td>Week 2 – Session 1</td>
</tr>
<tr>
<td>- Session 2</td>
</tr>
<tr>
<td>- Session 3</td>
</tr>
<tr>
<td><strong>Second stage (Practice stage)</strong></td>
</tr>
<tr>
<td>Week 3 – all sessions</td>
</tr>
<tr>
<td>Week 4 – all sessions</td>
</tr>
<tr>
<td>Week 5 – all sessions</td>
</tr>
<tr>
<td>Week 6 – all sessions</td>
</tr>
<tr>
<td>Week 7 – all sessions</td>
</tr>
<tr>
<td>Week 8 – all sessions</td>
</tr>
<tr>
<td>Week 9 – all sessions</td>
</tr>
<tr>
<td>Week 10 – all sessions</td>
</tr>
<tr>
<td>Week 11 – all sessions</td>
</tr>
<tr>
<td>Week 12 – all sessions</td>
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<tr>
<td>Week 13 – all sessions</td>
</tr>
<tr>
<td>Week 14 – all sessions</td>
</tr>
<tr>
<td>Week 15 – all sessions</td>
</tr>
<tr>
<td>Week 16 – all sessions</td>
</tr>
<tr>
<td>Week 17 – all sessions</td>
</tr>
<tr>
<td>Week 18 – all sessions</td>
</tr>
<tr>
<td>Week 19 – all sessions</td>
</tr>
<tr>
<td>Week</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>20 – all</td>
</tr>
<tr>
<td>21 – all</td>
</tr>
<tr>
<td>22 – all</td>
</tr>
<tr>
<td>23 – all</td>
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<tr>
<td>24 – all</td>
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<tr>
<td>25 – all</td>
</tr>
<tr>
<td>26 – all</td>
</tr>
</tbody>
</table>
**Data collection**

**Before the procedure**

1. The researcher gave a training session for the three research assistants, each with a nursing background, to explain how to use the four questionnaires (WHOQOL-BREF, GDS-SF, POMS-SF, and SEE).

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Explanation</th>
<th>Time</th>
<th>Conductor</th>
</tr>
</thead>
</table>
| WHOQOL-BREF     | 1. WHOQOL-BREF is used to measure four domains: 1. physical capacity (7 items), 2. psychological well-being (6 items), 3. social relationship (3 items), and 4.environment (8 items). It also has two items measuring overall QOL and general health.  
2. Participants are asked to choose the answer that appears most appropriate to the questions: *How do you feel about your quality of life,* ... *health?* and ... *other areas of your life?*  
3. Participants are asked to respond by choosing one of the following responses for each question: Their | 6 mins | The researcher  |
answers are scored as shown in brackets:  
(1) Not at all  (2) A little  
(3) A moderate amount  (4) Very much  (5) Extremely.

<table>
<thead>
<tr>
<th>GDS-SF</th>
<th>1. GDS-SF is a useful tool for detecting depressive symptoms.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. The GDS-SF consists of 15 items with a score range from 0 to 15. A score of 0 to 4 is in the normal range, 5 to 9 indicates mild depression, and 10 to 15 indicates moderate to severe depression.</td>
</tr>
<tr>
<td></td>
<td>3. Participants are informed that they should consider “how you have felt over the past week” and answer “YES” or “No” for each question.</td>
</tr>
<tr>
<td></td>
<td>4. The participant is asked to please choose the best answer to each question.</td>
</tr>
<tr>
<td></td>
<td>5. If the participant answers a question with “☐”, that is scored 1 point. If the participant answers a question with “□”, that question is scored 0 points.</td>
</tr>
<tr>
<td></td>
<td>5 mins</td>
</tr>
<tr>
<td>POMS-SF</td>
<td>1. POMS-SF is used to measure a person’s total mood disturbance.</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>2. POMS-SF measures six dimensions of mood states: tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment.</td>
</tr>
<tr>
<td></td>
<td>3. Each of these six dimensions is defined by five adjectives:</td>
</tr>
<tr>
<td></td>
<td>Tension-anxiety: tense, shaky, uneasy, nervous, and anxious</td>
</tr>
<tr>
<td></td>
<td>Depression-dejection: sad, unworthy, discouraged, lonely, gloomy</td>
</tr>
<tr>
<td></td>
<td>Anger-hostility: angry, grouchy, annoyed, furious, bad-tempered</td>
</tr>
<tr>
<td></td>
<td>Vigor-activity: lively, active, energetic, full of pep, vigorous</td>
</tr>
<tr>
<td></td>
<td>Fatigue-inertia: worn out, fatigued, exhausted, sluggish, weary</td>
</tr>
<tr>
<td></td>
<td>Confusion-bewilderment: confused, muddled, bewildered, efficient, forgetful</td>
</tr>
<tr>
<td></td>
<td>4. Participants are asked to describe how</td>
</tr>
<tr>
<td></td>
<td>6 mins</td>
</tr>
</tbody>
</table>
5. Participants are asked to respond using a five-point scale: 0 (not at all), 1 (a little), 2 (moderate), 3 (quite a bit), 4 (extremely).

