Tai Chi and Stress:
A Randomised Controlled Trial and Chinese Medicine Pattern Diagnostics

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Certificate of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

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Abstract

Stress is a growing problem in modern society and in severe cases could potentially lead to hospitalisation. The ancient Chinese mind body exercise of *Tai Chi* (TC) is practiced worldwide by millions of people daily and is often accredited with a plethora of health benefits, including reduction of stress. There has been a growing interest in the scientific community to evaluate the efficacy of TC practice for a range of diseases and conditions, in particular the effects of TC in the improvement of psychological and mental health. However the term "stress" itself is a common diagnosis used by both patients and practitioners alike to describe a "condition" generally regarded as subjective in nature and as such each individual will likely present with varying somatic or cognitive signs and symptoms. Currently there are no definitive diagnosis or signs and symptoms for "stress" for both biomedicine and Chinese Medicine (CM). This thesis evaluates the efficacy of TC as an intervention for stress through a randomised controlled trial (RCT) and the use of a questionnaire to identify the CM diagnostic patterns associated with stress

The RCT involved fifty participants who were randomly allocated into one of three groups; TC (n=17), exercise (n=16) or a wait list control group (WL) (n=16). Both TC and exercise groups were required to complete 5 hours per week of either TC or exercise for 12 weeks (total of 3600 minutes), whilst WL maintained their normal lifestyle. State Trait Anxiety Inventory (STAI) which assesses both state anxiety and trait anxiety was used as the primary outcome measure. Secondary outcome measures were the Perceived Stress Scale 14 (PSS14), blood pressure, heart rate variability, visual analogue scale and short form 36. Data were collected at baseline, midway at week 6 and at the completion of the trial at week 12. A two-way ANOVA with repeated measures followed by Bonferroni's post-hoc test was used for statistical analysis. The stress questionnaire was constructed using the signs and symptoms for General Anxiety Disorder and commonly

reported signs and symptoms for stress were cross referenced against TCM textbooks to relate each sign and symptom to possible patterns (*zheng*) and then cross referenced again against the signs and symptoms list to form two gender specific questionnaires. Pattern identification measurement was based on percentage of signs and symptoms present against possible number of signs and symptom per pattern for each gender.

Results for the RCT showed that there were significant improvements from baseline for both TC and exercise groups for the outcomes of STAI, PSS14, VAS as well as mental health and vitality domains of the SF36. Furthermore there were significant differences between groups for TC and the wait list control group for both state and trait anxiety as well as the mental health domain. The stress questionnaire results indicate that the top three pattern for both genders were Heart Qi deficiency, Heart Blood deficiency and Liver Blood deficiency. This result is different to the commonly accepted idea that stress is associated with Liver Qi stasis, however despite the reliability of the instrument a larger cohort size will be needed to ascertain the validity of these findings.

It is hoped that the results from these two studies will be incorporated into future research in both TC and stress diagnosis. The findings from the RCT revealed that TC effectively reduces stress levels in healthy individuals as early as week 6 and may provide a safer and less strenuous therapeutic alternative to exercise. Whilst the results from the stress questionnaire will hopefully help CM clinicians with their understanding of stress related symptoms the choosing the correct treatment principles for their patients.

List of referred papers, conference presentations and posters arising from the research

Publications

ZHENG, S., Lal, S.,Meier, P., Sibbritt, D., Zaslawski, C. 2014. "Protocol: The Effect of 12 Weeks of Tai Chi Practice on Anxiety in Healthy but Stressed People Compared to Exercise and Wait-list Comparison Groups: A Randomized Controlled Trial." *Journal of Acupuncture and Meridian Studies*, 7 (3), 159-165

ZHENG, S., Meier, P., Zaslawski, C. 2014. "Development of a novel questionnaire for the Traditional Chinese Medicine pattern diagnosis of stress", Poster Abstract, *Journal of Integrative Medicine*, 12 (3), 297.

ZHENG, S., Lal, S.,Meier, P., Sibbritt, D., Zaslawski, C. 2014. "The effects of twelve weeks of Tai Chi practice on anxiety in stressed but healthy people compared to exercise and wait-list groups: a randomised controlled trial", Poster Abstract, *Journal of Integrative Medicine*, 12 (3), 297-298.

ZHENG, S., Meier, P., Zaslawski, P. 2013. "WFAS 2013: Selected Conference Abstracts - Development of a novel questionnaire for the Traditional Chinese Medicine pattern diagnosis of stress." *Australian Journal of Acupuncture and Chinese Medicine*, 8 (2), 25-32.

Oral Presentations

Speaker at an international conference

ZHENG, S. 2013. "Development of a novel questionnaire for the Traditional Chinese Medicine pattern diagnosis of stress." *World Conference on Acupuncture World Federation of Acupuncture and Moxibustion Societies*, 2-4th November 2013, Sydney Australia..

Invited speaker at an international conference

ZHENG, S. 2012. "Tai Chi and Stress: A randomised controlled pilot study." *International Scientific Acupuncture and Meridian Symposium 2012*, Sydney, 5-7th October 2012.

Poster Presentations

ZHENG, S., Meier, P., Zaslawski, C. 2014. "Development of a novel questionnaire for the Traditional Chinese Medicine pattern diagnosis of stress". Society for Acupuncture Research and the Chinese Association of Acupuncture and Moxibustion Conference, Beijing, China. 30th May to 1st June 2014.

ZHENG, S., Lal, S.,Meier, P., Sibbritt, D., Zaslawski, C. 2014. "The effects of twelve weeks of Tai Chi practice on anxiety in stressed but healthy people compared to exercise and wait-list groups: a randomised controlled trial". Society for Acupuncture Research and the Chinese Association of Acupuncture and Moxibustion Conference, Beijing, China. 30th May to 1st June 2014.

Zheng, S., Lal, S., Meier, P., Zaslawski, C. 2013. "The effects of six weeks of Tai chi practice on anxiety in healthy but stressed individuals compared to an exercise only comparison a randomised controlled trial : Pilot Study. Society for Acupuncture Research Conference, Ann Arbor, Michigan, USA. 18th to 21st April 2012.

Zheng, S., Meier, P., Zaslawski, C. 2011. "The effects of six weeks of Tai chi practice on anxiety in healthy but stressed individuals compared to an exercise only comparison a randomised controlled trial : Pilot Study. International Forum & Exhibition on Integrative Medicine, Sydney, Australia. 21st to 23rd October 2011.

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Contents

List of Figures

List of Tables

Chapter I: Introduction and aims

1.1 Background to the studies

Stress is a major problem affecting the health of many individuals in today's society. The World Health Organisation (WHO) states that mental health problems, such as stress will likely become the second most common disability by the year 2020 (Greener, 2002). According to the Australian Institute of Health and Welfare (AIHW) 2,169 hospital episodes in psychiatric hospitals in Australia 2001-02 were for neurotic, stress-related and somatoform disorders (AAP, 2010) and a poll recently conducted in 2011 by Lifeline, a non-government organisation, reported that 93% of Australians were stressed, up from 90% in 2010. Furthermore a similar survey conducted by the Australian Psychological Society (Casey, 2011) in 2011 also found that 12% of Australians reported experiencing stress in the severe range, with one in three Australians reporting that they were suffering from depressive symptoms, and one in four from anxiety.

Patients with severe anxiety are generally treated with either pharmaceutical medications, psychotherapy or a combination of both (NIMH, 2009), however before treatment can be administered careful diagnoses must be undertaken, which could present as a social stigma for healthy individuals who have yet developed pathological or somatoform anxiety conditions. This may partially explain why people with anxiety are also beginning to explore complementary and alternative (CAM) options for treating their anxiety, with one such option being Tai Chi.

Taiji 太极 or *Tai Chi* (TC) as it is more commonly known outside of Asia, is an ancient Chinese mind body exercise that is practised worldwide by millions of people daily with the belief that it has potent healing effects upon the practitioner and is a fundamental path for longevity (ChinaSports, 1984). Whilst the mechanisms behind TC are not fully understood, it is purported that TC calms the mind and benefits health (ChinaSports, 1984). More recently there has been growing interest in the scientific community to

evaluate the efficacy of TC for various physiological and psychological conditions ranging from fear of falling in the elderly (Logghe et al., 2009, Song et al., 2010, Wu et al., 2010), balance (Au-Yeung et al., 2009, Hackney and Earhart, 2008, Lelard et al., 2010), metabolic disorders (Zhang and Fu, 2008, Chen et al., 2010, Lam et al., 2008), arthritis (Fransen et al., 2007, Hall et al., 2009, Lee et al., 2009, Lee et al., 2007, Song et al., 2010, Wang et al., 2008, Wang et al., 2009a) to psychological health (Wang et al., 2009b, Chen et al., 2010, Wall, 2005).

The recent reporting in 2011 of eight clinical trials investigating anxiety and two investigating stress reflect the growing interest in the use of TC for psychological conditions (Wang et al., 2009b). However, these studies showed mixed results. More recently a systematic review of the effects of TC on psychological wellbeing appraised 40 clinical trials conducted between March 2009 and May 2010 with a total of 3817 subjects (Wang et al., 2010). The authors concluded that TC significantly decreased anxiety levels (Effect Size=0.66; 95% CI: 0.29, 1.03), reduced depression (ES=0.56; 95% CI: 0.31, 0.80) and significantly improved mood (ES=0.45; 95% CI: 0.20,0.69). Despite this conclusion the claim that TC benefits psychological wellbeing is still contentious as many of the reported studies were poorly designed and lacked statistical power (Wang et al., 2010).

This indicates a need for a well-designed and statistically powered randomised controlled trial (RCT) to investigate the effects of TC on mental health, and in particular psychological stress.

1.1.1 Concept of Stress

The term stress has only recently been introduced into the modern lexicon, with the term being originally credited to Hans Seyle (Rosch, 2014) in the mid-20th century. The term stress is not a clear operational definition due to the subjective nature of the symptoms associated with the “feeling of stress”. As such there are no definitive diagnosis or a

definitive list of signs and symptoms for stress (First and Tasman, 2004, AIS, 2012). This is similar within Chinese Medicine (CM) as most practitioners classify stress as a disorder of the liver (Maciocia, 2004) or simply treating stress as a symptom of a different underlying Chinese medicine diagnostic pattern. Confusion arises when Chinese medicine practitioners see stress as a symptom of a certain pattern, as stress itself is not a single symptom but rather a cluster of symptoms which convey the subjective sensation of "feeling stressed". Whilst there are many questionnaires used in research which attempt to quantifiably measure the levels of stress (Ware Jr, 2004, Cohen et al., 1983), currently there has been no study dedicated to identifying the parameters of stress or the related symptoms. This creates a paradox, as there is a multiplicity of research attempting to measure stress without first establishing a clear operational definition. Furthermore it is only through the identification of the symptoms of stress that these symptoms be applied to pattern differentiation or *bian zheng* (辯症) to identify Chinese medicine diagnostic patterns associated with stress.

To accomplish this there needs to be a reliable instrument to collect data on the presence of symptoms which patients who identified themselves as stressed usually associate with the state of "feeling stressed" and apply a matrix to apply the data collect into patterns. The design of this questionnaire will have applications in research but also may become a valuable clinical tool to help clinicians better diagnosis patients suffering from stress and apply the appropriate treatment principles.

1.2 Study Aims

1.2.1 Tai Chi Randomised Controlled Trial (RCT)

The primary aim is to evaluate the effect of 12 weeks of TC practice on stress in healthy adults when compared with an exercise active control group and a non-active wait list control group.

In response to this aim, two hypotheses are given; 1) TC is statistically non-inferior to exercise in moderating stress; and 2) TC is statistically superior to doing nothing (non-active wait list control) in moderating stress.

The study design also allows for further comparisons to be made for both within and between group changes, namely to assess if supervised TC practice performs as well when unsupervised as well as how unsupervised TC practice compares to both the exercise and wait list groups at 12 weeks.

1.2.2 Stress questionnaire

The aim for the stress questionnaire is;

1) to create a reliable questionnaire to collect stress associated symptoms through self-reporting;
2) identify the most commonly associated stress related symptoms;
3) distinguish the most common CM diagnostic patterns for stress as reported by healthy but stressed individuals.

1.3 Format of thesis

Chapter II: Literature review

Chapter II reviews the research literature on the current TC research specifically the TC research in mental health and stress, as well as the present understanding and theories associated with stress.

Chapter III: Methods – Tai Chi RCT

This chapter describes the experimental design and procedures associated with the development of the TC RCT. It includes a justification of the statistical methods used for data analysis.

Chapter IV: Results – Tai Chi RCT

Results from the TC RCT will be presented in the order from the primary outcome measure to secondary outcome measures as described in chapter III. Results from an ANOVA (using a general linear model with a Bonferronni adjustment for multiple comparisons) for the three arms of the RCT are presented. Comparisons are both within the one intervention as well as between the three groups for each outcome measure. To assist the flow of the text, only the simultaneous confidence intervals and associated *post hoc* significance alpha levels are included while the complete ANOVA result tables appear in Appendix 4.

Chapter V: Discussion – Tai Chi RCT

This chapter discusses the implications of the results from the RCT and includes discussion on the limitations and prospective implications.

Chapter VI: Methods – Stress Questionnaire

Chapter IV describes the design, and procedures associated with the design, methods and administration for the questionnaire.

Chapter VII: Results – Stress Questionnaire

Chapter VII presents data from the stress questionnaire. Data are presented in the form of graphs and text and follow in order of reliability, pattern differentiation and symptom frequency.

Chapter VIII: Discussion – Stress Questionnaire

Chapter VIII considers implications arising from the questionnaire including its limitations and clinical repercussions.

Chapter IX: Overview and recommendations

A general summary of the findings for both studies together with recommendations for future TC studies is outlined in the final chapter.

References

This lists all references, in alphabetic order, used in the text of the thesis.

Appendices

Appendix 1: The information sheet and informed consent form given to each subject for Tai Chi RCT.

Appendix 2: Outcome measures used in the Tai Chi RCT

Appendix 3: Table of summary of results for the Tai Chi RCT

Appendix 4: ANOVA analysis tables for the Tai Chi RCT

Appendix 5:. Stress Questionnaire

Appendix 6: Correlation Matrix for Stress Questionnaire

Chapter II: Literature review

2.1. Introduction

Stress is a major problem affecting the health of many individuals in today's society and in severe cases can lead to hospitalisation or worse. Whilst stress may not always be a negative factor, stress beyond the body's capacity for homeostasis can be a serious health problem for the individual. According to the World Health Organisation mental health problems, such as stress will likely become the second most common disability by the year 2020 (Greener, 2002). According to the Australian Institute of Health and Welfare 2,169 hospital episodes in psychiatric hospitals in Australia 2001 to 2002 were due to neurotic, stress-related and somatoform disorders whilst a poll conducted by Lifeline (a non-government mental health counselling service) in 2010 showed that there was an 650,000 increase in the number of Australians who felt stressed from the previous year (AAP, 2010).

2.2 Theories of Stress

The term stress was first coined by Hans Seyle (Rosch, 2014) over 50 years ago. The term does not define a specific physiological disorder, but rather a broad concept. As a broad concept, stress can refer to various notions (Eriksen and Ursin, 2006b). The Greek philosopher Hippocrates, commonly referred to as the father of medicine, was the first to attempt to define illness from a "balance" or homeostatic perspective (Aich et al., 2009). Hippocrates believed that homeostatic balance is essential for health and a shift of this balance will manifest as a disease, thus stress or stressors are the threats which shift the body from its homeostatic harmony (Aich et al., 2009). This representation of stress and health is very similar to the fundamental concepts of Yin and Yang in Daoist philosophy (Chen, 2006) and the Chinese Medicine (CM) view of health and healing (Kaptchuk, 2000).

Whilst the understanding of stress is incomplete, there are three statements made by Levine and Ursin (1991) in the early 1990s which represent a consensus understanding of stress: "*1)There are no common physical characteristics of stress stimuli. 2) All stimuli are evaluated or filtered by the brain before gaining access to any response system and 3)Psychological (emotional) loads are the most frequently reported stress stimuli*"(Levine and Ursin., 1991). These three statements have remained the accepted consensus on the understanding of the term (Eriksen and Ursin, 2006b). Eriksen and Ursin (2006b) thus state that the effects on the brain are vital aspects of stress in any living organism, the only exception would be for plant ecology.

Eriksen and Ursin (2006b) further explain the stress response as a "*general alarm in a homeostatic system*". This alarm is triggered when there is a discrepancy between the set value (SV) and the actual value (AV) of a set variable. This forces the individual to increase or compensate performance so the AV becomes SV and will continue to do so until the discrepancy is no longer present (Eriksen and Ursin, 2006b). This alarm system is essential for a healthy physiological operation of the body, however whilst short term triggers are not malignant in nature, pathophysiological events do occur if this alarm is sustained. This will then lead to and manifest as disease and illness.

From a gross neurohormonal perspective, psychosocial challenges or stress affects the central nervous system (CNS) and these stimuli or signals then causes a response from the CNS to cope with these stimuli, which often comprises of an "emotional " response to stress (Folkow, 2006). This interaction involves the combination of the three efferent control systems: the somatomotor system, autonomic (visceromotor) system and the hormonal system (Folkow, 2006). This intrinsic interaction allows for the involuntary autonomic and hormonal systems to be equipped to allow the somatomotor system to work and be able to react to the stimuli as the most efficient response to a stimulated event, such as in the case in the classical "Fight of Flight" model. However if these psychosocially caused neurohormonal expressions are repeated or become chronic in

nature, then they can be detrimental to one's health. It is then the epidemiological nature of this condition that most people consider as being "stressed"(Levine and Ursin., 1991).

Physical, chemical and psychological responses occur as an individual becomes stressed. The cognitive response has been summarised by Eriksen and Ursin (2006b) into three separate categories of cognitive outcome expectancies: Coping, Helplessness and Hopelessness. Coping is the outcome expectancy that when facing stress, everything an individual does will have a positive outcome, however it is important to note that whilst coping is positive, an overconfident sense of coping can lead to narcissism and excessively positive outcome expectancies. Helplessness is where the individual believes that none of their responses will have an effect on anything. This state whilst seemingly negative can begin to equalise once the individual realises that since there is no solution, they eventually accept the situation (Eriksen and Ursin, 2006b). Hopelessness is the belief that every response undertaken by the individual will have a negative outcome. According to Eriksen and Ursin (2006b), it is with the expectancy of Hopelessness that it can become a model for depression as it makes the individual experience a sense of causational guilt (Eriksen and Ursin, 2006b).

Stress also has various cultural dimensions and these cultural dimensions play a vital role in an individual's worldview and beliefs and ultimately their ability to cope with stress. Traditional Freudian psychology, which is the accepted consensus amongst most of the Western world, does not correlate greed and desire to emotional and mental disorders, instead it hypothesises that the pursuit of desires and gratification are necessary for mental health and happiness (Chen, 2006). The problematic nature of this psychological perspective is problematic in modern society as the pursuit for wealth, fame and power has become more apparent as is the ensuing stress that follows. In contrast to the Freudian perspective, Chinese Daoist philosophy seeks contentment as the source of happiness (Chen, 2006). Chen (2006) states that within Daoist philosophy the pursuit of happiness and pleasure are generally seen to be short lived and the pursuit for happiness by nature will "*...inevitably give rise to aversion or rejection of what is seen to be*

unpleasant or unhappy." As such Daoist methods of coping with stress relates to the psychology and philosophy of self-acceptance and "do nothing," or in Chinese *wuwei* (无为) (Slingerland, 2014). The concept of *wuwei* is simply that the best form of action is often inaction or no action, in this situation by doing nothing one cannot positively or negatively affect an outcome but instead accept the situation and let nature takes its course (Chang, 1987). Correspondingly the "do nothing" approach is also similar to the concept of "unconditional acceptance" used by several schools of Western psychotherapy and in particular with rational-emotive-behaviour-therapy (REBT) (Chen, 2006). Thus using the philosophy of *wuwei* to cope with stress the individual bypasses the conventional outcome expectancies of Coping, Helplessness and Hopelessness as since there is no action taken, there can be neither positive or negative outcomes.

Daoist stress coping methods are not limited to the *wuwei* philosophy but also include practices for "mind body integration" (Chen, 2006). This includes both meditative sitting exercises similar to the Buddhist tradition as well as moving exercises such as *Qi Gong* and *Tai Chi* (Bian, 1987). Both of these practices involve the integration of the mind, the body and the *Dao* or nature through breathing and movement (Bian, 1987, ChinaSports, 1984). Therefore these Daoist exercises may potentially be regarded as an alternative non pharmaceutical method for individuals to improve their ability to cope with stress.

2.3 Stress hormones

The two main hormones associated with stress are cortisol and catecholamines. When an individual faces a stressor, there is an increase in plasma cortisol (Levine and Ursin., 1991, Chandola et al., 2008). This reaction is to maintain the homeostatic balance. Levels of plasma cortisol should return to normal once the individual begins to cope with the stress. However chronic stress can lead to a lack of restoration within the system, leading to continued secretion of cortisol (Eriksen and Ursin, 2006a).

Catecholamines are secreted during physical or emotional stress, which prepare the individual for a "fight or flight" sympathetic response (Vorvick, 2011). The main catecholamines are: dopamine, norepinephrine, and epinephrine.

2.4 Current Treatments for Stress

Whilst there are no specific pharmaceutical treatments for stress, there are a variety of medications available for stress related anxiety. These treatments generally comprise two main categories; anti-anxiety medication or anti-depressant medication (BeyondBlue, 2014). For anti-anxiety medication the most common drug class is Benzodiazepines, which include the drugs Xanax (alprazolam), Klonopin (clonazepam), Valium (diazepam) and Ativan (lorazepam) (Smith et al., 2014, NIMH, 2009). These drugs are also known as tranquilisers and work to reduce anxiety via depressing the central nervous system (CNS). However because the pharmacodynamics of benzodiazepines function to slow down the CNS, they are also accompanied by a range of side effects. These include drowsiness, lack of energy, clumsiness, slurred speech, confusion, disorientation, memory loss, nausea, dizziness and blurred vision. In addition there are also those individuals who have paradoxical reactions to tranquilisers and these pharmaceutical drugs may actually aggravate the condition causing increased anxiety, irritability and agitation which could also manifest as mania, rage and hallucinations (Smith et al., 2014, Arnetz, 2006).

Some anti-depressant medications; such as selective serotonin reuptake inhibitors (SSRIs), tricyclic antidepressants (TCAs) and monoamine oxidase inhibitors (MAOIs); have been shown to relieve symptoms of anxiety (Smith et al., 2014). These drugs are often preferred over anti-anxiety medication due to the reduced chance of abuse and addiction, however due to the fact that it requires at least four to six weeks before therapeutic benefits can be experienced it cannot be used as situationally as anti-anxiety medication (Smith et al., 2014, Anxieties, 2014). Anti-depressant medication also have a

variety of side-effects, including; nausea, nervousness, headaches, sleepiness, sexual dysfunction, dizziness and weight gain.

These pharmaceutical treatments both have a wide range of side effects and are generally prescribed to patients with quite severe anxiety disorders which have developed from stress. Stress however can manifest on different levels and in the general populace does not present as severe anxiety or other psychosomatic disorders. Furthermore there is always the social stigma associated with mental health conditions which may be exacerbated with the use of pharmaceutical drugs (Sirey et al., 2001).

Alternatives for stress disorders frequently sought are cognitive or talking based treatment therapies. The most common is cognitive behaviour therapy (CBT) (Rubin and Wessely, 2006). CBT works by dismantling problems to smaller components and changing the way a patient sees or views certain situations (Blenkiron, 2013). CBT has been shown to help with various chronic illnesses, many of which have no clear aetiology. One such example is the use of CBT to normalise cortisol levels in patients suffering Chronic Fatigue Syndrome (CFS) (Cleare, 2003). Whilst CFS is not directly related to stress, it is believed that the self-perception of patients with CFS can impact on their expressions of the condition, one of these being stress (Cleare, 2003). Cortisol levels are also a vital hormone involved in the stress response (Eriksen and Ursin, 2006a) and normalisation of cortisol levels can be an important biomarker that there is an reduction in stress. However one limitation of CBT is the need to seek aid from either a psychiatrist or counsellor and the accompanying social stigma which follows. All the current therapies for stress mentioned, both pharmaceutical and non-pharmaceutical, all require a certain level of severity before they can be administered and may be accompanied by social stigma. Therefore there is a need for a positive intervention to help with the coping of stress for milder cases of stress and does not carry the burden of social stigma.

2.5 History and development of Tai Chi

Tai Chi (TC) or *Tai Ji* (Ch: 太极) is an ancient Chinese mind-body exercise that is practiced worldwide by millions of people daily with the belief that it has the potent healing effects upon the practitioner and is a fundamental path for attaining longevity (ChinaSports, 1984). Whilst the mechanisms behind TC are not fully understood, there is general consensus among the general population that TC calms the mind and benefits health. The term TC or loosely translated as the "supreme ultimate" was originally derived from a divination concept based on the ancient Chinese text, the *Classic of Changes* or *Yi Jing* (Ch: 易经), encompassing the concept of "true completion and harmony", whereby the symbiotic existence of the two dichotomised forces of *Yin* and *Yang* become a complete whole entity (Sohn, 1989). This concept was then imparted onto the emerging martial art along with the name to emphasise the dual nature of the art, becoming *Tai Ji Quan* or *Tai Ji Jian*; respectively the empty handed and swordplay manifestation of TC. Historically the first documented practice of TC was from early *Qing* dynasty (1644-1912 CE) and according to the literature, TC was first practiced in *Chen* family village in Hebei province, China (Ch: 河北陈家沟）(Kang, 1990). It is believed that from the *Chen* family village it was passed down to Yang Lu Chan (Ch: 杨露禅), who adapted it to become what is now known as *Yang* style TC. *Yang* style TC was then further adapted to become *Wu* and *Sun* and others styles of TC (Kang, 1990, Zheng, 2011). Other stories about the creation of TC involve the legendary Daoist eremite priest, Zhang San Feng (Ch: 张三丰) who was believed to have created TC after observing a struggle between a snake and an eagle (Kang, 1990, Hua, 2007).

Whilst the art is Chinese in origin, the debate on the actual creator of TC is ongoing, with the art evolving into many various styles including *Chen, Yang, Wu, Sun* and others. Despite the various styles, this did stop the spread and popularity of TC nationally in China during the late Qing dynasty, however it did not spread internationally until after the creation of the simplified 24 stance *Tai Ji Quan* in 1956 (ChinaSports, 1984).

Classically the mechanical workings of TC is based on the Daoist (Ch: 道家) principles of internal cultivation by training the internal Dan or elixir. Daoists adepts believe that by cultivating the internal energies in the internal elixir you are able to attain immortality and better health (Cochran, 1996). The first historical evidence of this is sort of Daoist exercise is the evidence of the art of *Dao Yin* (Ch: 导引) in the *Ma Wang Dui Scrolls Ch:* 马王堆卷）(Cochran, 1996) and from there evolved into various forms of Daoist cultivation arts including the five animal play or *Wu Qin Xi* (Ch: 五禽戏) invented by the legendary Chinese physician Hua Tuo (Ch: 华佗) and TC. Dao yin and TC similarly work on the concept that through breathing correctly and with correct physical action the practitioner can improve one's health; the basis of what is known as *Qi Gong* (Ch: 气功) and in Daoist terms, it is the internal alchemy of cultivating the *Qi* into the *Dan Tian* (Ch: 丹田) or Elixir field located within the abdomen (Chang, 1987). More specifically TC is considered to be a very beneficial form of exercise in healing through the harmonisation and cultivation of *Qi* (Lagerwey, 2004) and its simplicity has made it become famous and widespread internationally (ChinaSports, 1984). The combination of both the perceived health benefits of TC and the already existing multitude of practitioners make research into this topic extremely pertinent. Research into the actual health benefits of practicing TC will not only justify or disprove its practice among its practitioners but also due to the multitude of practitioners, any research findings will also have a great importance for society in maintaining health and for treating various health problems

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2.6 Tai Chi Research

Published TC research has become increasingly populous in recent years as the scientific community seeks to both evaluate the purported traditional therapeutic beliefs of TC practice as well as explore the possibility of using TC in the treatment of non-traditional ailments. There has been growing interest in the scientific community to evaluate the efficacy of TC in various physiological and psychological conditions ranging from fear of

falling in the elderly (Logghe et al., 2009, Song et al., 2010, Wu et al., 2010), balance (Au-Yeung et al., 2009, Hackney and Earhart, 2008, Lelard et al., 2010), metabolic disorders (Zhang and Fu, 2008, Chen et al., 2010, Lam et al., 2008), arthritis (Fransen et al., 2007, Hall et al., 2009, Lee et al., 2009, Lee et al., 2007, Song et al., 2010, Wang et al., 2008, Wang et al., 2009a) and psychological health(Wang et al., 2009b, Chen et al., 2010, Wall, 2005).

In the treatment of musculoskeletal conditions such as osteoarthritis and rheumatoid arthritis the research literature shows mixed results. A randomised TC trial on the muscle strength and bone density in women with osteoarthritis in South Korea (Song et al., 2010) involved 82 subjects (mean age of 62) who were assessed on knee extensor muscle endurance, strength and the bone density. Of those 82 subjects, 30 were randomly assigned to a six month study period of 31 stance *Sun* style TC and showed significant increases in knee extensor muscle endurance and bone density, however there were no significant differences in knee extensor muscle strength when compared to the control group (Song et al., 2010). In the research of TC for rheumatoid arthritis a review was conducted in the United Kingdom of published articles from 1996 to 2007 (Lee et al., 2007) . This review evaluated 45 studies finding only ten trials met the statistical and design requirements. Across the trials they reported there were non-significant results of TC effectiveness observed in the areas of pain for two studies, range of movement for two other studies and for fatigue for only one study (Lee et al., 2007). There were mixed results for depression and mood (Profile of Mood State inventory), functional index (based on disability index) and quality of life (using SF36, short form 36 questions) with one particular study showing significant improved findings for every outcome measure listed above. These results indicate that the therapeutic benefit of TC for the treatment of osteoarthritis and rheumatoid arthritis is limited, with more significant results seen in the treatment of osteoarthritis and less convincing evidence for the treatment of rheumatoid arthritis.

The literature within TC research for metabolic diseases also shows that there is some positive evidence to support the efficacy of TC practice in controlling metabolic disease. One such trial focused on metabolic control in women in Beijing, China with type 2 diabetes (Zhang and Fu, 2008). In this trial 20 women diagnosed with diabetes were randomly assigned to either TC or a control group with the TC group practicing TC once daily for 14 weeks (Zhang and Fu, 2008). The results showed significantly lower levels of fasting plasma levels (FPG), fasting plasma insulin (FPI), glycated serum proteins (GSP), total cholesterol (TC), high-density lipoprotein-cholesterol (HDL-C), low-density lipoprotein-cholesterol (LDL-C) and triglycerides (TG) at the completion of the 14 week trial (Zhang and Fu, 2008). These results demonstrate that TC practice could potentially contribute to the treatment and control of the metabolic syndrome condition.

It is apparent form the published literature that there is an increased interest in the role and efficacy of TC in health care. The variation in TC research areas indicate that research has not only been conducted in conventional illnesses thought to be influenced by TC practice but also in some less obvious areas, such as metabolic disease. This coincides with the holistic approach towards the human body and health and the homeostasis concepts underlying the creation of TC. The results, whilst not always positive, show that the health benefits of TC are not purely speculative but there exist observable data to support these claims. Lee and Ernst (2012) in their overview of 35 systematic reviews on the efficacy of TC for a wide range of conditions, concluded similarly that whilst there are contradictory conclusions from the various systematic reviews, only the conditions of fall prevention and psychological health improvement showed convincing evidence.

2.7 Tai Chi Research in Psychological Health

There has been growing research in the scientific community to evaluate the efficacy of TC in the treatment of various psychological and psychosocial conditions. According to the 2001 WHO World Health Report, mental illness affects 450 million people

worldwide and 25% of the world's population will be affected by mental illness in their lifetime (Levav and Rutz, 2002). This led to the increased fervour in research into alternative treatments for mental illness. However whilst TC is *"... believed to improve mood and enhance overall psychological well being, but convincing evidence has so far been lacking..."* (Wang et al., 2010) the need for greater interest and study into the efficacy of TC in the treatment of psychological health should be further investigated.

A 2009 review on TC research in psychological health (Wang et al., 2010), showed that there were a total of 40 TC and psychological well-being studies with 3817 subjects identified. This number was filtered from a total database search result of 2,579 (1,354 in English and 1,225 in Chinese language) published papers to 40 studies due to various reasons for exclusion. From the 40 TC trials, there were reported significantly decreased stress levels observed from instruments such as the Perceived Mental Stress Score, the Impact of Event Scale, and the Chinese Psychological Stress Scores measured in 870 participants (Wang et al., 2010). A significant decrease in anxiety was examined in 1,869 participants from measurements collated from the Profile of Mood States Anxiety subscale; the Depression, Anxiety, Stress Subscale; and the Taylor Manifest Anxiety Scale (Wang et al., 2010). Similarly positive results were reported for depression (2,008 subjects), mood (1,613 subjects) and self-esteem (425 subjects) as measured by various scales (Wang et al., 2010). However whilst the evidence shows that there is a very strong therapeutic effect of TC on psychological disorders with improvements in almost 4000 subjects, the quality of the research is questionable, as of these 40 trials only 17 were randomised controlled trials (RCT) and the remainder were either non- randomised comparison studies or observational studies. This is comparable to a previous systematic review on the effect of TC on psychosocial well-being conducted in August 2008 (Wang et al., 2009b) where only 15 RCT's were detected. This indicates that between August 2008 and September 2009 there were only two additional RCT's conducted on the effects of TC on psychosocial health.

Upon examination of the 17 RCTs conducted on psychosocial health, only two of the trials were performed using healthy adult participants (Wang et al., 2010). The remaining trials were conducted on healthy elderly participants (n = 5), HIV/AIDS infected (n=2), knee or hip problems (n= 2), obese women (n=1), fibromyalgia (n =1), depression (n=1), breast cancer survivors (n=1), frail elderly (n=1) and rheumatoid arthritis (n=1). Of the two RCTs with healthy adults both were conducted in the 1990s (Brown et al., 1995, Jin, 1992) almost 20 years ago.

Jin (1992) conducted one of the two studies which involved healthy adult participants in Australia with 96 participants (mean age of 36 years old). The participants were tested for changes in stress, anxiety, mood and emotion. The outcome measures used were the Salivary Cortisol Level for stress, State Trait Anxiety Inventory (STAI) for anxiety and Profile of Mood States (POMS) for mood and emotion. The results showed a significant improvement in POMS across all groups (TC practice, TC mediation, brisk walking or neutral reading) and the TC group particularly showed more reduction in STAI than the reading group. However the data collected from the trial was performed from a single one hour dose of TC practice, TC meditation, brisk walking or neutral reading, making it difficult to conclude whether these improvements can be maintained over a longer period of time or whether TC actually improves psychological health.

The other study involving 135 healthy adults (mean age of 53) was conducted by Brown et al (Brown et al., 1995) in the United States of America. Participants were randomised into one of three groups; TC practice, various intensity walking and a wait list. The TC intervention comprised of three 45 minute sessions a week for 16 weeks. The outcome measures used were POMS, STAI, State-Trait Anger Expression Inventory (STAXI), Positive and Negative Effect Schedule (PANAS), Rosenberg Self-Esteem Scale (RSES) and Life Satisfaction Elderly Scale (LSES). These outcome measures sought to quantify changes in mood, anxiety, anger, positive and negative effect, self-esteem and satisfaction. Results from the study showed that female TC group experienced reductions in mood disturbance, general mood and significant decreases in anger (Brown et al.,

1995). However there were no significant changes for stress or anxiety. Of note was that the age of participants was ranged from middle aged to borderline elderly (40-69 years old) and was not representative for younger and more nominal adult age range.

Upon analysing these two studies it can be noted that there was an absence of data regarding the effects of TC on psychosocial health in healthy adults between the ages 18-50 years. The design of both studies was also flawed as they did not investigate the issue of effect duration, specifically over a longer duration and whether the effects of TC can be sustained over a reasonable time. Findings from these studies also fail to be convincing in terms of statistical inference and whether there were any real effect of efficacy elicited by TC in the treatment of stress and anxiety. Furthermore these studies were administered 20 years or more ago. Robust studies are therefore needed with more rigorous research design to ensure a decisive understanding of the effects of TC for psychological health.

Whilst there has been insufficient research investigating the efficacy of TC in healthy individuals, there have been other studies evaluating the psychological implications of TC for "unhealthy" participants. For example, Pang et al (Pang et al., 2010) evaluated the efficacy of six weeks of TC practice for Attention Deficit Hyperactivity Disorder (ADHD). This study comprised of 19 adolescents (mean age 14) with approximately 50% (n= 9) diagnosed with ADHD, and the remainder with other types of depressive or anxiety disorders. The participants were randomly allocated into either a TC group (n=10) or a control group (n= 9). After a six week intervention of TC, a decrease in hyperactivity scores was reported to have dropped from 47.11 to 45.22 ($p= 0.03$) and a decrease in the ADHD index from 52.00 to 51.90 ($p= 0.005$) were observed in subjects practicing TC. From this study it can be deduced that TC is very effective in controlling ADHD at week six. However the study also showed that a follow-up measure at week 12, the effects were not long lasting as the hyperactivity scores between groups were no longer significant and the TC group returned to using medication. Pang (2010) inferred that the poor results from the follow up was due to the lack of continued practice of TC

after the initial six weeks. This study raises two points of discussion regarding the use of TC in the treatment of ADHD; first that support strategies are needed to ensure TC practice continues once formal instruction has stopped and testing should follow after to examine whether or not this will improve efficacy of TC once implemented. Second, the study results cannot be generalized due to a small sample size of 19 participants. Further studies are needed with greater participant numbers to assess the efficacy of TC in ADHD.

A recent pilot study on the effects of TC on cancer patients was conducted in Columbia, United States of America (Reid-Arndt et al., 2011). The study showed that there were reduced neuropsychological complaints and enhanced neuropsychological functioning. The study consisted of 23 female cancer survivors with an average age of 62 years old, who attended two 1 hour TC classes a week for a period of 10 weeks. The psychological measures used were the Impact of Event Scale – Revised (IES-R) and a modified POMS to measure the effects of TC on the subscales of depression, vigour, confusion, tension, anger and fatigue (Reid-Arndt et al., 2011). Measures were recorded at baseline and at completion of the trial and analysed by ANOVA. The results showed a statistically significant reduction in the total IES-R, although only marginally ($p=0.49$). This study however was limited by its quasi-experimental nature, lack of control and randomisation, thus results need to be interpreted cautiously.

The effects of TC on psychological well-being, in particular stress, is more aptly demonstrated in a Taiwanese study (Tsai et al., 2003) involving participants who were borderline and type stage I hypertensive. Hypertension is purported to be a major resultant effect of stress and hypertension is often a precursor to coronary heart problems (Chandola et al., 2008). This perception however needs to be validated in further psychological well-being studies. In this study 76 participants (mean age of 51) were randomly allocated into TC ($n=37$) or a control group ($n=39$). The TC group participated in three 50 minute *Yang* style TC practice per week for 12 weeks. The control group continued their usual activities. Data were obtained from the two groups, at baseline and

at the conclusion of the study at 12 weeks; no follow up evaluations were obtained. The outcome measure administered for psychological well-being was the STAI which sought to measure stress through the subscales of State Anxiety and Trait Anxiety. State Anxiety is an individual's reaction to stress and their emotional state at a particular time (Spielberger, 1983). Trait Anxiety is related to an individual's personality trait and how they perceive stress. The relationship between State and Trait Anxiety is that an individual's Trait Anxiety can determine the ability to respond to and the intensity of a State Anxiety reaction (Spielberger, 1983). The results showed significant decreases in STAI scores for both the State and Trait Anxiety subscales for the TC group ($p<0.01$), whilst no significant differences were observed for the control group (Tsai et al., 2003). The results indicate that TC may be an effective treatment for stress, especially for mildly effected hypertensive patients. The non-psychological outcome measures also reflect positive metabolic outcomes for TC practice in hypertensive patients, as there were significant decreases observed for both systolic and diastolic blood pressure ($p<0.001$ and $p<0.05$ respectively), cholesterol ($p<0.01$), triglycerides ($p<0.05$), and both low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C) ($p<0.01$ and $p<0.05$ respectively) (Tsai et al., 2003). The findings reported in this study, strongly support the possibility of TC becoming an effective treatment for psychological well-being as well as complementary therapy in conjunction with standard pharmaceutical medicine for the treatment of signs and symptoms associated with hypertension and metabolic syndrome.

While the evaluation of TC for the treatment for psychological health may be more recent, it coincides with the use of other physical exercise for psychological health. A 1991 (Crocker and Grozelle) study was reported to evaluate whether acute aerobic exercise reduced State Trait Anxiety, when compared to a group given autogenic relaxation and a standard control group. The interventions implemented for aerobic exercise, comprised of 40 minutes of an aerobic exercise program where participants' heart rate reached 70-80% maximum while for the autogenic relaxation group participants were positioned in a supine position and listened to 30 minutes of a

relaxation tape. The State Anxiety was measured using the STAI, which comprises the two subscales of State Anxiety (Y-1) and Trait Anxiety (Y-2); however for this study only the State Anxiety subscales was administered. To justify the use of the STAI in this study the authors stated that the STAI is a highly reliable measure for both stress and anxiety, which has been determined to have internal consistency alpha coefficients ranging from 0.83 to 0.92 for State Anxiety (Spielberger, 1977). The results from the study showed that both experimental groups were significantly different from the control group at the post intervention measurement time ($p<0.01$). Both experimental groups were significantly improved post and pre-intervention, indicating that both aerobic exercise and autogenic relaxation were effective in reducing the State Anxiety subscale. Despite the reduction in STAI scores, there were no significant differences observed between the aerobic exercise and the autogenic relaxation group, indicating that both groups may be equally effective in reducing stress. However the limitation of this study was that it was a short term measure design with no longer term follow up making the longer effects of exercise and autogenic relaxation on stress and anxiety unknown. A paucity of knowledge remains concerning the situation in modern society where most stressed individuals believe themselves stressed, not simply due to an acute episode of stress but more as a result of chronic ongoing stress (Eriksen and Ursin, 2006b).

Recent literature reveals that acupuncture has also become a possible option for the treatment of stress and other psychological conditions, A study by Huang et al (Huang et al., 2011) aimed to investigate if acupuncture could reduce stress in 18 healthy participants. The participants were randomised into three groups; acupuncture (n = 6), attention (n=6) and control (n =6). The acupuncture group received weekly traditional Chinese acupuncture weekly treatments for five consecutive weeks and each participant was treated with individualised pattern differentiation and diagnosis (Huang et al., 2011). However for standardisation of point selection, all participants received the same core acupuncture point prescription and if necessary, additional points were added at the practitioner's discretion (Huang et al., 2011). The core points were: *BaiHui* 百会 (DU20), *ShenTing* 神庭 (DU24), *YinTang* 印堂 (EX-HN3), *HeGu* 合谷 (LI4), *NeiGuan* 内关

(PC6), *ZuSanLi* 足三里 (ST36) and *TaiChong* 太冲(LR3). The attention group basically formed a placebo group for this study, as the participant would have a consultation with the same practitioner as the acupuncture group and undergo a general consultation without any specific Chinese medicine diagnostic techniques and no subsequent treatment following consultation. The control group formed a standard wait list group for the duration of five weeks. The psychological measure used was the Perceived Stress Scale (PSS14), a 14 question questionnaire with seven negative and positive questions relating to perceived stress levels (Cohen et al., 1983). The results from this study revealed there were no significant differences before and after treatment in any of the three groups. There were also no differences between groups at baseline and post treatment (Huang et al., 2011). This indicates that whilst there is interest in the use of acupuncture to help treat stress the results are not significant to prove that there is any efficacy at all. However it should be noted as this was a small study of 18 subjects and as such it was not powered to obtain statistically significant results and therefore their results need to be interpreted cautiously.

Disorders in psychological wellbeing have become a major health concern in modern society, with stress becoming one of the most worrying conditions, affecting both healthy and unhealthy individuals. As a result there have been various studies conducted using complementary and alternative medicine approaches to determine whether individuals using these approaches cope with stress as reported using psychological measures. From the literature it is obvious that TC has a effect on psychological well-being especially in regards to participants who suffer from hypertension, metabolic disorders and ADHD. The majority of the research conducted till now lacks rigour and fails to provide significant results and decisive conclusions. Therefore there is a huge gap in understanding the effects of TC on healthy individuals, in particular in regards to whether or not there is a long lasting effect from the TC on psychological well-being. Furthermore it is unlikely that those individuals practicing TC will only attend one session of TC or that a single session of TC will lead to a sustained effect on an individual's overall psychological well-being. Existing studies on psychological health implemented in

healthy adults are conducted over 20 years or more ago and with the advancement of scientific research, these results should also be re-evaluated. This identifies the importance for further research into the efficacy of TC on stress in healthy adults, conducted over a significant duration of time for 12 weeks. The study will also need to accommodate into the research design, the necessity of assessment to assess if there is any sustainability of the effects of TC. Furthermore the design will need to have the TC compared to a control group and a previously accepted form of stress coping, such as exercise in a three arm parallel RCT to truly evaluate the efficacy of TC. It is only in this way that a rigorous study can be conducted to evaluate the efficacy of TC on stress in healthy individuals.

Chapter III: Methods – Tai Chi RCT

3.1 Trial design and protocol

The design is a prospective parallel three arm randomized controlled trial with repeated measures. Participants will be randomly allocated to three equally sized groups, comprising of a TC intervention group, an exercise group and a wait list group. The TC intervention group will be the primary intervention group with the exercise group acting as an active comparison group and the wait list group as the non-active control group. The use of a three arm design is to differentiate between the benefits of physical movements and the mind-body aspects unique to TC. The wait list group will control for regression to the mean and other time tied factors. The protocol for the study was developed using the 2013 Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) (Chan et al., 2013) with SPIRIT item numbers included in brackets where appropriate.eg. *(SPIRIT item 6b & 8*). The trial protocol was published in an international peer reviewed journal (Zheng et al., 2014).