| SEE | 1. SEE is used to measure the participants’ perception of their confidence to continue doing exercise in the face of various circumstances, such as bad weather, tiredness, and feeling depressed. |
|     | 2. Participants are asked to describe *How confident are you right now that you could exercise if: the weather was bothering you*, etc.... |
|     | 3. Participants are asked to respond using a scale from 0 (not confident) to 10 (very confident) for each question. | 5 mins |
Practice using the four questionnaires (WHOQOL-BREF, GDS-SF, POMS-SF, and SEE)

1. The researcher and the three research assistants practiced how to use the four questionnaires with each other.

80 mins

The researcher and the other three research assistants

2. The researcher asked the research assistants to understand that it is not permitted for them to express any individual emotions or opinions while doing a survey.
**The randomization and data collection procedures**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Details</th>
<th>Time</th>
<th>Conducted by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline test</td>
<td>1. The three research assistants tested all participants using the following four questionnaires: WHOQOL-BREF, GDS-SF, POMS-SF, and SEE. 2. The tests were conducted 8:50am–11:30am and 2:10pm–4:50pm on the weekend (Saturday and Sunday) before the intervention begins in Week 1. 3. The three research assistants assisted each participant to complete the questionnaires. 4. If a participant felt tired during the interview, the research assistant working with that participant would ask if the participant was willing to continue, or if they would like a short break. All data were collected in the one sitting, or as soon as possible after any break,</td>
<td>40 mins for each person</td>
<td>The researcher and three research assistants</td>
</tr>
</tbody>
</table>
preferably during the same session. *(see Note below)*

<table>
<thead>
<tr>
<th>Randomization</th>
<th>1. Participants were randomized into an experimental group or into a control group, using computer generated random sampling.</th>
<th>1 day</th>
<th>Statistician provided randomization list</th>
</tr>
</thead>
<tbody>
<tr>
<td>13th week test</td>
<td>1. The three research assistants tested all participants using the following four questionnaires: WHOQOL-BREF, GDS-SF, POMS-SF, and SEE.</td>
<td>40 mins for each person</td>
<td>The researcher and the three research assistants</td>
</tr>
<tr>
<td></td>
<td>2. The tests were conducted 8:50am–11:30am and 2:10pm–4:50pm on the weekend (Saturday and Sunday).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. If a participant felt tired during the interview, the research assistant working with that participant would ask if the participant was willing to continue, or if they would like a short break. All data were collected in the one sitting, or as soon as possible after any break.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
preferably during the same session. *see note below.

4. If a participant was unable to attend the interview (e.g. because of family visiting), the research assistant would ask whether she can interview at another time (i.e. later that day, or on the Monday of week 14). *see note below

5. Missing data was analyzed appropriately following a missing values analysis using intention-to-treat (ITT) and dealing with missing values (e.g. Last Observation Carrying Forward, LOCF).

<table>
<thead>
<tr>
<th>26th week test</th>
<th>1. The three research assistants tested all participants using the following four questionnaires: WHOQOL-BREF, GDS-SF, POMS-SF, and SEE.</th>
<th>40 mins for each person</th>
<th>The researcher and the three research assistants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. The tests were conducted 8:50am–11:30am and 2:10pm–4:50pm on the weekend</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(Saturday and Sunday).

3. If a participant felt tired during the interview, the research assistant working with that participant would ask if the participant was willing to continue, or if they would like a short break. All data were collected in the one sitting, or as soon as possible after any break, preferably during the same session.*see Note below.

4. If a participant was unable to attend the interview (e.g. because of family visiting), the research assistant would ask whether she can interview at another time (i.e. later that day, or on the Monday of week 27).*see Note below

5. Missing data was analyzed appropriately following a missing values analysis using intention-to-treat (ITT) and dealing with missing values (e.g.
Last Observation Carrying Forward, LOCF).

*Note: the data collection and conducting of questionnaires all proceeded extremely smoothly, and no circumstances arose which meant collection of data from a participant was interrupted.

**After the data collection in week 26, ending the intervention**

3. Explain to the participants that the study is complete and thank them for taking part in the study.

4. Give a STEP DVD to all participants (those in the Tai Chi intervention group and those in the control group) after they complete the questionnaires in week 26.

5. Explain that the researcher will provide them with a lay summary of the findings of the study once the data has been analyzed.
Appendix F

Jen-Tao Long-Term Care Statement

Jen-Tao Long-Term Care Statement
Address: No. 29, Shanjiao Rd. Sec 2, Siang 95. Shetou Township, Changhua County, Taiwan.
Administrator: Lu Hui-Jiao
Telephone: 04-8738389
Fax: 04-8724749
E-mail: topbst.liu@mas.hinet.net

To: Ms. Chen-Yuan Hsu
Statement Date: Republic of China 99 year 07 month 08 day
Statement Number: Jen-Tao nursing word 0990000029 number
Speed: General document
Decryption:
Attachment:

Substance: This is permission for collection data of a nursing research proposal “The Effect of Tai Chi on Quality of life of Older People Living in Long-Term Care Using Wheelchairs for Mobility: A Randomized Controlled Clinical Trial”.

Progenitor: Ms. Chen-Yuan Hsu
Duplicate: Jen-Tao Long-Term Care

Supervisor: Zhan Shu-Ying