3.2 Participant Recruitment

Individuals were recruited from the general Sydney metropolitan area in Australia through various media advertisements. General information was provided on both posters and in emails sent to interested participants. Individuals who were interested were asked to reply to a specific email account created for screening purposes and an email response containing additional information on inclusion and exclusion criteria was sent. Those individuals who potentially met the given criteria were screened in person to determine eligibility.

Potential participants who met the screening criteria were required to complete the Lifestyle Appraisal Questionnaire (LAQ) (Craig et al., 1996) and the State Trait Anxiety Inventory (STAI) (Spielberger, 1977) to determine if they fulfilled the requirements for

the study. The LAQ assesses health risks and perceived stress of participants and asks questions regarding smoking habits, family history of severe medical conditions, current medical conditions if any, medication use and serves to identify if potential participants were suitable for the study in terms of physical, mental and social health (Craig et al., 1996). For the STAI a cut off score of 50 was selected as this would place participants in the 90th percentile or higher as "stressed" (Spielberger, 1983). Those participants who qualified for inclusion had the trial explained to them in detail and informed consent was obtained prior to commencing the trial. Participants were asked to sign a declaration stating that they will participate fully to the best of their ability and will continue their involvement in the TC program once they commenced the study. A log book was given to each participant to monitor involvement and home practice of either TC or exercise as well as for reporting of adverse events.

3.3 Inclusion and Exclusion Criteria

The inclusion criteria were:

- between 18-60 years of age and have no serious medical conditions, screened using the LAQ (Craig et al., 1996);
- Must be English literate and able to read and sign the consent form;
- Score above the threshold of 50 on the STAI (Spielberger, 1983).

The exclusion criteria were:

- Currently suffering from a major illness;
- Currently taking anti-depressant medication;
- Currently training or have trained in Tai Chi in the last 12 months;
- Currently exercising on a regular basis (greater than 5 hours of exercise per week on a regular basis);
- Currently pregnant.

(SPIRIT item 10, 11c, 15, 18b, 22 & 26a)

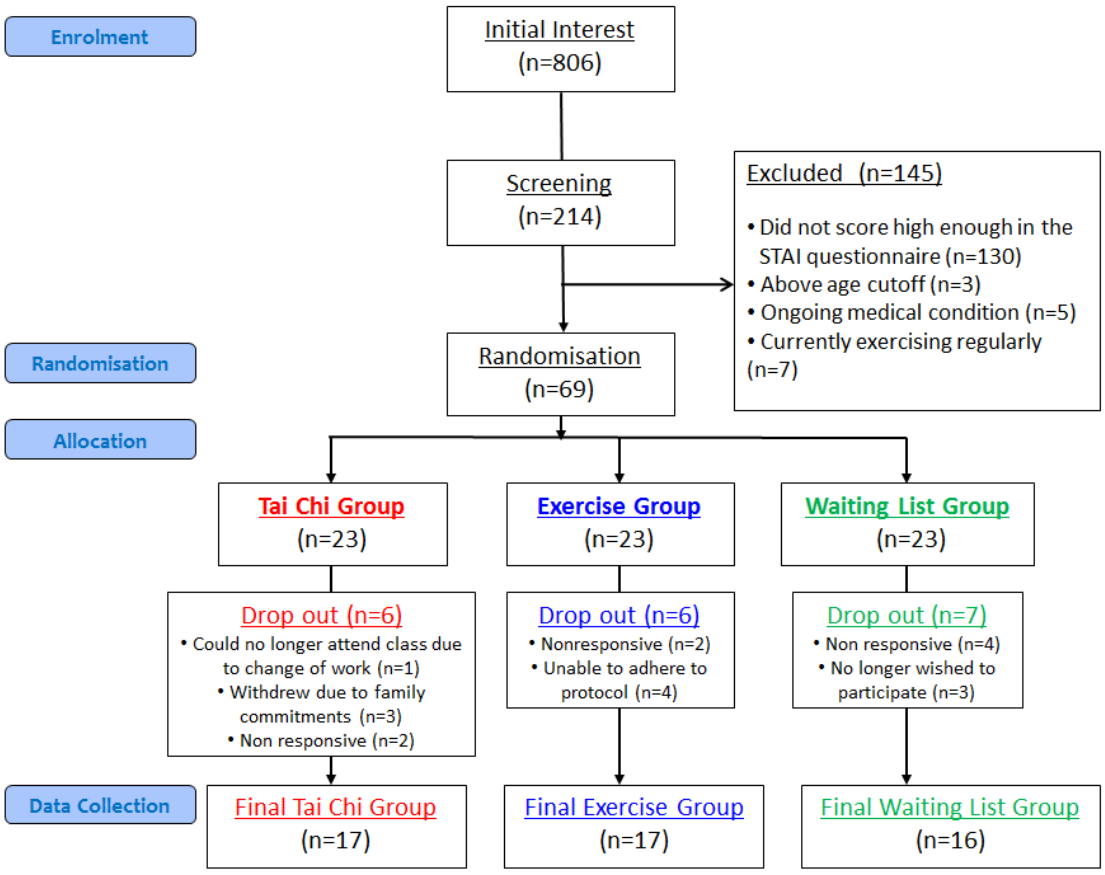

Figure 1: Flow chart of recruitment and completion of the outcome measures

3.4 Data Collection Location

All participants were recruited from the Sydney region and all outcome measures were collected on the Sydney city campus of the University of Technology, Sydney (UTS). The TC sessions were conducted at the University of Technology, and at least two hours

of exercise per week for the exercise group was completed at the University of Technology, Sydney Fitness Centre.
(SPIRIT item 9)

3.5 Ethical Considerations

This trial obtained University of Technology, Sydney Human Research Ethics Committee approval (HREC 2011-107A) and was registered with Australian New Zealand Clinical Trial Registry (ACTRN12611000810910).
(SPIRIT item 2a & 24)

3.6 Intervention

3.6.1 TC Rationale

TC is believed to enhance mood and improve psychological wellbeing. While stress is generally non-pathological in nature, an inability to cope with an increase of stress may lead to pathological psychosomatic presentations which are commonly self-reported as a "feeling stressed". Feeling stressed is becoming more prevalent in modern society affecting both the "healthy" and the sick (Wang et al., 2010). Past research has shown that TC practice has significantly reduced both Trait anxiety and State anxiety from baseline after a 12 week TC trial (Tsai et al., 2003), however there are very few trials which use the STAI as a primary measure for conducting TC research on stress. For this trial the simplified 24 stance *taiji quan* was chosen as the TC intervention. Whilst there are various other styles of TC (i.e., Chen, Yang, Sun, Wu) the simplified 24 stance *taiji quan* was chosen for its simplicity and ease of learning (ChinaSports, 1984). This style was also chosen because it is the most well-known form of TC internationally (ChinaSports, 1984) and could have provided the participants access to self-research materials in terms of books and internet video clips as this form was well represented in books and you-tube clips.

3.6.2 TC Instruction Method

The TC sessions involved group practice with instruction given in both verbal and visual form to demonstrate both the movements and the basic theory behind each action. The TC component was taught in sets of movements and over the period of the trial, accumulated into the entire 24 stance form.

Each TC session consisted of ten minutes of warm up, 45 minutes of TC practice and five minutes of cool down. The TC was led by a skilled instructor (SZ) who has practiced TC for more than 15 years. The TC practice component consisted of TC meditative stance for ten minutes followed by the set of progressive movements each session.

A DVD of the 24 stance sequence was given to each participant of the TC group to encourage home practice and act as a prompt in case the participant failed to remember a movement during home practice. The DVD consisted of the instructor completing the entire TC set to ensure that movements were exactly identical to the face to face TC session.

During this time participants could continue their normal lifestyles (based on the initial inclusion criteria that they were not exercising on a regular basis), and were asked not commence any regular exercise regime or participate in other mind-body exercises; such as yoga or qigong during the study.

A logbook was given to each participant to record practice times and home practice was reinforced by writing reflective entries on their practice and thoughts on various stances in the TC form as well as recording any adverse events.
(SPIRIT item 11a & 11d)

3.6.3 TC Dosage

TC sessions were conducted initially during the first six weeks and during this period there were five TC sessions (one hour each) each week available for participants to attend. It was required that participants must complete at least five hours of TC a week (minimum 1800 minutes during the initial six weeks) and at least two of these must be face to face sessions with the instructor. There were no restriction on how many TC sessions any individual could attend, but the minimum two must be completed. Remaining sessions were recorded in the logbook to ensure sufficient hours were completed.

The six weeks only of face to face instructions was designed to assess if the efficacy of TC is limited only to the condition that participants must have an instructor present or if the efficacy of TC will be reflected and maintained through a further six weeks of self-directed practice. This can potentially lead to self-empowerment of participants without the need to attend specific classes once basics of TC have been learned.

Home practice was expected throughout the 12 weeks (six weeks contact and six weeks non-contact) and was reinforced by logging time and frequency of practice. The total minimum dosage of TC practice for the 12 weeks was 3600 minutes with 720 minutes of face to face class time. Study staff could contact participants via email during throughout the study to ensure adherence to protocol, especially during the last six weeks of non-contact TC.

3.6.4 Active control

The exercise group was an active control group and were provided with gym membership for the duration of the trial (twelve weeks). During the study participants in this group were asked not to undertake any form of mind-body exercises.

As with the intervention group they were given a logbook to record the amount of time, frequency and type of exercise undertaken, as well as for recording any adverse event. It was expected that they complete a total of five hours of exercise per week including at least two hours at the UTS Fitness Centre. The participants were assessed by the staff at the UTS Fitness Centre and were required to attend at least one of the scheduled exercise classes inclusive in the minimum two hours they were required to spend at the UTS Fitness Centre. The total dosage for the active control group was also 3600 minutes with total of 720 minutes of face to face class time required over the period of 12 weeks similar to the TC group. This arm controlled for attention and exercise equivalence.

3.6.5 Non active control

The non-active control involved a wait list group. The wait list group was idle for the twelve weeks of the trial; during this time participants could continue their normal lifestyles (based on the initial inclusion criteria that they were not exercising on a regular basis), and were requested not to commence any regular exercise regime or participate in other mind-body exercises; such as yoga or qigong.

At the completion of the study they were given the same six weeks of TC practice and the DVD after the twelve weeks as appreciation for their involvement. This group controlled for time tied factors.

3.7 Adverse events and discontinuation from the study

Participants were asked to record any adverse events in the logbooks and were asked to withdraw from the study if: 1) due to any physical ailments or injury they are unable to complete the study; or 2) stress in participants is unmanageable without medical intervention.
(SPIRIT item 11b &22)

3.8 Outcome Measures

Primary Outcome measure

The trial measured the level of anxiety in healthy but stressed individuals with the STAI as the primary outcome measure.

Secondary Outcome Measures

Secondary outcome measures were the PSS-14 (Perceived Stress Scale 14 Questions), Heart Rate Variability (HRV), blood pressure (BP), Short Form 36 Health Survey (SF36) and a Visual Analogue Scale (VAS).

All outcome measurements were administered at three points in time, prior to the commencement of the intervention phase (week 0), at the completion of contact intervention (week 6) and at the conclusion of the study (week 12). Participants who met the inclusion criteria were evaluated using the outcome measures prior to the commencement of the trial, at the completion of the contact intervention (end of week six) and at the completion of the trial (week twelve). After this time the wait list participants took part in six weeks of TC practice which was not included in the trial data as appreciation for their participation in this trial. *(SPIRIT item 12, 13 & 18a)*

3.8.1 State Trait Anxiety Inventory

The STAI consists of two subscales which collect self-report data from participants on their State and Trait Anxiety in the form of two questionnaires consisting of 20 questions each (Spielberger, 1977). The State Anxiety (Y-1) section is designed to assess an individual's reaction to stress and their emotional state at a particular time, whilst Trait Anxiety (Y-2) is related to an individual's personality trait and how they perceive stress (Spielberger, 1983). The questions require the participant to rank their current and general feelings towards certain statements between four options of increasing frequency ranging from "almost never" to "almost always."

STAI is a highly reliable measure for both stress and anxiety, which is also supported by internal consistency alpha coefficients ranging from 0.87 to 0.92 for Y-1 and 0.89 to 0.90 for Y-2 (Spielberger, 1983).

3.8.2 Perceived Stress Scale 14

The PSS14 is a 14 question instrument requiring participants to rank the frequency in which they felt or thought about various statements with response descriptors ranging from "never" to "very often"(Cohen et al., 1983). The questions are designed to measure perceived stress and the coefficient alpha reliability for the PSS14 ranges from 0.84 to 0.86 (Cohen et al., 1983).

3.8.3 Heart Rate Variability

HRV was assessed because anxiety generally influences these cardiac parameters adversely. Individuals experiencing anxiety symptoms have elevated levels of circulating cortisol, controlled by the hypothalamic pituitary adrenal axis (HPA axis). Cortisol is known to elevate sympathetic nervous system activity (Davies and Lefkowitz, 1984). While results on anxiety effects on HRV are variable most indicate a reduction in high frequency component of HRV or total HRV due to anxiety (Hovland, 2012, Friedman and Thayer, 1998, Pittig, 2013).

For the measurement of HRV, a three electrode electrocardiogram (ECG) was used (Flexcomp Infinity ® -Thought Technology Ltd, model SA7550, USA). ECG was analysed to derive HRV measures. The two active ECG electrodes were placed level to the 4^{th} intercostal space, approximately 2cm lateral to the sternum. The reference electrode was placed on the left shoulder (Berntson and Cacioppo, 2007). A three lead ECG is sufficient to obtain the R-R measures required for HRV analysis (Berntson et al., 1997).

HRV provides a measure of sympathetic (low frequency) and parasympathetic (high frequency) activities of the autonomic nervous system (Koskinen T. et al., 2009). The entire area under the HRV spectrogram also provides a measure of total HRV. Sympathovagal balance, a measure of the equilibrium between the sympathetic and parasympathetic arms, can also be derived as a ratio of the low frequency to high frequency activity (Eckberg, 1997).

Participants were required to fast from food and caffeinated beverages (four hours) and alcohol (24 hours) prior to the collection of HRV data to reduce possible confounders that may affect results. The ECG for the HRV was obtained for ten minutes at each data collection session with the participant in a seated position with limited contact with the technician.

LF, HF activity, total HRV activity and sympathovagal balance was analysed to identify the effects of the intervention compared across the three arms. This was to provide a measure of change in autonomic activity before and after the entire experimental phase.

3.8.4 Blood Pressure

BP was recorded as anxiety increases peripheral blood pressure and has been shown in several studies (Bystritsky, 1995, Lewis and Drewett, 2006, Johnson, 1987). BP was recorded using a digital sphygmomanometer (A&D Medical, model UA-851, Japan). Systolic (SP) and diastolic (DP) BP was recorded a total of six times per data collection period, three times prior to conducting the HRV and three times following the HRVmeasures. Individual systolic and diastolic data was collected and from it the Mean Arterial Pressure was calculated using the following formula (Meaney et al., 2000):

$$\textit{Mean Arterial Pressure} \approx DP + (SP\text{-}DP)/3$$

3.8.5 Short Form 36 Health Survey

The SF 36 Health Survey (English version) is a commonly used generic health questionnaire for adults which measures 8 domains of health comprising of physical functioning, role – physical, bodily pain, general health, vitality, social functioning, role – emotional and mental health (Ware Jr, 2004). This questionnaire includes 36 main questions which contain several subset questions, with questions relating to the various domains nested into the instrument with the deliberate intention that the participant will need to carefully read and assess each question prior to responding (Ware Jr, 2004). As there is no common consensus on stress stimuli (Levine and Ursin., 1991), various factors which affect the quality of life of participants can contribute to directly or indirectly to perceived stress and the ability to cope with stress. This demonstrates the need to collect data from participant regarding their quality of life.

The reliability of the different domains are 0.93 for physical functioning, 0.89 for role – physical, 0.90 for bodily pain, 0.81 for general health, 0.86 for vitality, 0.68 for social functioning, 0.82 for role – emotional, and 0.84 for mental health (Ware Jr, 2004).

3.8.6 Visual Analogue Scale

The VAS consists of a 100 mm line with the terms “not stressed at all” and “very stressed” on either ends of the line. The participant was asked to mark on the VAS their current stress levels.

3.9 Statistical Methods

3.9.1 Sample Size and Randomisation

Sample size required was 42 participants, with 14 individuals equally and randomly allocated to each group. The sample size is based on Y-1 results of the pilot study completed in 2011 (difference of means from baseline to week 12 between TC and wait

list groups = 17.143, SD = 5.96) and provided a power of 0.8. Similarly with a non-inferiority limit of 10 for Y-1, based on standard deviation for norm scores (Spielberger, 1983), the minimum sample size requirement was 11 per group at a power of 0.8 (difference of means from baseline to week 12 between TC and active control groups = 6.17 SD = 9.02). To account for drop-outs or loss to follow-up the sample size needs to be inflated by 30% (based on pilot data) resulting in 57 participants needing to be recruited (n= 19 individuals per group).

The randomisation process was conducted by a third party not involved in the study. The third party employed the "sealed envelope" method to randomize participants (sealed opaque envelopes which contain the allocation information written on a piece of folded paper which is not visible when held up to a light source) in permutated blocks of 6. *(SPIRIT item 16a, 16b)*

3.9.2 Data Management and Statistical Analysis

All personal information from participants was de-identified and coded. Data was entered by an outcome assessor and analysed by a blinded data analyst.

This was an intention to treat (ITT) study and participants who either dropped out from the study or failed to adhere to the protocol would have their last known data carried forward.

The statistical test involved a two-way ANOVA with repeated measures followed by Bonferroni's post-hoc test. *(SPIRIT item 19, 20a & 20c)*

3.10 Method Discussion

This trial investigated the efficacy of TC on anxiety in healthy individuals implementing three parallel arms and using the STAI as the primary measure. The trial design sought to evaluate the clinical efficacy of TC both as an intervention administered to an individual

under guidance as well as to evaluate if the results can be sustained without the ongoing assistance and supervision of an instructor.

The STAI was chosen as the primary outcome because it is a highly reliable measure for both stress and anxiety, which is also reflected by internal consistency alpha coefficients ranging from 0.87 to 0.92 for State Anxiety and 0.89 to 0.90 for Trait Anxiety (Spielberger, 1983). The importance of the relationship between State and Trait Anxiety to an individual is vital for an individual's ability to cope with stress as an individual's Trait Anxiety can very well determine the ability to respond to and influence the intensity of a State Anxiety reaction (Spielberger, 1983). This is because State Anxiety is an individual's reaction to stress and their emotional state at a particular time and this can fluctuate based on a specific event or situation. Trait Anxiety (Y-2) however, is related to an individual's personality trait and how they perceive stress.

The use of HRV serves as an objective measurement for the study. It is an indirect measure of stress through measuring changes to the autonomic nervous system (ANS) and the equilibrium of the sympathetic and parasympathetic components of the ANS (Brosschot et al., 2007). One understanding of the mechanisms of stress relates to the neurological interaction of stimuli or stressors on the body and the related interaction with the autonomic nervous system (Eriksen and Ursin, 2006a), thereby causing abnormal autonomic and cardiovascular responses (Rubin and Wessely, 2006). Whilst it is established there are correlates between stress and the autonomic nervous system, the results are variable (Berntson and Cacioppo, 2007) and as such the HRV was only included as a secondary outcome measure.

The inclusion of an active control group was to control for the physical or exercise component within TC. This is to ensure that the study does not take measurements solely concerning the physical exercise aspects of TC but also takes into account the non-exercise components that contribute to the purported holistic benefits of practicing TC. As such the active control group was designed to match the TC in total hours required

and also the total hours of supervised group interactions within both groups over the period of 12 weeks. The dosage of intervention time prescribed has been compared to the 2008 report by Sannes et al (Sannes et al., 2008) and it exceeds the average hours reported in past TC studies. While the study is not powered to establish a difference between the TC group and exercise group there may have been a difference between these two groups. Furthermore TC is invariably less physically demanding on the body and does not require specialised equipment present in a gymnasium.

The SPIRIT statement forms a guide for the content required for reporting a clinical trial protocol (Chan et al., 2013), however not all 33 items were covered in this protocol due to the specific peculiarities in the study design.

Chapter IV: Results – Tai Chi RCT

A total of 50 participants completed the study with 17 participants in both the TC and exercise (active control) groups and 16 participants in the wait list (control) group.

As shown in Table 1. The mean age of participants was 33.9 years (range 20-56 years old). After randomisation the mean age in the TC group was 35.4 ± 2.1, while in the exercise and wait list groups it was 32 ± 1.8 and 34.6 ± 2.3 years respectively. There was no statistically significant difference between the groups concerning age ($p>0.05$).

Female participants comprised the majority of the cohort in this study with only six males in the TC group (35.29%), three in the exercise group (17.65%) and two in the wait list group (12.5%).

There were no statistically significant differences between groups for all baseline parameters with the exception being the Short form 36 health survey domain subscale of General Health, where the wait list group was significantly different to both the TC ($p<0.001$, CI 95%, 9.6 to 31.2) and exercise groups ($p<0.001$, CI 5.4 to 27.1) (Table 1).

Baseline Parameters

Variable	Tai Chi (n=17)	Exercise (n=17)	Wait List (n=16)
Demographics			
Age	35.41 ± 2.11	32 ± 1.83	34.57 ± 2.28
Male/ Female	6/11	3/14	2/14
Stress and Anxiety Questionnaires			
State Anxiety	55.35 ± 1.91	55.71 ± 1.91	50.75 ± 1.97
Trait Anxiety	56.18 ± 1.27	57.24 ± 1.27	54.31 ± 1.31
Perceived Stress Scale 14	38.88 ± 1.15	37.47 ± 1.15	35.38 ± 1.18
Visual Analogue Scale	77.53 ± 4.21	71.59 ± 4.21	62.63 ± 4.34
Blood Pressure			
Mean Arterial Pressure (mm/Hg)	89.16 ± 1.00	85.08 ± 1.00	86.96 ± 1.03
Systolic Blood Pressure (mm/Hg)	113.8 ± 1.21	110.3 ± 1.21	110.9 ± 1.25
Diastolic Blood Pressure (mm/Hg)	76.84 ± 1.02	72.45 ± 1.02	74.97 ± 1.05
Short Form 36 Subscales			
Physical Functioning	86.18 ± 2.05	85.29 ± 2.05	87.81 ± 2.11
Role – Physical	48.24 ± 5.25	49.41 ± 5.25	52.50 ± 5.41
Bodily Pain	72.76 ± 3.04	63.76 ± 3.04	69.69 ± 3.13
General Health	41.18 ± 2.29	45.29 ± 2.29	61.56 ± 2.36*
Vitality	27.35 ± 3.16	30.00 ± 3.16	33.44 ± 3.26
Social Functioning	48.53 ± 3.94	47.06 ± 3.94	55.47 ± 4.06
Role – Emotional	31.37 ± 7.05	15.69 ± 7.05	43.75 ± 7.27
Mental Health	41.18 ± 2.59	40.47 ± 2.59	52.50 ± 2.67
Heart Rate Variability	**(n= 14)**	**(n=11)**	**(n=11)**
LF (ms^2)	846.8 ± 348.3	2057.2 ± 392.9	2323.6 ± 392.9
HF (ms^2)	1340.3 ± 479.7	2091.7 ± 541.2	1673.5 ± 541.2
LF:HF Ratio	3.348 ± 0.4611	1.523 ± 0.5202	2.024 ± 0.5202
Total power (ms^2)	2985 ± 962.9	5769 ± 1086.3	5566 ± 1086.3

Table 1: Mean Baseline Parameters for Particpants in the TC RCT
All values are mean values ± Standard Error of the mean unless otherwise stated. P values are calculated via a two-way ANOVA with repeated measures followed by Bonferroni's post-hoc test.
†Lower scores indicate improved state
‡Higher scores indicate improved state
*p<0.05, **p<0.01, ***p<0.001

4.1 Primary Outcome Measures – State Trait Anxiety Inventory (STAI)

4.1.1 State Anxiety (Y-1)

Scores for the State anxiety measure for TC group decreased from a mean of 55.4 ± 1.9 at baseline to 47.0 ± 1.9 at week 6 and decreased significantly to 39.7 ± 1.9 ($p<0.001$, CI -24.6 to -6.8) at the completion of the study (week 12). The exercise group scores also significantly decreased during the study, falling from a mean baseline score of 55.7 ± 1.9 to 46.4 ± 1.9 ($p=0.031$, CI -18.2 to -0.4) at week 6 and 42.9 ± 1.9 ($p<0.001$, CI -21.7 to -3.9) at week 12. The wait list remained stable across the three measurement times with mean values of 50.75 ± 2.0 at baseline, 49.6 ± 2.0 at week 6 and 50 ± 2.0 at week 12.

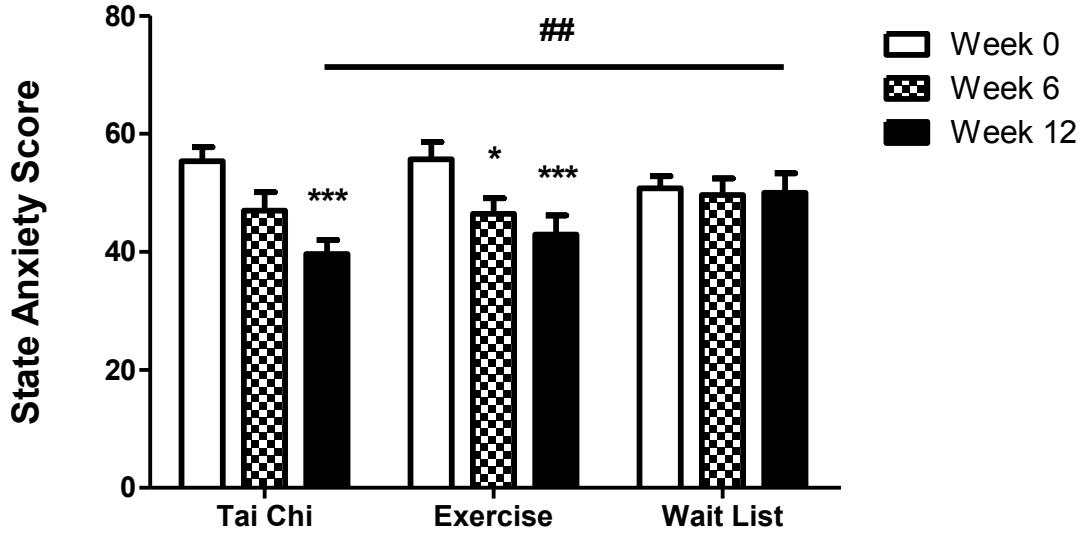

Figure 2: State anxiety score in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Further post hoc analysis across groups showed that there were also statistically significant differences between groups for the TC (39.7 ± 1.9) and wait list (50.0 ± 2.0) at week 12 ($p=0.01$, CI 1.3 to 19.39) only. No statistically significant differences were found between exercise and wait list at week 6 ($p=1.0$, CI -5.8 to 12.2) or at week 12 ($p=0.418$, CI -2.0 to 16.1).

State anxiety (Y-1) scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

4.1.2 Trait Anxiety (Y-2)

Trait anxiety scores decreased significantly from baseline for both the TC and exercise groups at both week 6 and week 12 time points. TC scores decreased from 56.2 ± 1.3 (baseline) to 47.5 ± 1.3 ($p<0.001$, CI -14.6 to -2.8) at week 6 and 45.1 ± 1.3 ($p<0.001$, CI -17.0 to -5.1) at week 12. Similarly trait anxiety scores in the exercise group had statistically significant reductions from a baseline score of 57.2 ± 1.3 to 48.9 ± 1.3 ($p<0.001$, CI -18.2 to -0.4) and 47.2 ± 1.3 ($p<0.001$, CI -21.7 to -3.9) at weeks 6 and 12 respectively. Scores from the wait list showed no significant changes at either time point (baseline score of 54.3 ± 1.3 to 53.3 ± 1.3 at week 6 and 52.6 ± 1.3 at week 12). A statistically significant difference was found between the TC scores and wait list scores at week 12 (45.1 ± 1.3 compared with 52.6 ± 1.3, $p=0.003$, CI 1.4 to 13.5).

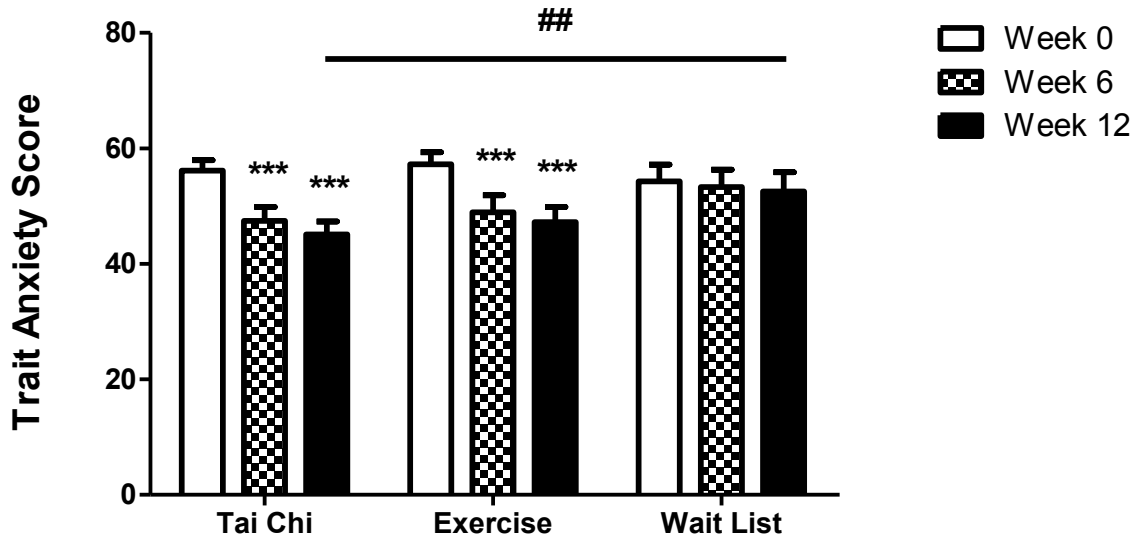

Figure 3: Trait anxiety score in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Trait anxiety (Y-2) scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

4.1.3 State and Trait Anxiety

State/trait scale results indicate that both TC and exercise were successful at decreasing stress over time as both state and trait anxiety scores decreased after 12 weeks when compared to their respective baseline data ($p<0.001$).

While the effects of exercise on state anxiety appear to impact earlier than TC; as significant differences at week 6 appeared only for participants in the exercise group ($p=0.031$, CI -18.2 to -0.4) both groups achieved significant changes at week 12 when compared to baseline ($p<0.001$, CI -24.6 to -6.8 for TC and $p<0.001$, CI -21.7 to -3.9 for

exercise). Despite this only the TC group showed significant differences when compared across groups, with week 12 state anxiety scores statistically significantly different to wait list scores (p=0.01, CI 1.3 to 19.39). This indicates that while both TC and exercise significantly reduce state anxiety compared to their respective baseline data, only the TC group showed significant improvement when compared to the wait list control group.

With trait anxiety both the TC and exercise groups shared a similar response showing statistical significant improvement at both week 6 ($p<0.001$) and 12 ($p<0.001$) when compared to baseline scores. Similar to state anxiety, the only significant difference between groups was observed when TC was compared to the wait list control group (p=0.003, CI 1.4 to 13.5) at week 12.

These results show that while both TC and exercise will significantly reduce state and trait anxiety at 12 weeks, only TC obtained statistically significant scores when compared to the wait list group. This indicates that TC can not only significantly reduce state or situational perceptions of stress but also improve trait or long term coping mechanics to deal with stress.

4.2 Secondary Outcome Measures

4.2.1 Perceived Stress Scale 14

Perceived Stress Scale 14 (PSS14) scores for both the TC and exercise groups statistically decreased compared to their respective baseline scores at both the week 6 and week 12 time points. TC reduced the scores from 38.9 ± 1.1 to 28.1 ± 1.1 ($p<0.001$, CI -16.2 to -5.5) and to 26.7 ± 1.1 ($p<0.001$, CI -17.6 to -6.9) at weeks 6 and 12 respectively. Similarly the exercise group showed a similar trend, statistically decreasing to 28.88 ± 1.1 at week 6 ($p<0.001$, CI -13.9 to -3.2) and to 26.5 ± 1.1 ($p<0.001$, CI -16.4 to -5.7) at week 12 when compared to baseline score of 37.47 ± 1.1. There were no significant differences noted between groups. These results indicate that in terms of perceived stress

as observed using the PSS14, both TC and exercise were equally effective in reducing stress from week 6 onwards, however while both interventions were effective within their own groups, no statistically significant difference was found between the three groups at either week 6 or 12 ($p>0.05$).

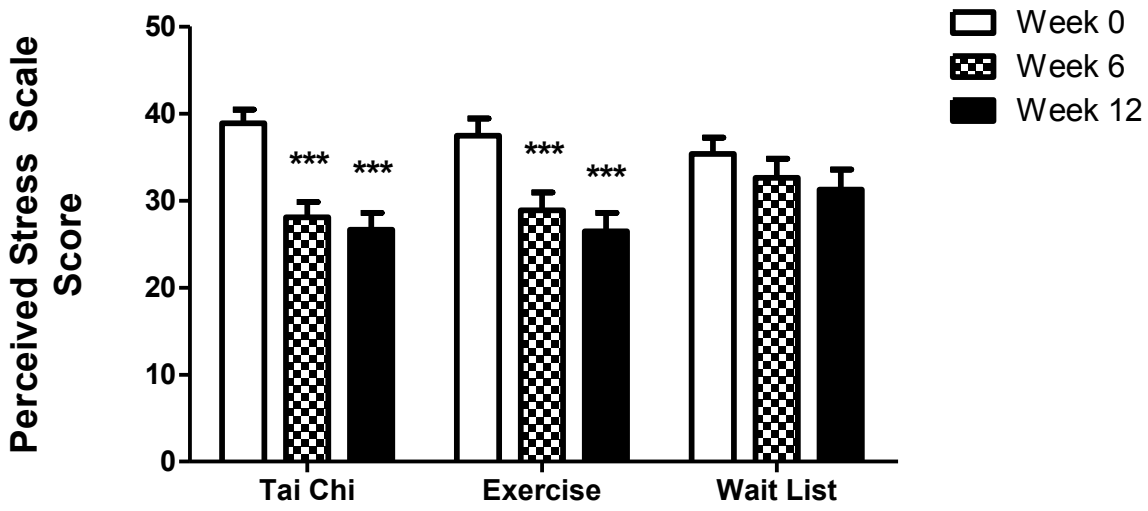

Figure 4: Perceived stress scale 14 score in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Perceived stress scale 14 (PSS14) scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

4.2.2 Visual Analogue Scale (VAS)

Results from VAS showed that participants from both the TC and exercise groups significantly reported that they were less stressed during the intervention phase. The TC group decreased their scores from 77.5 ± 4.2 to 49.00 ± 4.2 at 6 weeks ($p<0.001$, CI -48.1 to -28.5) and to 43.9 ± 4.2 at 12 weeks ($p<0.001$, CI -53.2 to -14.0). Similarly the exercise group reduced their VAS scores from 71.6 ± 4.2 at baseline to 51.2 ± 4.2

(p=.0.033, CI -40.0 to -0.8) and 46.1 ± 4.2 (p=0.002, CI -45.1 to -5.9) after 6 and 12 weeks respectively. Whilst participants in the wait list control group also had some decreases over the 12 weeks (baseline; 62.6 ± 4.3, week 6; 54.6 ± 4.3 and week 12; 52.9 ± 4.3) there was not enough change to warrant the decrease as statistically significant. There were no significant differences between groups.

These results indicate that after 12 weeks, participants in both the TC and exercise groups shifted their self-perceived stress levels from closer to the "very stressed" polar extreme towards the proximity of the "no stress" level.

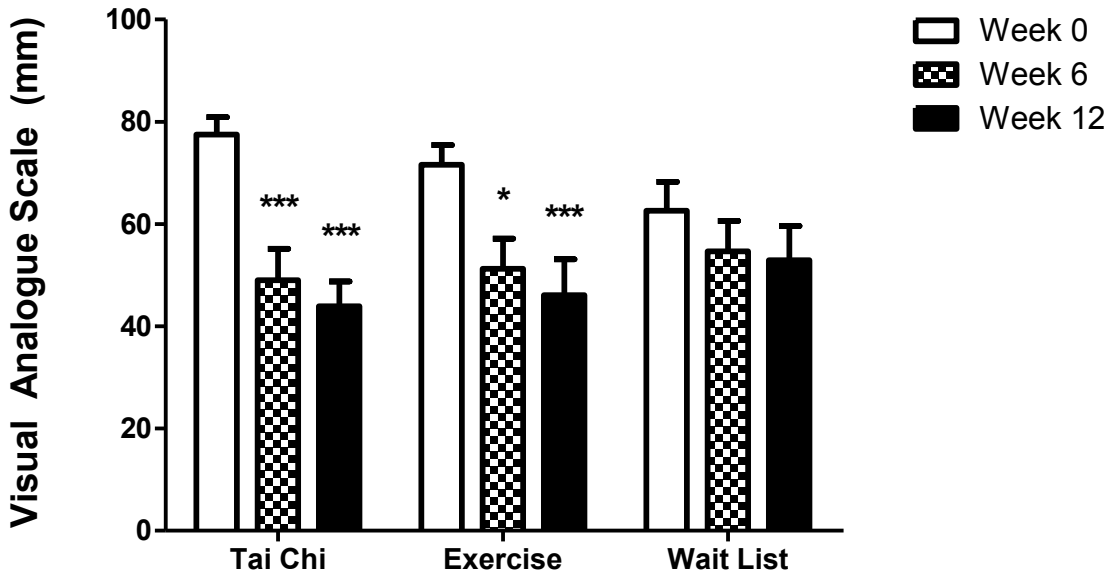

Figure 5: Visual analogue scale 14 score in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Visual analogue scale (VAS) scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

4.2.3 Blood Pressure

The results indicate that throughout the study participants recorded blood pressures within the normal healthy range. As such it was very unlikely to observe significant blood pressure changes throughout the study. Mean Arterial Pressure was derived using the systolic blood pressure (SBP) and diastolic blood pressure (DBP) collected and applied to the following formula: *Mean Arterial Pressure ≈ DP + (SP-DP)/3*. The results were averaged from SBP and DBP collected three times prior and three times post Heart Rate Variability measurements. The MAP results showed that there were no significant differences within any of the three groups. The MAP for the TC group remained relatively constant from baseline at 87.2 ± 1.0 mm/Hg at week 6 and 86.7 ± 1.0 mm/Hg at week 12 (baseline 89.2 ± 1.0 mm/Hg). Similarly the MAP for exercise were similarly stable at 85.1 ± 1.0 mm/Hg at baseline, 85.7 ± 1.0 mm/Hg at week 6 and 85.0 ± 1.0 mm/Hg at week 12. The MAP for the wait list control group also remained stable (87.0 ± 1.0 mm/Hg, 87.4 ± 1.0 mm/Hg and 85.8 ± 1.0 mm/Hg at baseline, week 6 and week 12 respectively).

Results for Systolic Blood Pressure (SBP) from the study show that there were no significant changes in any of the groups. SBP for TC remained similar to the baseline readings of 113.8 ± 1.2 mm/Hg with 112.3 ± 1.2 mm/Hg at week 6 and 111.9 ± 1.2 mm/Hg at week 12. Similarly the exercise group (110.3 ± 1.2 mm/Hg at baseline, 109.5 ± 1.2 mm/Hg at week 6 and 109.5 ± 1.2 mm/Hg at week 12) and wait list group (110.9 ± 1.2 mm/Hg at baseline, 111.8 ± 1.2 mm/Hg at week 6 and 109.6 ± 1.2 mm/Hg at week 12) also remained consistent.

The trend with MAP and SBP was also reflected for the Diastolic Blood Pressure (DBP) which remained stable for all three groups. DBP for TC at weeks 6 and 12 (74.7 ± 1.0 mm/Hg and 74.0 ± 1.0 mm/Hg respectively) remained similar to the baseline DBP of 76.8 ± 1.0 mm/Hg. Similar steady readings were recorded from participants in the

exercise group with the baseline score of 72.5 ± 1.0 mm/Hg remaining unchanged at both week 6 (73.8 ± 1.0 mm/Hg) and week 12 (72.7 ± 1.0 mm/Hg). The wait list readings were also stable with baseline (75.0 ± 1.1 mm/Hg) readings similar at both weeks 6 and 12 (75.1 ± 1.1 mm/Hg and 74.0 ± 1.1 mm/Hg respectively).

These results indicate that 12 weeks of TC and exercise have no effect on blood pressure, either within group compared to their respective baseline scores or when compared across groups.

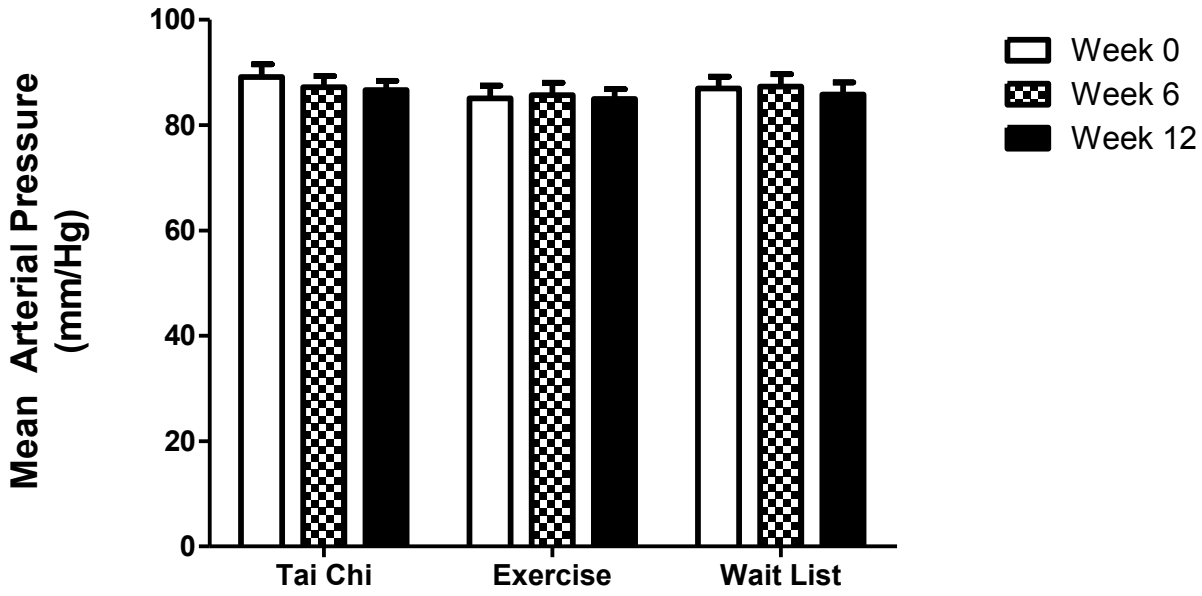

Figure 6: Mean arterial pressure in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Mean arterial pressure (MAP) were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

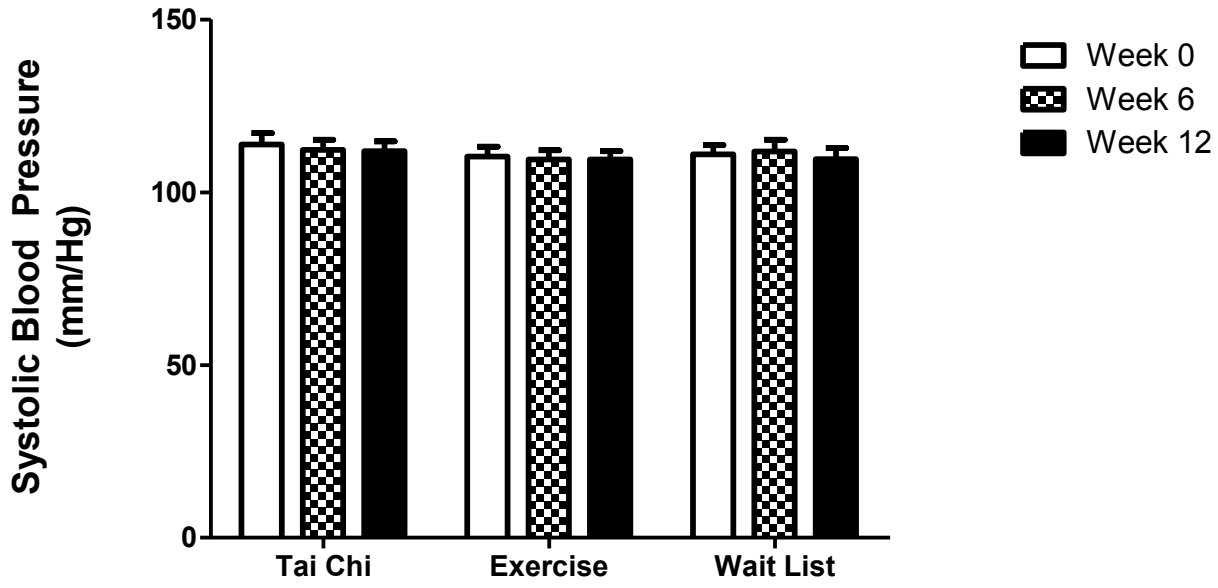

Figure 7: Systolic blood pressure in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Systolic blood pressure (SBP) were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

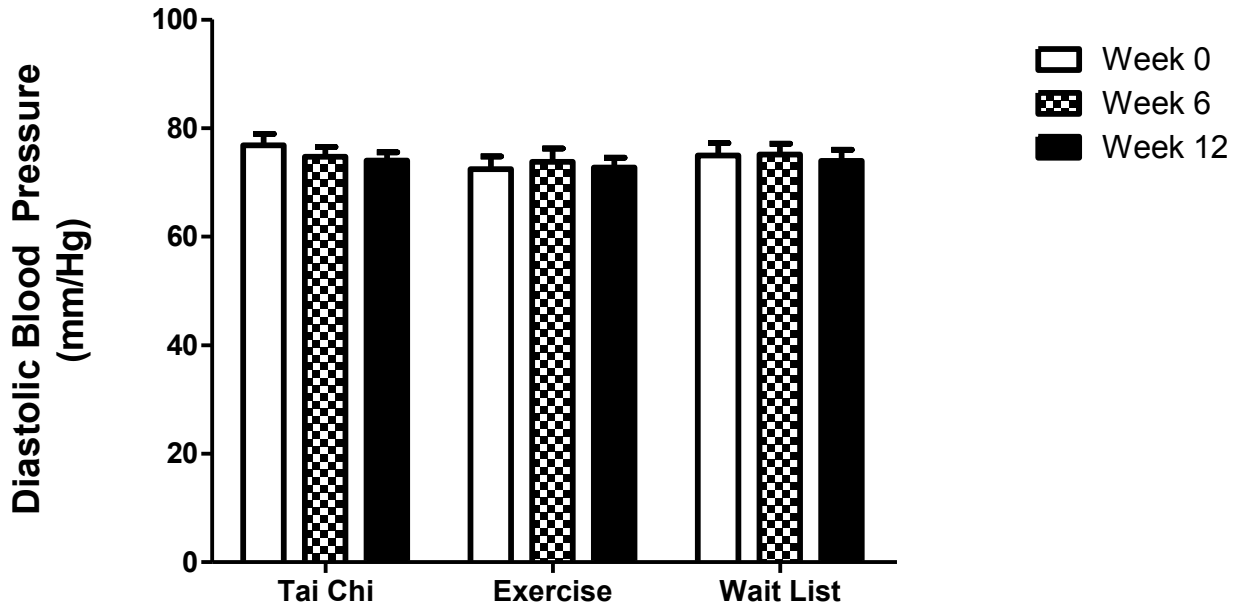

Figure 8: Diastolic blood pressure in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Diastolic blood pressure (DBP) were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

4.2.4 Short Form 36 Health Survey (SF36)

The Short Form 36 Health Survey consists of eight domains of subscales measuring the different facets of an individual's health. These facets or domains; namely physical functioning, role – physical, bodily pain, general health, vitality, social functioning, role – emotional and mental health are all scored so that a higher score indicates an improved state. For example, a high score in physical functioning indicates a higher ability to perform physical functions and a high score in bodily pain indicates increased freedom from pain.

Physical functioning relates to an individual's ability to perform general physical activities ranging from bathing and dressing to vigorous physical activities (Ware Jr, 2004). Scores from the physical functioning domain of the SF36 indicate that there were small increases across all groups however these were all statistically insignificant. For example TC increased from a baseline score of 86.2 ± 2.0 to 91.2 ± 2.0 at week 6 and 93.5 ± 2.0 at week 12. Similar exercise increased slightly from 85.3 ± 2.0 at baseline to 86.2 ± 2.0 and 93.5 ± 2.0 at weeks 6 and 12 respectively. Wait list scores at all three measurement times were similar with 89.1 ± 2.1 at week 6 and 89.7 ± 2.1 at week 12 from baseline (87.8 ± 2.1).

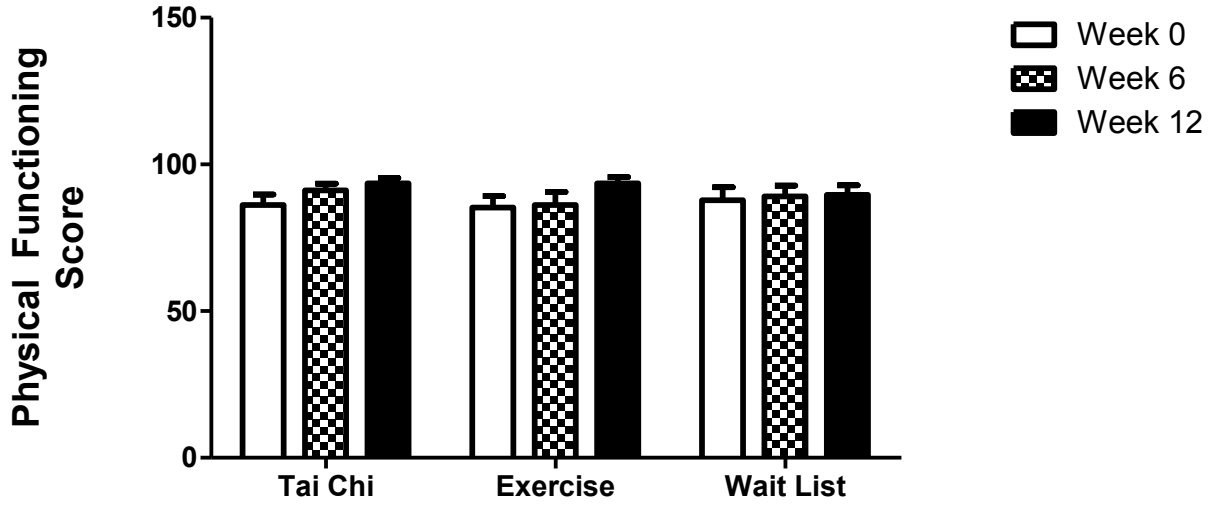

Figure 9: Physical functioning scores in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Physical functioning scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

The role – physical domain measures whether or not physical health has affected an individual's ability to undertake everyday activities or work (Ware Jr, 2004). The results for this domain followed a similar trend to physical functioning, as scores for all three groups increased slightly over time but the results were not statistically significant. TC increased from 48.2 ± 5.2 at baseline to 49.4 ± 5.2 at week 6 and 60.0 ± 5.2 at week 12. Exercise increased from the baseline score of 49.4 ± 5.2 to 54.1 ± 5.2 and 57.7 ± 5.2 at weeks 6 and 12 respectively. The wait list also showed a similar response, increasing slightly from 52.5 ± 5.4 at baseline to 63.8 ± 5.4 at week 6 and 62.5 ± 5.4 at week 12.

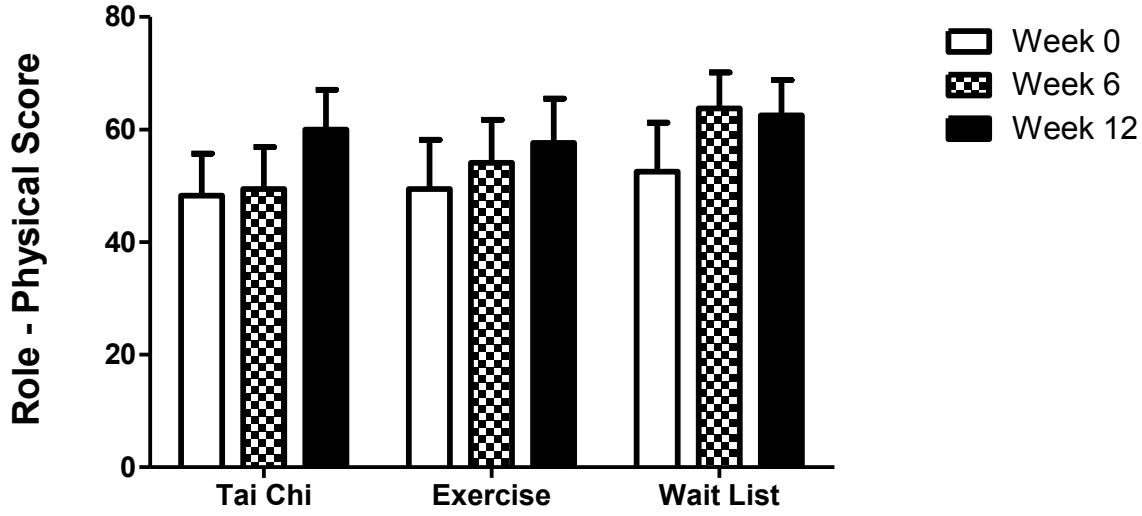

Figure 10: Role – physical scores in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Role – physical scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

This trend continued with the bodily pain domain subscale which measures for the presence of pain or limitations due to pain and is scored such that the higher the score the

more freedom from pain is experienced (Ware Jr, 2004). TC results for the bodily pain domain increased from an initial baseline score of 72.8 ± 3.0 to 72.4 ± 3.0 at week 6 and 76.1 ± 3.0 at week 12. Scores for the exercise group increased from a baseline score of 63.8 ± 3.0 to 69.8 ± 3.0 and 73.4 ± 3.0 at weeks 6 and 12 respectively. Wait list scores also increased from baseline (69.7 ± 3.1) to 75.7 ± 3.1 at week 6 and 73.2 ± 3.1 at week 12. All changes were statically insignificant.

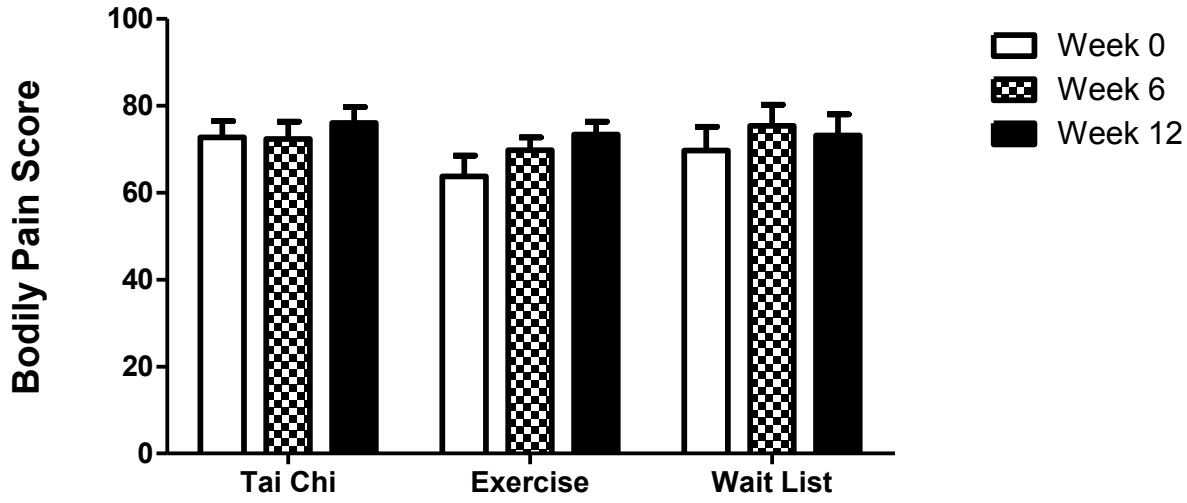

Figure 11: Bodily pain scores in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Bodily pain scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

The general health domain relates to a participants personal health and health expectations (Ware Jr, 2004). Results from this domain indicate that both TC and exercise were beneficial in improving perceived general health. TC scores statistically increased from a baseline score of 41.2S ± 2.3 to 52.2 ± 2.3 ($p=0.036$, CI 0.3 to 21.7) at

week 6 and 57.2 ± 2.3 at week 12 (p<0.001, CI 5.4 to 26.7). Similarly, exercise also statistically increases scores in this domain from baseline (45.3 ± 2.3) to 56.4 ± 2.3 at week 6 (p=0.031, CI 0.5 to 21.8) and 60.8 ± 2.3 at week 12 (p<0.001, CI 4.9 to 26.2). Despite being significantly different to both TC (p<0.001, CI 9.6 to 31.2) and exercise (p<0.001, CI 5.4 to 27.1) in both instances) at baseline, the wait list showed no significant changes from baseline (61.6 ± 2.4) with scores of 58.4 ± 2.4 at week 6 and 62.7 ± 2.4 at week 12. No other differences between groups were observed at any time point.

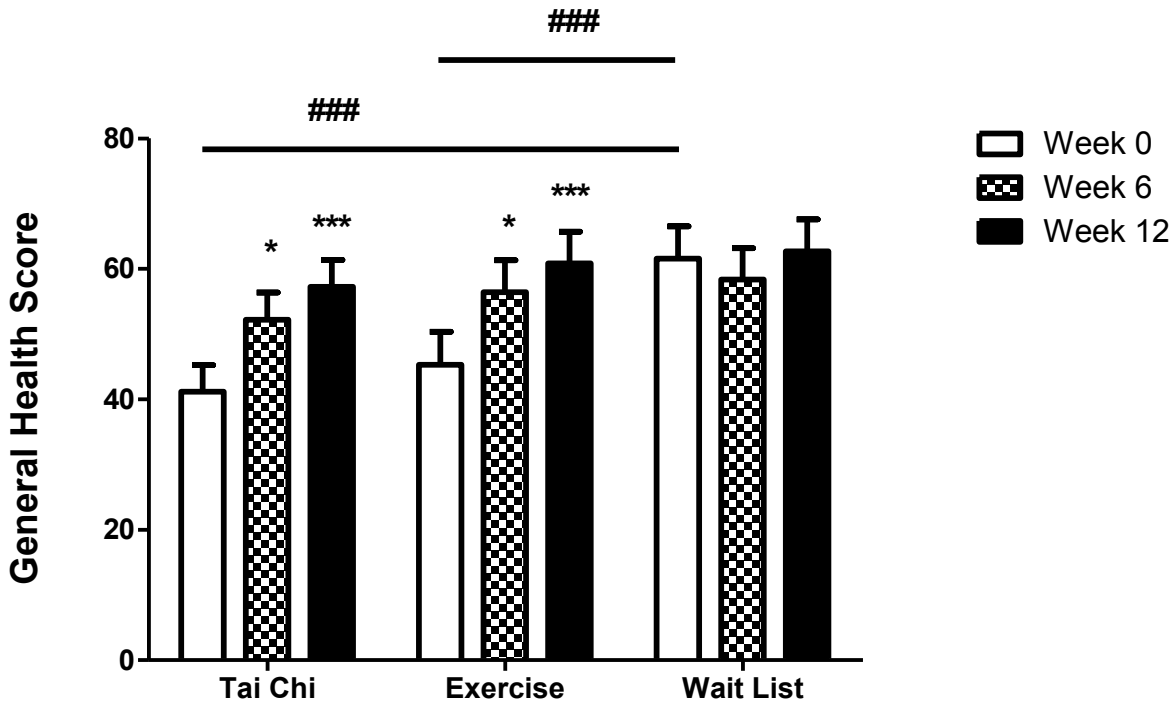

Figure 12: General health scores in Tai Chi, exercise and wait list at weeks 0, 6 and 12

General health scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

The vitality domain measures if an individual is full of "pep" and "energy" or feels "worn out and exhausted" (Ware Jr, 2004). Results from the vitality domain show that both TC and exercise can significantly increase reported vitality after just 6 weeks and the results continue to improve at 12 weeks. With the TC group vitality increased from 27.4 ± 3.2 at baseline to 45.6 ± 3.2 at week 6 ($p=0.003$, CI 3.5 to 33.0) and 49.4 ± 3.2 at week 12 ($p<0.001$, CI 7.4 to 36.8). Similarly the exercise group improved from a baseline score of 30.0 ± 3.2 to 47.9 ± 3.2 at week 6 ($p=0.004$, CI 3.2 to 32.7) and 51.5 ± 3.2 at week 12 ($p<0.001$, CI 6.8 to 36.2). Wait list results for vitality also followed the tendency and increased (from 33.4 ± 3.3 at baseline to 35.9 ± 3.3 and 41.6 ± 3.3 at weeks 6 and 12 respectively) but there was no statistically significant differences observed from baseline. No differences were observed between groups at week 6 and 12 ($p>0.05$).

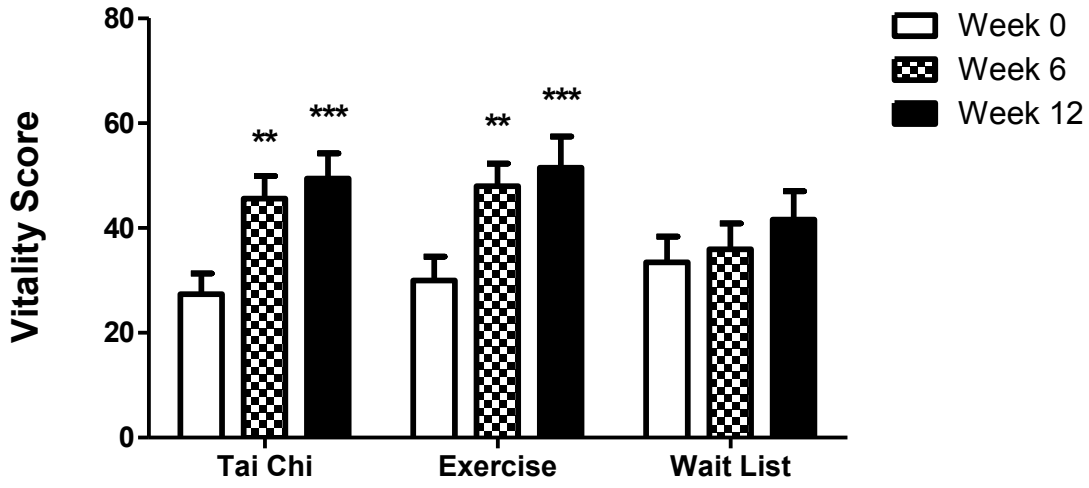

Figure 13: Vitality scores in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Vitality scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

The domain of social functioning relates to the ability to perform social activities without interference from physical or emotional limitations (Ware Jr, 2004), with a higher score indicating that there are no limitations and a lower score indicating that there are extreme and frequent interruptions to social activities due to physical or emotional problems. The scores from the social functioning domain indicate that those participants who were randomised into either TC or exercise had a statistical improvement in their social functioning. TC results showed that there were significant increases from baseline (48.5 ± 3.9) compared to week 6 (66.9 ± 3.9, p=0.049, CI 0.02 to 36.8) and week 12 (74.3 ± 3.9, p<0.001, CI 7.4 to 44.1). Whilst the exercise group also increased in their social functioning score from baseline (47.1 ± 3.9) at weeks 6 and 12 (64.7 ± 3.9 and 72.1 ± 3.9 respectively), the increase was only significant at week 12 (p<0.001, CI 6.6 to 43.4). Results from the wait list group; whilst not statistically significant, also increased from baseline (55.5 ± 4.1) but remained stable (64.1 ± 4.1 at week 6 and 64.6 ± 4.1 at week 12).

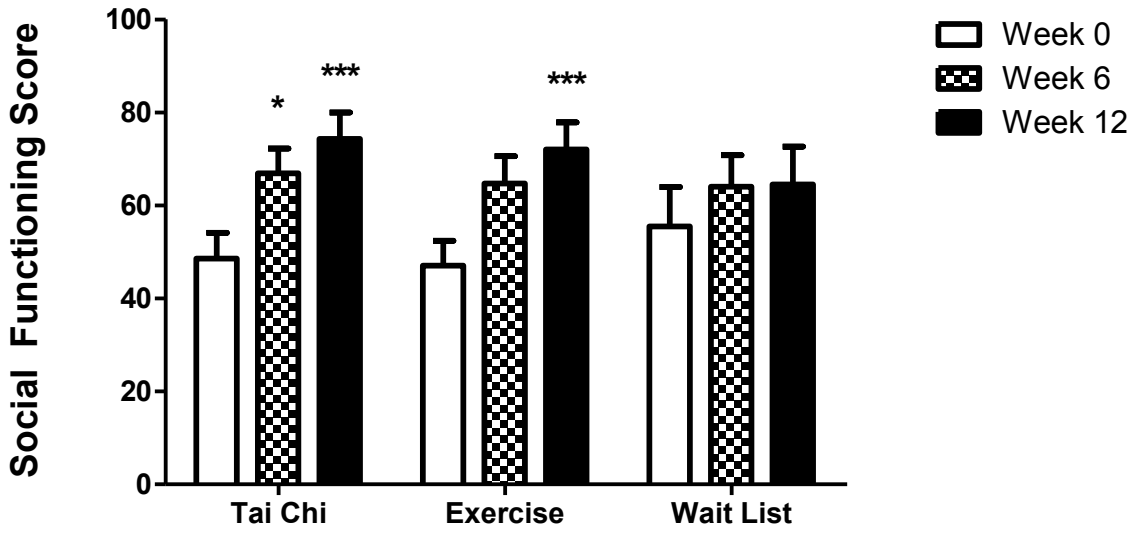

Figure 14: Social functioning scores in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Social functioning scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

Similarly to role – physical; role – emotional measures the influence of certain factors on an individual's ability to carry out daily activities and work without hindrance, however role – emotional is applied specifically to the measure of emotional influence on these activities. The measurement is measured such that a higher score indicates that there are improvements to emotional health and a reduction of limitations to work and daily activities due to emotional factors (Ware Jr, 2004). Results from this domain show that exercise was the only group which had a significant impact on role – emotional scores, with values statistically increasing from baseline (15.7 ± 7.1) to 56.9 ± 7.1 at week 6 ($p=0.003$, CI 8.3 to 74.0) and 70.6 ± 7.1 at week 12 ($p<0.001$, CI 22.0 to 87.8). Results from the TC group also showed a general increase over time (from baseline score of 31.4

± 7.1 to 60.8 ± 7.1 at week 6 and 62.8 ± 7.1 at week 12), however there were no significant differences. Results collected from the wait list showed a decrease at week 6 (29.2 ± 7.3 from baseline score of 43.8 ± 7.3) and a return to baseline scores at week 12 (43.8 ± 7.3).

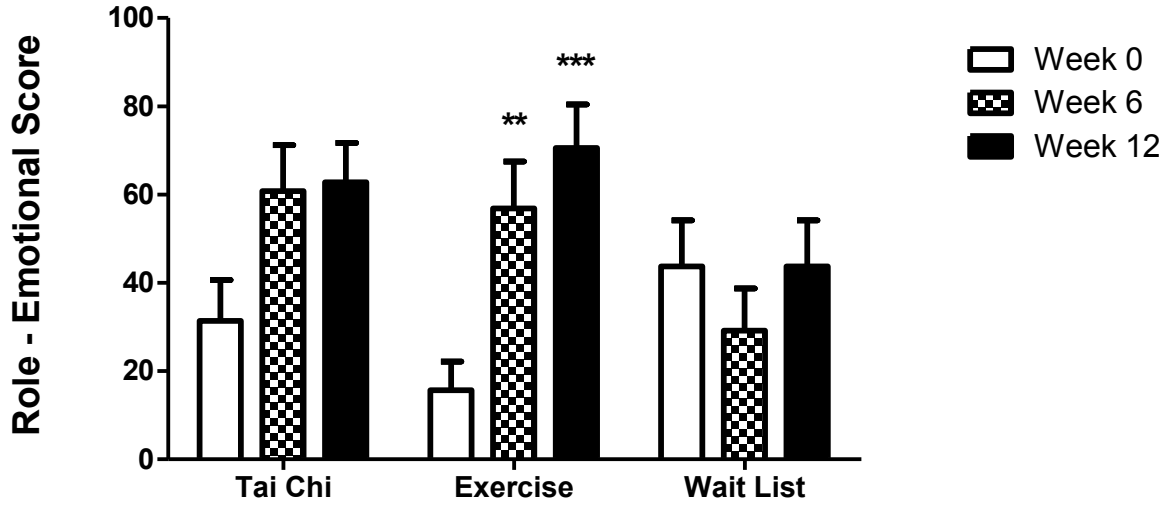

Figure 15: Role – emotional scores in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Role – emotional scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

The mental health domain assesses the presence of psychological distress and/or limitations due to emotional or health problems, with high scores representing no limitations and an absence of psychological distress and low scores indicating high frequency of psychological stress and disability due to emotional and health problems (Ware Jr, 2004). The results from this domain show that both TC and exercise significantly and positively affected mental health from as early as 6 weeks. Scores for

the TC groups changed from 41.2 ± 2.6 at baseline to 63.1 ± 2.6 at week 6 ($p<0.001$, CI 9.8 to 33.9) and 67.8 ± 2.6 ($p<0.001$, CI 14.5 to 38.7) at week 12. Exercise showed a similar trend improving from a baseline score of 40.5 ± 2.6 to 58.4 ± 2.6 at week 6 ($p<0.001$, CI 5.8 to 29.9) and 60.5 ± 2.6 at week 12 ($p<0.001$, CI 7.9 to 32.1). Wait list group results however showed that scores were mostly unchanged (52.5 ± 2.7 at baseline, 50.5 ± 2.7 at week 6 and 54.0 ± 2.7 at week 12). Further analysis also showed that there were also significant differences when scores for weeks 6 and 12 of TC were compared with the wait list group at each respective time point ($p=0.038$, CI -24.8 to -0.3 at week 6 and $p=0.013$, CI -26.0 to -1.5 at week 12). This result indicates that despite the fact that both TC and exercise significantly improve their mental health scores from their respective baselines, TC is significantly better at improving mental health than a wait list control group and these results can be seen as early as after six weeks of TC.

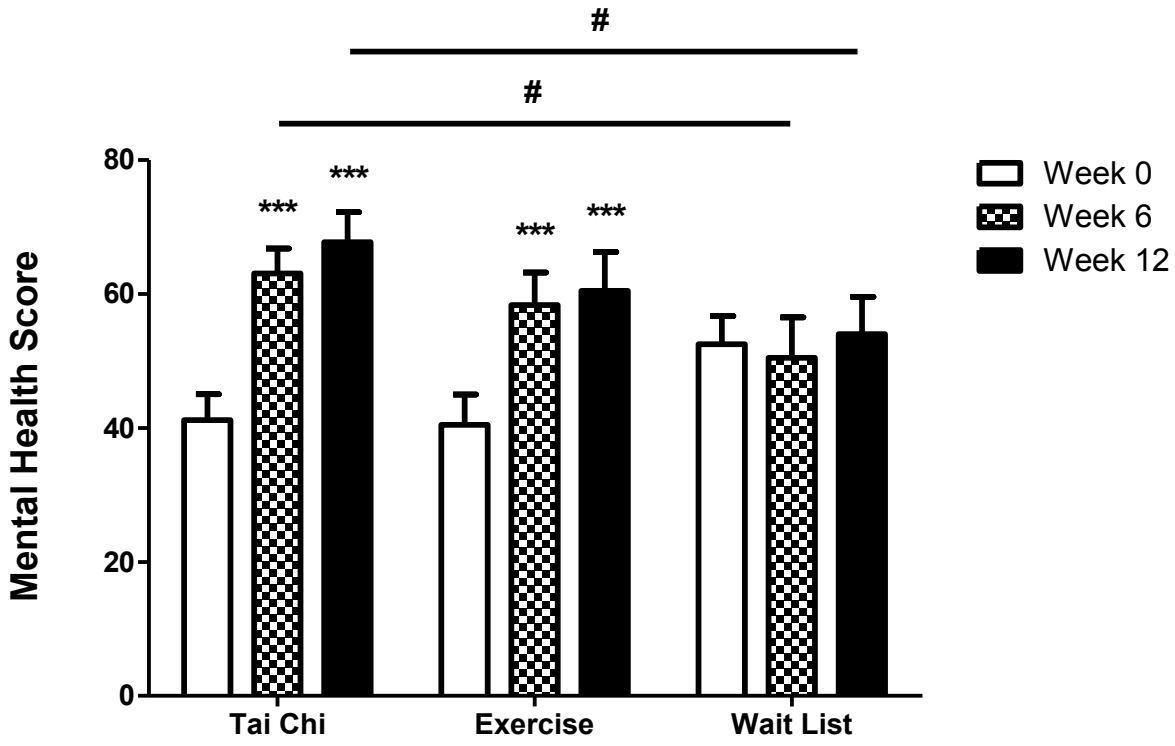

Figure 16: Mental health scores in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Mental health scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

Analysis of all eight domains of the SF36 concludes that there were no significant changes either within or between groups in the domains of physical functioning, role – physical and bodily pain ($p>0.05$). These results may be expected as these three domains all relate specifically to limitations due to problems with physical health and the candidates for this study were all screened for severe illnesses and conditions to confirm suitability for this study.

In the domains of general health and vitality; both TC and exercise appear to have made a statistical improvement from baseline at both weeks 6 and 12. Social functioning results show that TC results were statistically significant at both week 6 and 12 when compared to baseline whilst exercise was only significant at week 12. The results from the role-emotional domain show that despite a positive improvement for both TC and exercise, only exercise expressed significant differences from baseline and did so at both weeks 6 and 12. The mental health score showed that both TC and exercise significantly improve mental health scores at both weeks 6 and 12 but TC scores were also significantly different to that of the wait list control group scores at both weeks 6 and 12.

4.2.5 Heart Rate Variability

Of the 50 participants in this study only HRV data from 36 participants were useable after outliers were removed. Of the data collected 14 participants in the TC group, 11 in the exercise group and 11 in the wait list group were analysed. Results from the study showed that there were no statistical differences at any time point in any of the three groups across the measures of low frequency (LF) and high frequency (HF), total power and LF:HF ratio.

Results for the LF component showed that for the TC group there was a slight increase from baseline scores of 846.8 ± 348.3 ms^2 to 946.3 ± 348.3 ms^2 at week 6 and 924.8 ± 348.3 ms^2 at week 12. The exercise group however showed a decreasing trend from the baseline score of 2057.2 ± 392 ms^2 to 1373.3 ± 392.9 ms^2 at week 6 and 1244.4 ± 392.9 ms^2 at week 12. The wait list showed the baseline score of 1569.1 ± 338.0 ms^2 did not differ greatly at week six (1572.5 ± 338.0 ms^2) but increased at week 12 (2107.5 ± 338.0 ms^2). Despite these variations no statistical differences observed.

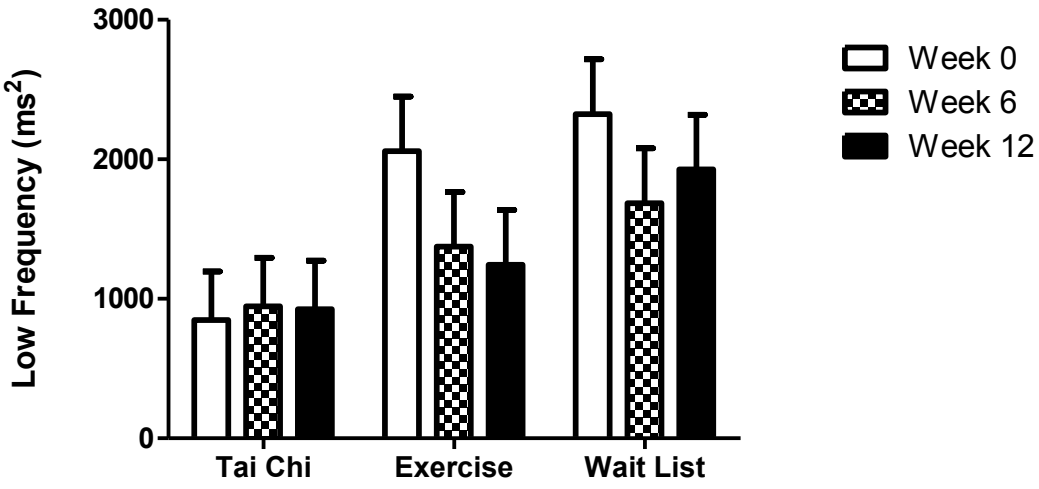

Figure 17: Low frequency scores in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Low frequency scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

Similarly for the HF component there were no statistical differences noted with any group. The TC group decreased from the baseline score of 1340.3 ± 479.7 ms^2 to 720.8 ± 479.7 ms^2 at week six and 744.0 ± 479.7 ms^2 at week 12. Similarly the exercise group also showed a decreasing trend, decreasing from the baseline score of 2091.7 ± 541.2 ms^2 to 905.0 ± 41.2 ms^2 at week six and 1173.2 ± 541.2 ms^2 at week 12. The wait list however increased from its baseline score of 1673.5 ± 541.2 ms^2 to 2129.2 ± 541.2 ms^2 at week six before returning back a stable score of 1679.1 ± 541.2 ms^2.

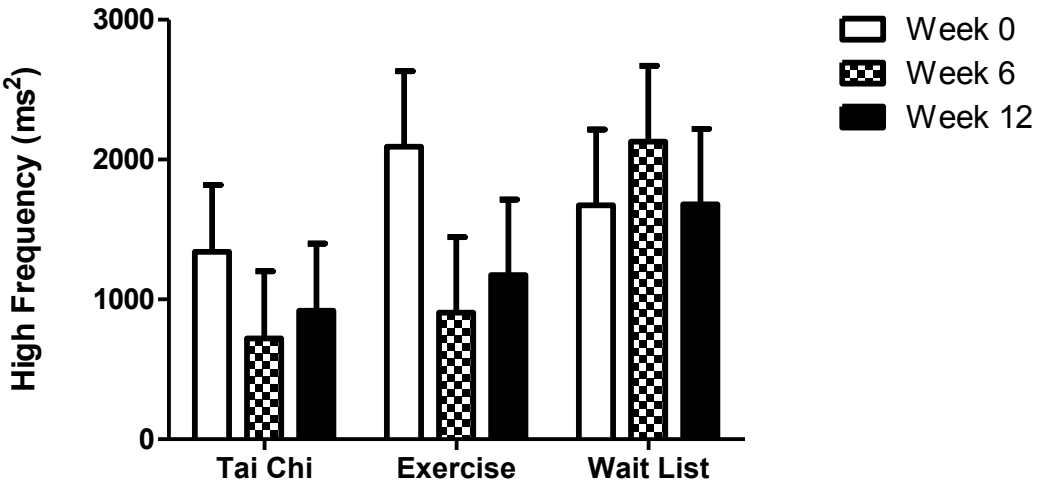

Figure 18: High frequency scores in Tai Chi, exercise and wait list at weeks 0, 6 and 12

High frequency scores were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

Results from the LF:HF ratio showed that whilst TC had an overall higher ratio there were still no statistical differences observed for any of the groups. Specifically the results from showed there were decrease in the LF:HF ratio from the baseline ratio of 3.348 ± 0.4611 to 3.268 ± 0.4611 at week six and then to 2.740 ± 0.4611 at week 12. Exercise group however showed an increase in the ratio with the ratio increasing from the baseline of 1.523 ± 0.5202 to 1.741 ± 0.5202 at week six and 1.680 ± 0.5202 at week 12. The wait list showed a decreasing trend from a mean ratio of 2.024 ± 0.5202 decreasing to 1.435 ± 0.5202 at week six and 1.478 ± 0.5202 at week 12.

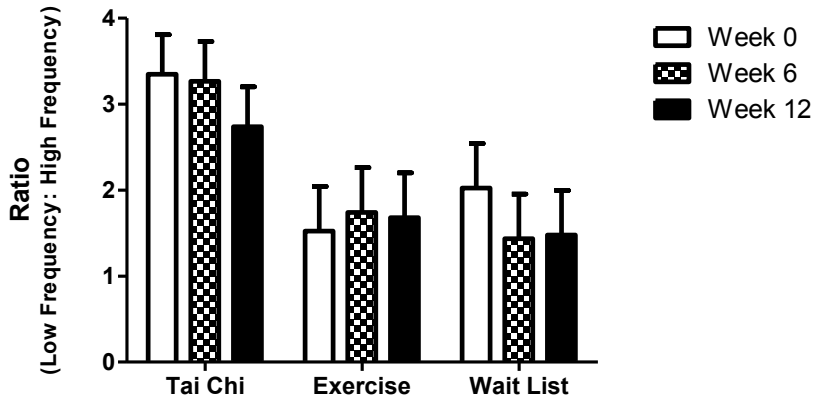

Figure 19: Low frequency: high frequency ratio in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Low frequency: high frequency ratio were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

Results from the total power also showed that there were no statistically differences within any of the groups at any of the time intervals. The TC group maintained a consistent total power throughout the study, with baseline total power at 2985 ± 962.9 and 2910 ± 962.9 at week six and 2764 ± 962.9 at week 12. Exercise group decreased from its baseline data of 5769 ± 1086.3 to 3843 ± 1086.3 at week six and 3785 ± 1086.3 at week 12. Results from the wait list group showed that total power was 5566 ± 1086.3 at baseline and remained consistent with 5387 ± 1086.3 at week six and 5714 ± 1086.3 at week 12.

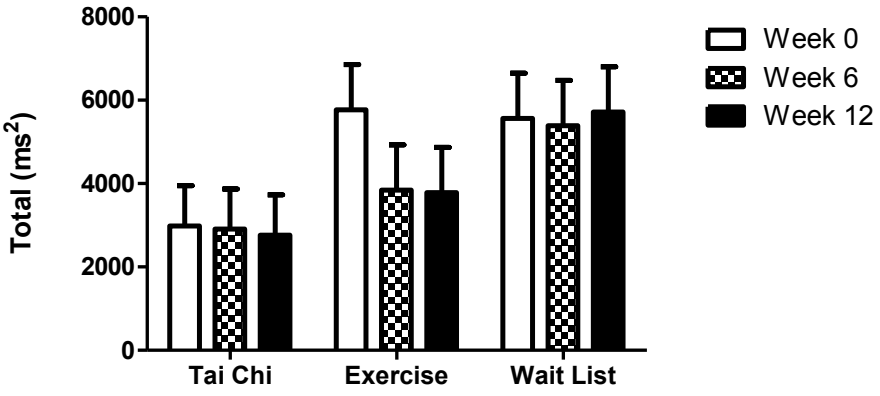

Figure 20: Total power in Tai Chi, exercise and wait list at weeks 0, 6 and 12

Total power were measured in subjects that underwent Tai Chi, exercise or wait list at weeks 0 (white), 6 (checker) and 12 (black bars). Data are expressed as mean ± SEM. Statistical analysis was carried out using two-way ANOVA followed by Bonferroni's post-hoc test; * $p < 0.05$ and *** $p < 0.0001$ versus week 0 within the respective group. # Indicates a significant difference $p < 0.05$ amongst the intervention groups, ## indicates a significant difference $p < 0.01$ and ### indicates a significant difference $p<0.001$.

4.3 Summary

The results from the outcome measures demonstrate that both TC and exercise groups statistically improve the primary outcomes scores for state and trait anxiety as well as secondary outcomes of PSS14, VAS and the SF36 domains of general health, vitality, social functioning and mental health. However significant differences between groups when the respective time points were compared to the wait list control group were only present in the TC group and specifically for the outcome measures of state anxiety, trait anxiety and the mental health domain of the SF36.

Exercise appears to be significantly beneficial in improving the SF36 domain of role–emotional when compared to its baseline scores. However it was not significant when compared across groups. Blood pressure, regardless of MAP, SBP or DBP was unaffected by either TC or exercise. HRV components of LF, HF, LF:HF ratio and total

power also showed no statistical changes. Similarly, the SF36 domains of physical functioning, role – physical and bodily pain, demonstrated no statistical changes.

Chapter V: Discussion – Tai Chi RCT

This is the first time that a study of the efficacy of TC on modulating the stress response has been conducted. Despite numerous anecdotal claims of the effect of TC on stress few studies have been undertaken. Statistically significant improvements were found for several outcome measures used in the study while a few failed to find any significant change.

5.1 State Anxiety

For example, for the STAI, both the TC and exercise groups showed significant improvements after 12 weeks of practice while the waitlist group found no significant change at all. Interestingly the exercise group however had an earlier impact, with statistical significance observed at week 6 ($p<0.031$). Despite the statistically significant changes at week 6 compared to its respective baseline scores, the scores between TC and exercise at exercise did not differ significantly with a mean score 47.00 ± 1.9 obtained from the TCM compared to exercise with a score of 46.41 ± 1.9. This is reflected by a difference of the means of 8.4 (baseline score of 55.35 ± 1.9) in the TC group compared to a difference of means of 9.3 (baseline score of 55.71 ± 1.9) for the exercise group. The significance at week 6 may be due to the initial learning curve when participants are still learning the TC, which may account for a higher, non-significant trait anxiety score, whilst the exercise group did not face this limitation. This indicates that the significant change obtained by the exercise group at week 6 is statistically significant; the change is relatively small when compared to the TC group scores at the same time.

Other factors which may affect State anxiety could be how recent each individual has undertaken the activity before data for state anxiety was collected. As the nature of state anxiety concerns the immediate feelings of stress and anxiety it is highly variable depending on the individual experience of each participant at that particular time. Whilst the experimental design of a randomised controlled trial such as randomisation should account for these possibilities, there is a higher chance for this to be more positively

biased towards the exercise group as there is much more flexibility in when participants could have access to the UTS Fitness Centre.

It should be noted that both TC and exercise share certain features and characteristics which may explain why improvement trends are similar and it is also because of these similarities that the initial protocol design incorporated two active interventions (Zheng et al., 2014). For example both TC and exercise groups share a physical component within each paradigm and an attempt was made to standardise and ensure compliance with the level of activity for both groups throughout the study. Second the study design also incorporated measures to ensure that there is a controlled amount of group and social interaction, either in the form of group TC classes for the TC group or various fitness classes at the UTS Fitness Centre. The involvement of both the physical activity and social interaction in the two groups could explain the similarities in the trend of the results observed. Studies have shown that participants who exercised vigorously or have levels of habitual physical activity have lower levels of emotional distress (Salmon, 2001). This may be due to the function of exercise to reduce stress related hormones such as adrenaline and cortisol, whilst stimulating the release of endorphins to elevate mood (HMS, 2011). As both TC and exercise share physical components it is therefore not surprising that both groups should share similar benefits and it is also because of the similarities that the study design aim was to establish non-inferiority between TC and exercise and simultaneously justify the choice of conventional exercise as an active control comparison for the study.

However despite these similarities there are differences which may indicate that TC is a better choice over conventional exercise. Philosophically and theoretically, TC is believed to be a form of internal martial arts, which emphasises elements of meditation and the teaching of natural breathing. These elements lend to TC an advantage over exercise as the focus is not purely external or physical, but emphasises an integration of mind and body. It is also because of this that there is less emphasis on completing and achieving the same physical milestones to obtain the same results, unlike conventional

exercise. Furthermore TC is generally gentler and less stressful physically on the body, which makes TC more easily accessible to individuals in the population who have trouble completing certain physical exercises. This potentially will lead to a decrease in injuries and provides a much safer and less physical goal specific alternative to conventional exercise. An additional benefit of TC over exercise is the spacial requirements needed to ensure a "workout" is not limiting. Exercise often needs either a large area to conduct the physical activities or requires specific equipment in smaller spaces, for example gym equipment. TC however has the flexibility to be either practiced in its entirety in a larger space or segmentally in smaller spaces. This is largely due to the multi-faceted mind-body component of TC and a lesser onus on completing physical milestones to achieve goals.

However it should be noted that regardless of TC or exercise these two methods still provide a cheaper, more patient-centric and more patient empowered alternative to pharmaceutical treatments for stress and anxiety.

As state anxiety scores continued to decrease at week 12 for both the TC and exercise groups it can be observed that both groups showed high statistical difference compared to their respective baseline scores ($p<0.001$). Raw scores showed that TC had a greater change compared to baseline with a mean difference of 15.7 (week 12 score of 39.7 ± 1.9), compared to the exercise group which had mean difference of 12.8 (week 12 score of 42.9 ± 1.9). The lack of statistical significant difference between TC and exercise groups, accompanied by the fact that the difference of means scores of both TC and exercise do not differ greater than the norm standard deviation presented in the STAI sampler set (10.4 in working adult males, 10.6 in adult females, 10.0 in college males and 11.95 in college females) (Spielberger, 1983) indicate that TC is non-inferior to exercise.
TC results also showed that there were significant difference between groups when week 12 TC scores were compared to the wait list control group at week 12 ($p=0.01$). This result demonstrates that TC is statistically superior to a wait list in reducing state anxiety scores at 12 weeks. This result with the absence of other statistical changes between

groups for state anxiety indicates that whilst exercise can reduce state anxiety scores, the reduction is not statistically superior to a wait list while TC can both statistically reduce state anxiety compared to its baseline and is superior to a wait list control group at week 12.

5.2 Trait Anxiety

Whilst trait anxiety scores followed a similar trend to state anxiety in that both TC and exercise groups had highly significant statistical improvements from baseline at week 12 ($p<0.001$), these trends could be statistically identified in both groups at week 6, with both TC and exercise reporting highly statistically significant changes in their trait anxiety scores ($p<0.001$). This can be observed due to difference of means scores for TC of 8.7 (56.2 ± 1.3 at baseline and 47.5 ± 1.3 at week 6) and 11.1 at week 12 (45.1 ± 1.3). This score is similar to the difference of means scores reported for the exercise with scores of 8.3 at week 6 (baseline score of 57.2 ± 1.3 and 48.9 at week 6) and 10 at week 12 (47.2 ± 1.3). Similar to state anxiety responses there were no significance between TC and exercise at any time points. Furthermore the difference of means with both groups are also within the norm SD for trait anxiety (9.2 in working adult males, 9.2 in adult females, 9.2 in male college students and 10.2 in female college students) (Spielberger, 1983) and demonstrate that TC is non inferior to exercise.

The statistically significant difference reported at week 12 between TC and wait list ($p=0.003$) indicate that TC is superior to wait list at reducing reported trait anxiety, however despite the similar raw scores between TC and exercise groups there are no statistical evidence to show that exercise is more effective than the wait list control group.

The nature of the STAI is that it consists of the two subscales of state and trait. Whilst both subscales are equally important the state anxiety subscale can be more easily affected by acute influences on the participant and thus impacts reporting as participants

are asked situational questions at the specific time the questionnaire was taken. It should be noted that trait anxiety measures the participants' personality and ability to cope with stress and relies on the participant to recall their "general" attitude towards certain statements. Both state and trait anxiety are interdependent factors as the trait ability determines an individual's ability to cope with anxiety and this will in turn influence how state anxiety is perceived by the individual. The positive trend in trait anxiety scores for both the TC and exercise group show that the participants are more able to cope with stress based anxiety at week 6 however the state anxiety reflects that whilst their personal outlook on stress has changed (trait anxiety), their ability to deal with situation or acute anxiety; whilst improved from baseline; are not as well developed. This balance between state and trait anxiety appeared to have equalised at week 12 with both subscales for both TC and exercise groups reporting a highly significant difference. This reflects the common understanding that whilst TC is a mind-body exercise it requires significant practice and "cultivation" to attain a state of calm. Other possibility for the non-significant state anxiety scores for TC at week 6 could be due to the stress of learning TC itself. As participants in the TC group are expected to not only practice five hours of TC weekly there could also be a self-implicit requirement for the participants in the TC group to remember and "master" the 24 stance simplified TC form within the first six weeks of class. Whilst this requirement was not reinforced or emphasised there could still be an implicit assumption on the participants which will in turn affect as state anxiety.

5.3 Perceived Stress Scale 14

The treatment groups of TC and exercise both showed statistically significant changes from week 6 ($p<0.001$) and continued to do so at week 12 ($p<0.001$). This result indicates that both TC and exercise are equally effective in reducing perceived stress as reported by the PSS 14. Whilst these within group results show statistical significant from their relative baseline scores there were no statistical differences when compared across groups to the wait list group. Despite the high significance in these two intervention groups versus no change in the wait list group it is not conclusive that either TC or

exercise is statistically better than a wait list control for this outcome measure. This may be due to the size of the study which may not be sufficiently powered to demonstrate this and further and more extensive studies may be needed. However from the within group analysis and decreasing trend observed in both TC and exercise groups it can be seen that TC and exercise are capable of reducing perceived stress.

5.4 Visual Analogue Scale

VAS results were also another measure that support the use of TC and exercise in reducing stress for which statistically reduced perceived stress scores were observed in these two groups. This is in contrast to the wait list group which no statistical changes were observed. TC participants obtained a highly statistical reduction at week six ($p<0.001$) and this trend continued at week 12 ($p<0.001$). Exercise showed a similar trend achieving statistically significant differences at week six ($p=0.033$) and week 12 ($p=0.002$). Similarly to the PSS 14 the lack of any between group significant differences may be due to the insufficient power and further studies may be needed to establish conclusive and statistical data that will verify that either TC or exercise is superior to a wait list control group.

Whilst these results show that both TC and exercise are capable of reducing stress it is important to note that the 100 millimetre VAS can be easily influenced by acute stress prior to data collection and as such may not be the most reliable outcome measure. As such these results should not be used as a primary outcome but only as secondary outcome.

5.5 Blood pressure

Results from the blood pressure showed that there were no significance changes with systolic blood pressure, diastolic blood pressure and MAP measures. This result was somewhat expected as participants for this study were all screened to ensure health adults

with no chronic or serious illness using the LAQ (Craig et al., 1996). As the data was taken over a period of six week intervals (with variable time lags between the measurement and the activities of TC and exercise) it is expected that blood pressure would normalise during this time period unlike studies where blood pressure would be taken directly after the intervention. Furthermore blood pressure is a highly variable outcome when only taken periodically as blood pressure fluctuates throughout the day (Robb-Nicholson, 2008). Whilst the best efforts were made to remove any confounders and each blood pressure measurement were all taken under the same controlled environment (including fasting and abstinence from caffeine, alcohol and tobacco) it is still difficult to completely replicate each measurement every time. Therefore for future studies to accurately measure blood pressure the participants should be equipped with devices to monitor blood pressure in a 24 hour period such as a halter monitor. However even if this equipment was utilised the validity of blood pressure as an outcome measure remains doubtful when used in healthy participants. A possible research project however could evaluate the effects of TC on blood pressure in patients with either hypertension or hypotension monitored with a 24 hour blood pressure monitor as there have been several published supportive clinical studies (Thornton, 2004).

5.6 Short Form 36

The SF36 showed mixed results with some domains showing improvement while others did not. For example the domains of physical functioning, role- physical and bodily pain did not demonstrate any significant change. These domains are normally associated with an individual's ability to function normally in both social and professional situations. As the participants in this study were all screened prior to starting the study for any major health issues, including presence of chronic pain, the results would naturally reflect a lack of any statistically significant changes in the results regardless of which group the participants were allocated to.

The results from the general health domain showed that wait list baseline scores were statistically higher than that of both TC ($p<0.001$) and exercise ($p<0.001$). Whilst this may be a type II error due to small sample size, there is no reason to suspect that there was a problem with the randomisation process as this domain was the only one that differed from the TC and exercise groups at baseline. Furthermore the statistical software (Minitab 15) uses a general linear model to run the statistical analysis and as a result the data has been balanced to prevent loss of integrity of the data for this outcome measure. Despite this both TC and exercise groups both showed statistically significant changes within group from their respective baseline scores at weeks six ($p=0.036$ for TC and $p=0.031$ for exercise) and 12 ($p<0.001$ for both). Whilst there were no between group changes, this result indicates that TC can improve general health in individuals. Whilst this may not be directly associated with the main study outcome of stress, stress in individuals can indirectly affect an individual's overall health as measured by the general health domain.

Similarly the domains of vitality and social health can also be indirectly affected by stress and these domains also make up an individual's health as a whole. The results from this study indicate that vitality is statistically improved by TC and exercise from as early as week six ($p=0.003$ for TC; $p=0.004$ for exercise) and further so at week 12 ($p<0.001$ for both groups). As vitality is a measure for an individual's energy, a lower score in this area reflects a feeling of being worn out which could be a physical manifestation of excessive worry and stress. These results show that those who practice TC have a significantly increased vitality which may indirectly reflect the impact of stress on their personal lives. The lack of significant differences between groups could be due to the lack of statistical power or simply because vitality is only partially affected by stress but as these participants are generally healthy they may not show a significant change between groups for this domain.

This is also reflected in the domain of social functioning, with TC showing statistically significant changes at week six ($p = 0.049$) and at week 12 ($p<0.001$). The exercise also showed statistical significance at week 12 ($p<0.001$) but not at week 6. These results

similarly reflect the same concept as present previously in the vitality domain, as social functioning also plays a part as an indirect measure for the impact of stress on an individual's life, in particular the ability to perform social activities.

Results from the role – emotional domains are unique in that this was the only measure where the statistically significant changes are isolated to the exercise group and not the TC group. The results show that the exercise group had statistically significant changes at week six ($p=0.003$) and 12 ($p<0.001$) from its respective baseline score, whilst no other group showed this. One possible reason for this may be due to the unusually low baseline scores for the exercise group (15.7 ± 7.1) compared to TC and wait list baseline scores (31.4 ± 7.1 and 43.8 ± 7.3 respectively). Whilst there were no statistically significant differences observed with the week six scores for TC and exercise groups the results demonstrated TC had a higher score (60.78 ± 7.1 for TC and 56.86 ± 7.1 for exercise). However the positions reversed at week 12 with exercise having a much higher score of 70.59 (± 7.1) compared to TC (62.75 ± 7.1). This may be due to the group atmosphere during the study, as during the first six weeks of the study both TC and exercise had equal time in a group environment which may nurture social interaction and thus reduce any emotional burdens during the study period. After week six however the TC group was delegated to home practice thus losing some of this social interaction whilst the exercise group continued their group activities until the completion of the study. This result calls for further investigation to closely monitor the effects of a group environment and social interaction on role – emotional in both TC and exercise interventions.

Results from the mental health domain showed that both TC and exercise groups had statistically significant changes from baseline at weeks six and 12 ($p<0.001$). As the mental health domain is associated with limitations due to emotional problems or psychological distress (Ware Jr, 2004) this result becomes the most important of all the domains in the SF36 for this study to investigate stress coping mechanisms. Not only were there statistically significant differences within group for the TC participants there were also statistically significant differences when week six and 12 of TC were compared

across groups with the wait list control group (p=0.038 and p=0.013 respectively). These results show that whilst TC and exercise are effective in improving mental health, only TC is significantly better than a wait list control group. Whilst there were no significant differences between TC and exercise, this may be attributed to the size of the study as power sample analysis for this study was calculated based on a non-inferior model between TC and exercise. Further and larger studies will be required to replicate this study with a superiority model between TC and exercise.

The implications from these results indicate that whilst the physical activities, such as both TC and exercise help overall health, TC consists of elements which expand upon normal exercise which further improves mental health. This may be attributed to the almost meditative qualities of TC practice and its emphasis on slow regulated breathing whilst completing the forms and less emphasis on the quality of the movements completed. However as both TC and exercise show positive trends it is hard to confirm these findings without further research with a larger study cohort.

5.7 Heart Rate variability

Whilst 50 participants completed the entirety of the study, only HRV data from 36 participants were useable. This was due to certain technical issues encountered during this study. The primary issue for the failure to obtain useable HRV readings was due to issues with the electrode wiring. During the study there were instances where either the wires connecting the electrodes were not functioning optimally, and while this issue was resolved with replacement electrode wires some of the data were still compromised due to the strict timeline to obtain data. Secondly, as the laboratory space used for the HRV component of this study is not located in a dedicated insulated physical space, some electrical interference from machinery in neighbouring laboratories may have impacted on the quality of the trace. Whilst all efforts were made to ensure necessary protocols were in place to confirm correct location for electrode placement and filters in place to resolve artefacts there are always unforeseen circumstances which compromise the

quality of some of the traces. As a result after the removal of outliers only the results from 36 participants remained, 14 from the TC group, 11 from exercise and 11 from the exercise group.

The results from the HRV showed that there were no significant differences in any of the components of LF, HF, LF:HF ratio and total power. This outcome could be attributed to various factors. Firstly as these participants were all healthy as confirmed by LAQ screening it should be expected that participants would have no abnormal heart irregularities which would be detected by an ECG, as in the majority HRV is recognised as a diagnostic tool for cardiac physiology. Whilst LF and HF are indirectly indicative of the equilibrium of sympathetic and parasympathetic nervous system (Brosschot et al., 2007) this is still secondary to HRV's primary function to detect changes in cardiac physiology. Secondly since only 36 participants completed the HRV component of the study the statistical power may not be sufficient to illicit any statistical changes. Thirdly, as data were collected at six week intervals the HRV results may not be as accurate due to various confounders and the delay between TC practice and ECG measurement that may wash out any beneficial immediate results.

The results for HRV appear to contradict some previous research of HRV in psychophysiology. Whilst there are variable outcomes for what is indicative of anxiety or stress, the majority attributes a decrease in HF and total power to stress and anxiety (Hovland, 2012, Friedman and Thayer, 1998, Pittig, 2013). The results from this study showed that, whilst not statistically so, the HF for both TC and exercise groups had a trend to decrease whilst the wait list increased. Results for total power also appear to contradict previous studies as there also a decrease in the TC group results; albeit at a much slower rate (from 2985 ± 962.9 at baseline to 2910 ± 962.9 at week six and 2764 ± 962.9 at week 12) than the exercise group (from 5769 ± 1086.3 to 3843 ± 1086.3 at week six and 3785 ± 1086.3), whilst the wait list stayed consistent. These results, whilst not conclusive; pose several questions regarding current understanding of the relationship between HRV, stress and anxiety. First, does HF and total power of HRV actually

decrease during stress, as the results from this study showed HF increased with the reduction of self-perceived stress? Second, does this variation from that reported in previous studies occur due to the six week data collection period and small participant number? These unanswered questions warrants further research in the area of stress and HRV using larger numbers to ensure statistical power.

5.8 Limitations and Future Directions

As with any research there are always limitations inherent with research and in particular a randomised controlled trial with human participants. The two most obvious examples of this are the adherence of participants to protocol and participant selection. This is unlike animal or laboratory studies where specimens can be placed in a controlled environment and/or originate from a controlled stock. In contrast human research suffers from the pragmatic flaw that human participants can never be exactly uniform or react the same way, despite best efforts to account for these variations in the selection criteria and adherence to strict protocol. While animal studies control for the environment whereby animals are housed and protocols easily followed, with human research the amount of control the researcher has on participants is limited and monitoring of adherence is of a self-reported nature by the participants.

Whilst this study was sufficiently powered for the primary outcome measures there is the issue of follow-up and drop out. The study design does require a large amount of commitment from participants (60 hours over 12 weeks), which may become difficult when dealing with individuals; mostly professionals who are feeling stressed already often because of an overburden of commitments. Therefore there should an acknowledgement that those participants who completed the TC and exercise activities may already have a certain level of mental fortitude and will power to continue with the study. Conversely there were many drop outs due to group randomisation, those who choose to drop out from the study due to dissatisfaction with the group they were allocated to. The majority of these drop outs occurred in the wait list group who wished

to be part of either the TC or exercise groups. Whilst measures had been in place to avoid this, such as thorough explanation of a randomised study and incentives that all participants in the wait list group will be offered free TC lessons at the completion of the study, many participants still did not wish to continue. Both these issues related to drop outs can be very detrimental to any clinical study and due to human free will and ethical considerations and it is impossible deny participants the right to withdraw. One possible strategy to minimise drop outs in future studies may be the use of further incentives to ensure continued participation in the study.

Other issues may relate to the potential bias of only having one instructor for the trial. Whilst the TC was taught by an experienced instructor there may be bias towards that sole instructor which may influence the repeatability of the study. Whilst the instructor followed a strict protocol during TC instruction it is possible that the results obtained from this study could be influenced by that particular individual instructor's style of teaching, personal manner or other behavioural characteristics. To ensure the generalizability of future studies it is suggested to have a multisite study with numerous instructors to reduce the likelihood of bias towards one instructor. This multi-instructor approach would require oversight to ensure each instructor complied with the standardised protocol and that an assessment and supervision checklist be developed to ensure no instructors deviate from the protocol.

Finally it needs to be acknowledged that while this study was sufficiently powered to evaluate whether TC was superior to the control group and non-inferior to exercise, however further studies may need a much larger sample size to allow a statistically significant difference. Based on a power study from the number required to show statistical power to differentiate between the TC and exercise groups was calculated at 1096 per group to differentiate the more subtle aspects of TC from the benefits of just physical exercise.

Chapter VI: Methods – Stress Questionnaire

6.1 Instrument Design

6.1.1 Initial Biomedical Sign and Symptom Selection

Currently there is no definitive diagnosis or list of signs and symptoms for "stress" in either modern biomedicine (First and Tasman, 2004, AIS, 2012) or Chinese Medicine (CM). While modern theories on stress relate to the neurological interaction of a stressor or stimuli on the autonomic nervous system (Eriksen and Ursin, 2006a) it is generally regarded as subjective in nature and as such each individual will likely present varying somatic or cognitive signs and symptoms. This was both the chief challenge in the process of creating an instrument to identify the CM patterns associated with stress and the justification for the development of such an instrument.

While there is no definitive diagnosis of stress in modern psychological health, the DSM-IV-TR Mental Disorders (First and Tasman, 2004) does list a condition known as Generalised Anxiety Disorder (GAD), which is defined as "*excessive anxiety and worry (apprehensive expectation) occurring for a majority of days during at least a 6 month period, about a number of events or activities (such as work or school performance)*"(pg.946). Withholding the timeframe of six months this definition fits well with the common understanding of stress. As a result the somatic diagnostic criteria for GAD was implemented as a basis for likely signs and symptoms associated with stress - that being sufferers of GAD should have at least three of six specific somatic symptoms; 1) restlessness or feeling keyed up or on edge; 2) being easily fatigued; 3) difficulty concentrating or mind going blank; 4) irritability; 5) muscle tension; and 6) sleep disturbance (difficulty falling or staying asleep, or restless unsatisfying sleep) (First and Tasman, 2004).

Additional signs and symptoms were added to these initial six symptoms based on commonly reported signs symptoms thought to be associated with individuals reporting

being stressed (AIS, 2012, Smith et al., 2012). Below is a table adapted from Smith (2012) outlining some of the "warning" signs and symptoms associated with stress.

Cognitive Symptoms	Emotional Symptoms
• Memory problems • Inability to concentrate • Poor judgment • Seeing only the negative • Anxious or racing thoughts • Constant worrying	• Moodiness • Irritability or short temper • Agitation, inability to relax • Feeling overwhelmed • Sense of loneliness and isolation • Depression or general unhappiness
Physical Symptoms	**Behavioural Symptoms**
• Aches and pains • Diarrhoea or constipation • Nausea, dizziness • Chest pain, rapid heartbeat • Loss of sex drive • Frequent colds	• Eating more or less • Sleeping too much or too little • Isolating yourself from others • Procrastinating or neglecting responsibilities • Using alcohol, cigarettes, or drugs to relax • Nervous habits (e.g. nail biting, pacing)

Table 2: Symptoms commonly associated with stress
Adapted from: http://helpguide.org/mental/stress_signs.htm

6.1.2 CM Diagnostic Pattern Differentiation and Sign and Symptom Integration

Within the CM framework stress is often associated with the liver organ (Ch: *gan zang*) and this may be due to the liver's function of purging emotions (Kaptchuk, 2000). Furthermore according to Macioicia (2004) the symptom "feels stressed" is often attributed as an indication for liver disharmony in zangfu diagnosis. However "stress" is not a singular identifiable sign or symptom but a more generalised cluster of signs and symptoms that individuals report as stress.

The signs and symptoms for GAD and the commonly associated stress signs and symptoms were cross referenced with three CM diagnostic textbooks (Maciocia, 2004, Deng, 1999, WHO, 2007) to discern which CM patterns listed each sign or symptom. For example the symptom of "poor memory" was present in nine patterns; namely *Spleen blood deficiency, Spleen Qi deficiency, Heart Yin deficiency, Heart blood deficiency, Heart Qi deficiency, Heart blood stasis, Phlegm misting the Heart, Kidney deficiency* (general) and *Kidney Yin deficiency* (Maciocia, 2004, Deng, 1999, WHO, 2007). From this first cross referencing process 43 CM diagnostic patterns were identified, consisting of involvement from all five *zang* (liver, spleen, heart, kidney and lung) and two *fu* (gallbladder and stomach) and eight signs and symptoms were rejected for inclusion in the instrument because it was either unmeasurable due to poor operational definition (i.e. "poor judgment") or invalid according to CM concepts.

From the 43 patterns every sign and symptom associated with each CM diagnostic pattern was added to the list of signs and symptoms which came to total of 73 non gender specific signs and symptoms and eight gender specific signs and symptoms (eight female and three male). This new set of signs and symptoms were then cross referenced against the 43 already identified CM diagnostic patterns to determine the frequency of sign and symptom occurrence within the patterns and cross referenced with the WHO standard terminology to check for repetition of patterns due to inconsistent nomenclature (i.e. stomach heat and stomach fire). As a result only 14 patterns were selected that satisfied frequency (each pattern had 10 or greater signs and symptoms). The final instrument consists of two gender specific questionnaires (male and female) with 68 possible male signs and symptoms and 70 in the female questionnaires with results reflecting on 14 different patterns. See Appendix 5 for the final instrument.

Measurement was based on percentage of signs and symptoms present against possible number of signs and symptom per pattern per gender (i.e. for *liver blood deficiency* the maximum possible signs and symptoms is 17 in males and 19 in females).

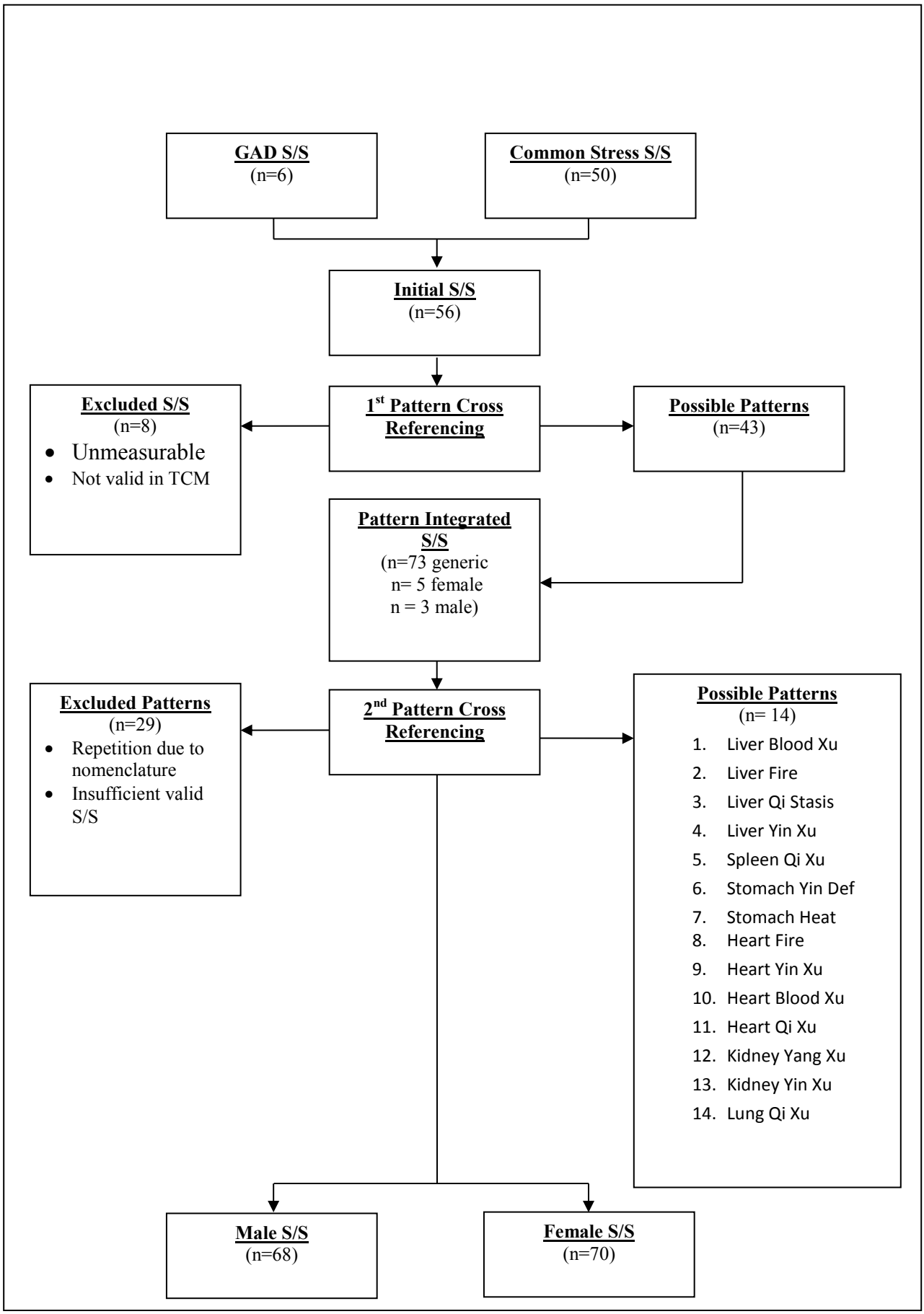

Figure 21: Flow chart of stress questionnaire instrument design

GAD refers to general anxiety disorder s/s refers to signs and symptoms.

6.2 Ethical Considerations

This study was deemed Nil/ Negligble risk and was approved by the Faculty of Science UTS with a HREC application number (UTS HREC 2013000564).

6.3 Intra-rater Reliability

Prior to data collection intra-rater reliability was established using a test re-test approach on volunteers. Thirty three participants (20 female and 13 male) who self reported as stressed were asked to complete the questionnaire and were then asked to retake the questionnaire one hour later. Matched data were analysed using Pearson correlation to ascertain intra-rater reliability.

6.4 Data Collection

The questionnaire was made available at the reception area of the UTS Chinese Medicine Clinic in the CBD area of Sydney. Self reporting stressed individuals attedning the clinic were given the opportunity to complete the questionnaire and deposit the completed questionnaire in a sealed box. Questionnaires from the box were collected periodically.

The questionnaires were used to determine symptom frequency and calculate the most common CM diagnostic patterns. The response to each question was tabulated in excel then transferred into a statistical package for analysis. Internal consistency (Cronbach's Alpha) was also calculated. Cronbach's Alpha was obtained using a multivariate item analysis for each individual question in the questionnaire (Minitab 16 statistical software).

Chapter VII: Results – Stress Questionnaire

7.1 Intra Rater Reliability

A total of 13 male participants and 20 female participants completed their respective questionnaires through the test and retest model. The results show that the intra rater reliablity was "very strong" (Weir) with the male questionnaire scoring a Pearson correlation of 0.846 ($p<0.001$) and the female participants a Pearson correlation of 0.844 ($p<0.001$).

7.2 Internal consistency

Results for internal consistency also showed excellent results with a Cronbach's Alpha of 0.959 in male participants (n=16) and a Cronbach's Alpha of 0.829 in female participants (n =45).

7.3 Pattern Differentiation

A total of 45 female participants and 16 male participants (n=61) completed their respective stress questionnaire. The mean age in years for females was 36.05 (±2.29 SD) while for males it was 40.7 (±3.32 SD).For the 45 females who completed the questionnaire the mean percentage of symptoms per CM pattern showed that the pattern with the highest average percentage was *Heart Qi deficiency* (61.88%) followed by *Liver Blood deficiency* (60.23%) and then *Heart Blood deficiency* (60.12%). The remaining pattern percentages were as follows *Heart Yin deficiency* (56.26%), *Spleen Qi deficiency* (55.15%), *Liver qi depression* (51.01%), *Liver Fire* (50.91%), *Heart Fire* (50.06%), *Liver Yin deficiency* (49.80%), *Stomach Heat* (47.72%), *Kidney Yin deficiency* (47.39%), *Kidney Yang deficiency* (44.19%), *Lung Qi deficiency* (43.76%) and *Stomach Yin deficiency* (43.41%).

In males (n =16), *Heart Qi deficiency* was also the highest scoring CM pattern with a scoring percentage of 54.81%. In males however *Heart Blood deficiency* was second with

53.29% followed by *Liver Blood deficiency* with 51.10%. The remaining patterns are ranked as follows; *Spleen Qi deficiency* (48.30%), *Liver qi depression* (48.13%), *Heart Yin deficiency* (47.50%), *Heart Fire* (45.07%), *Liver Fire* (43.44%), *Stomach Heat* (41.78%), *Kidney Yin deficiency* (40.12%), *Liver Yin deficiency* (38.69%), *Lung Qi deficiency* (37.02%), *Kidney Yang deficiency* (35.05%) and *Stomach Yin deficiency* (33.33%).

Mean Percentage of Symptoms per Pattern (%)

Pattern	Female (n =45)	Male (n = 16)
Heart Qi deficiency	61.88	54.81
Liver Blood deficiency	60.23	51.10
Heart Blood deficiency	60.12	53.29
Heart Yin deficiency	56.26	47.50
Spleen Qi deficiency	55.15	48.30
Liver qi depression	51.01	48.13
Liver Fire	50.91	43.44
Heart Fire	50.06	45.07
Liver Yin deficiency	49.80	38.69
Stomach Heat	47.72	41.78
Kidney Yin deficiency	47.39	40.12
Kidney Yang deficiency	44.19	35.05
Lung Qi deficiency	43.76	37.02
Stomach Yin deficiency	43.41	33.33

Table 3: Mean percentage of symptoms per pattern in males and females

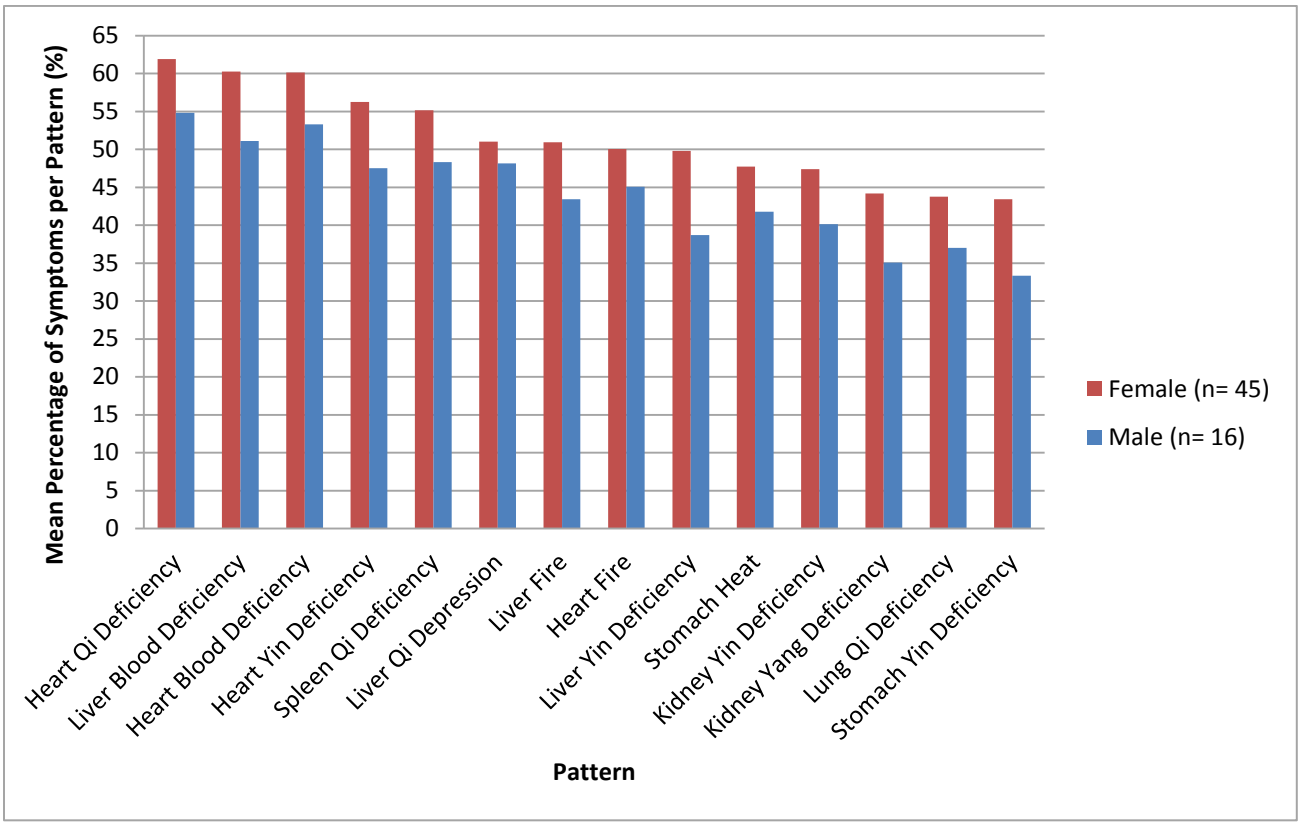

Figure 22: Mean percentage of symptoms per pattern in males and females

Based on individual pattern differentiation, 12 of the 45 female participants had *Heart Qi deficiency* as the primary CM pattern. Ten of the 45 female participants reported *Heart Blood deficiency* as their primary pattern (1 shared equal primary pattern with *Stomach Heat, Heart Fire* and *Heart Yin deficiency*, and another shared primary with *Liver Blood deficiency*). *Liver Blood deficiency* was the highest scoring pattern for 10 of 45 participants (1 shared first with *Liver Blood deficiency*). *Heart Qi deficiency* was the secondary pattern for 10 participants whilst for *Heart Blood deficiency*, this pattern was the secondary pattern in 10 participants (shared secondary pattern 3 times) and 12 occasions for *Liver Blood deficiency* (shared secondary pattern four times). Heart Qi deficiency was also the tertiary pattern for six individuals, whilst *Heart Blood deficiency* was the tertiary pattern nine times (shared 4 times) and *Liver Blood deficiency* 10 times (shared tertiary pattern 6 times). This equates to 28 of the 45 female participants having

Heart Qi deficiency as the primary, secondary or tertiary pattern. *Heart Blood deficiency* had 29 of 45 (with 10 shared) and *Liver Blood deficiency* had 30 of 45 (with 12 shared).

For males, the most prevalent patterns seen based on individual pattern differentiation were *Heart Qi deficiency, Heart Blood deficiency*, *Liver Blood deficiency* and *Liver qi depression*. *Heart Qi deficiency* was the primary pattern in 7 in 16 participants (1 shared), whilst *Heart Blood deficiency* was the primary pattern in 3 of 16. Both *Liver Blood deficiency* and *Liver qi depression* were primary patterns in two of 16 participants. *Heart Qi deficiency* was not a secondary pattern in any of the male participants, however *Heart Blood deficiency* was the secondary pattern in 5 of 16, *Liver Blood deficiency* in 4 of 16 and *Liver qi depression* 2 in 16. *Heart Qi deficiency* was also the tertiary pattern in 2 of 16 participants. Similarly *Heart Blood deficiency* was also the tertiary pattern in 2 of 16 participants (shared 1) as with *Liver qi depression* (2/16). No participants had *Liver Blood deficiency* as the tertiary pattern. Overall of the 16 male participants; nine (1 shared) had *Heart Qi deficiency* as primary, secondary or tertiary pattern, 10 (1 shared) for *Heart Blood deficiency*, and six for both *Liver Blood deficiency* and *Liver qi depression*.

Frequency of Most Common Patterns						
	Female			Male		
Pattern	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Liver Blood deficiency	8 (2)	12 (4)	10 (6)	2	4	0
Liver Fire	2 (1)	1	5 (1)	0	0	0
Liver qi depression	0	2	4	2	2	2
Liver Yin deficiency	1(1)	2	1 (1)	0	0	1
Spleen Qi deficiency	5 (1)	6	6 (1)	0	1	2
Stomach Yin deficiency	1	1	1	0	0	1
Stomach Heat	4 (1)	1	2 (1)	0	1	1 (1)
Heart Fire	3 (1)	1 (1)	3 (3)	1	1	2
Heart Yin deficiency	4 (1)	5 (2)	9 (4)	1	1	1
Heart Blood deficiency	10 (3)	10 (3)	9 (4)	3	5	2 (1)
Heart Qi deficiency	12	10	6	7 (1)	0	2
Kidney Yang deficiency	0	1	2 (1)	0	0	0
Kidney Yin deficiency	0	0	1 (1)	0	0	1
Lung Qi deficiency	2	0	1	1 (1)	1	1

Table 4: Frequency of most common patterns

Values depict frequency each pattern scores as primary, secondary or tertiary per individual participant questionnaire. Values in () indicate shared rankings.

7.4 Symptoms

From the general non gender specific symptoms collected (n=65 symptoms) the symptom which was most common reported by both men and women was “anxious or racing thoughts” (S4) with a total of 59 of the 61 participants reporting this symptom. Next most frequent was “constant worrying” (S5) with 58 participants reporting this as a symptom they experience. “Inability to concentrate” (S1), was ranked third with 57 of 61 participants reporting this as a symptom they experienced while feeling stressed. Symptoms of “irritability or short temper” (S7), “agitation, inability to relax” (S8) and “insomnia or sleep disturbances” (S8) were equally ranked 4th with 54 of 61 participants reporting this symptom when stressed. Following were symptoms of “moodiness” (S6) with reported by 52 of 61 individuals, “easily fatigued” (S17) with 51 of 61 individuals, “poor memory” (S1) and “listlessness” (S3) both with 45 of 61 and “depression” (S9) with 44 of 61 participants reporting this symptom.

Of the symptoms reported by the 45 females (n = 70 symptoms), the most commonly reported symptoms were “anxious or racing thoughts” (S4) and “constant worrying” (S5) with 43 of 45 participants reporting that they associate this with stress. “Easily fatigued” (S17) was the next most frequent with 42 of 45 participants reporting this, followed by “inability to concentrate” (S2) with 41 of 45 and then “irritability or short tempered” (S7) with 40 of 45. Symptoms of “agitation, inability to relax” (S8) had 39 of 45, “insomnia or sleep disturbances” (S60) was 39 of 45, “moodiness” (S6) 38 of 45, “thirst” (S35) with 36 and “poor memory” (S1) with 34 of 45.

For the symptoms reported by the 16 males (n = 68 symptoms), the most frequently reported symptom were "anxious or racing thoughts" (S4) and "inability to concentrate" (S2) with all 16 of 16 participants reporting that they associate this with stress. Symptoms of "constant worrying" (S5), "agitation, inability to relax" (S8) and "insomnia or sleep disturbances" (S60) are the next most frequent with each symptom (15 participants) "Irritability or short temper" (S7) and "moodiness" (S6) (14 participants). "Listlessness" (S3), "depression or general unhappiness" (S9) and "frequent sighing" (S13) all reported by 12 of the 16 participants

VIII: Discussion – Stress Questionnaire

8.1 Reliability

The results from the reliability computation show that the questionnaire was reliable. For intra-rater reliability this can be demonstrated with the male questionnaire obtaining a Pearson's correlation of 0.846 and the female questionnaire a Pearson's correlation of 0.844. Similarly inter-rater reliability was also quite high with the male questionnaire scoring Cronbach's Alpha of 0.959 and for the female questionnaire a Cronbach's Alpha of 0.829. From these scores it can be seen that the questionnaire developed is reliable; however there are also issues which need to be addressed to further validate the reliability. Firstly there needs to be a greater number of participants for the intra-rater reliability computation. Due to the nature of the intra-rater reliability testing via test and retest method, data from a smaller number of participants were collected. Whilst the Pearson's correlation scores for both questionnaires were adequate, only n= 13 male and n= 20 females completed the test retest process therefore a larger sample size to further validate these results is needed. Further consideration regarding the questionnaire is that participants were not in a controlled environment during the entire test and retest period and variables may have altered and influenced participants during the wait period of one hour between the test and retest times.

The inter-rater-reliability or internal consistency also suffered similar limitations. Whilst for female participants there was a reasonable sample size (n= 45), the male group was small (n= 16). Whilst this may be sufficient to calculate the Cronbach's Alpha further research is needed with a larger sample size.

8.2 Pattern and Symptoms

The results from the collective male and female questionnaires show that the three highest scoring patterns based on mean percentage were *Heart Qi deficiency* (61.88% in females and 54.81% in males), *Heart Blood deficiency* (60.12% in females and 53.29% in

males) and *Liver Blood deficiency* (60.23% in females and 51.10% in males). This was similar when pattern differentiation was applied individually for each respondent with *Heart Qi deficiency* (28 or 45), *Heart Blood deficiency* (29 of 45 with 10 shared) and *Liver Blood deficiency* (30 of 45 with 12 shared) being the most frequent patterns to be ranked first, second or third in females. For males this was also the case with *Heart Qi deficiency* (9 of 16 with 1 shared) and *Heart Blood deficiency* (10 of 16 with 1 shared), but with the inclusion of *Liver Qi Stasis* equally frequent as *Liver Blood deficiency* (6 of 16).

These results indicate that the most likely pattern for stress is *Heart Qi deficiency*, which is reflected in the symptoms of poor memory (S1), listlessness (S3), constant worrying (S5), depression or general unhappiness (S9), frequent sighing (S13), sweating in both daytime and night time (S14 and S15), easily fatigued (S17), loss of sex drive (S19), tinnitus or deafness (S33), palpitation (S46), difficulty breathing or shortness of breath (S48) and timidity (S65). Of these symptoms, four are within the ten most frequently presented symptoms (poor memory (S1), listlessness (S3), constant worrying (S5), depression or general unhappiness (S9) and easily fatigued (S17)). The Chinese medicine pathomechanism (Ch: *bing ji* 病机) underlying this finding is supported by the Chinese medical concept of the heart's ability to house and nourish the spirit (Ch: *shen* 神) within the body (Kaptchuk, 2000, Maciocia, 2004, Deng, 1999). Chinese medical theory establishes that the function of the *shen* is to control cognitive function, mood and emotion, memory and sleep-wake patterns. This will account for all of the ten most frequent symptoms for both genders with the exception of frequent sighing (S13) and thirst (S35).

The results from the study have changed the textual and populist perception that "stress" is usually associated with CM diagnostic pattern *Liver Qi Stasis*. One often cited example of this is the association of stress to a wiry pulse (Ch: *xian* 弦) and therefore a connection to a liver disharmony (Maciocia, 2004). Further connection of stress to the CM diagnostic

pattern of *Liver Qi Stasis* may also be due to liver's function as the mediator for the free flow of Qi within the body and its function to purge emotions (Kaptchuk, 2000). However once the most frequent symptoms associated with stress were identified, there are more aspects of heart involvement and *Shen* disturbed symptoms. This appears the same with both genders with *Heart Qi deficiency* and *Heart Blood deficiency* appearing as the most common primary, secondary or tertiary patterns; and highest scoring average. Despite this, the liver still play an important role as in both CM and western biomedicine in that the heart and liver share a very close connection (the CM relationship of emperor and the general (Kaptchuk, 2000) and the connections via the hepatic portal vein). *Liver Blood deficiency* was consistently one of the three highest scoring patterns in both genders, but placed higher in females (often second behind *Heart Blood deficiency*). This may be due to the Liver's connection to the female menstrual cycle in CM through connections with Penetrating Vessel channel (Ch: *Chong Mai* 冲 脉) (Kaptchuk, 2000). Whilst *Liver Qi Stasis* did not place highly in female respondents it appears much higher in male respondents, sharing a similar position with *Liver Blood deficiency* when patterns are compared individually. This may reflect the CM theory that men are more Qi orientated whilst women are blood orientated and their illness reflect this yin-yang dichotomy. Symptomatically this may be due to the presence of "frequent sighing" (S13), a classical symptom associated with *Liver Qi Stasis,* in the ten most frequent symptoms in men with 12 of 16 (75%) participants reporting this but only 29 of 45 females (64%) reporting this in their respective questionnaires. The symptom of "frequent sighing" is only associated with *Liver Qi stasis*, *Spleen Qi deficiency* and *Heart Qi deficiency*. It is also interesting to note that of the highest scoring patterns, with the exception of *Liver Qi Stasis* in males, are all deficient in nature. This may change the clinical outlook and overall treatment principles to treat stress disorders. Rather than focusing on treatments aimed to "reduce excess" or "move stagnation", perhaps treatments should focus more on supplementing and strengthening the deficiency to improve ability to overcome and cope with stress. This reflects negatively with some modern psychological views of stress and stress management, whereby stress hormones are seen to be in excess and pharmaceutical medications are administered to sedate patients suffering from stress to re-establish a

homeostatic balance (BeyondBlue, 2014). The CM concept of supplementation does reflect positively when the goal for treatment of stress may be perceived to be to improve a patient's coping mechanisms; that is rather than decrease the stressor, which often may not be possible, the patient is taught through cognitive therapy to better cope with the pressures of stress before any psychosomatic symptoms develop (Blenkiron, 2013). This does in some facets reflect the CM concept of supplementation.

8.3 Limitations

The questionnaire design has several limitations which cannot be mitigated. First the questionnaire was designed to collect symptoms which when collated would be used to calculate the percentage of an expressed pattern. However in CM diagnosis there are four diagnostic methods used; observation (Ch: *wang* 望), listening or smelling (Ch: *wen* 闻), inquiry (Ch: *wen* 问), and palpation (Ch: *qie* 切) (Kaptchuk, 2000). These diagnostic methods are used to determine which CM patterns the individual is expressing. However due to the limitation of a self-report questionnaire only symptoms that are self-reported by the respondent can be extrapolated and other potential diagnostic signs (criteria recognised by the diagnostician through the acts of observation, for example tongue characteristics), listening and smelling and palpation (for example, the radial artery and body) had to be excluded. The failure to obtain all diagnostic information, only which obtained from self-reporting by individuals, may bias the results of the study. The collective symptoms listed in the questionnaire is obviously not reflective of the complete CM diagnostic pattern, and at the same time the exclusion of signs from the original symptom cluster list for pattern identification obtained from The CM textbooks is also limited. This questionnaire was designed for logistic and pragmatic purposes to be easy to be administered to the general non-technical individuals who have no prior medical training as well as simple enough to be disseminated to maximise sample population. Using only self-reporting by respondents also minimises potential bias from the practitioner which may be present if the practitioner scored the questionnaire responses (Berle et al., 2010). Caution is suggested if the questionnaire is to be used as a form of

clinical CM diagnosis as it was not designed to a replace the experience of a practitioner but rather as an adjunctive tool to assist with the process of CM diagnosis.

A further limitation of the study is that while respondents were asked to rank the severity of symptoms they experienced, for the pattern differentiation process only whether the symptom was "present" or "absent" was used. This was due to the need to scale the symptoms to allow comparison across patterns. This concept of scaling of symptoms or the concept of "a key or a main symptom" which uniquely defines a pattern is reflective of the current practice of CM. However this method of diagnosis is not objective and or works as a clear operational definition. As a result it is very difficult to incorporate this into the questionnaire for two reasons, first the challenge of obtaining a consensus on which symptoms are considered more important than others and second the mathematical weighting model that should be used. Despite this the inclusion of ranking of severity allows clinical monitoring of progress of patients in regards to whether certain symptoms have improved (Berle et al., 2010).

Despite the limitations identified, the need for a better understanding of the term "stress" is warranted. While authors often use the term stress (Kondo and Kawamoto, 2014), few have offered to provide a clear operational definition or an explanation for the supposed CM patterns to be used as the basis for the CM treatment of stress. Other issues regarding use of the term come from translational errors, with a recent article by Santee (2008), investigating the stress management approaches described by the ancient Chinese philosopher *Zhuang Zi* (Ch; 庄子). While this manuscript implies the existence of the term "stress" in pre-modern China, the actual character used for the translation of stress was *you* 忧, which is conventionally translated as worry or anxiety (MDBG, 2014). The concept of worry is very different from the actual term stress, as the term stress was only first coined by Hans Seyle approximately 50 years ago (Rosch, 2014). Some authors may argue that worry or anxiety is often an associated stress response, it is by no means a definition for the term stress. As the nature of stress is subjective it cannot be simply defined as a single psychological symptom but may present as various psychosomatic

signs and symptoms. This raises the concern that many literature which aim to investigate stress are in actuality not investigating stress but only a facet of an associated stress presentation. This further emphasises the need for a clear operational definition of stress and its associated symptoms, which was one of the reasons for the development of the CM diagnostic pattern questionnaire within the current research study.

Chapter IX Overview and Recommendations

The aim of this thesis was to accomplish two main objectives; the development and coordination of a clinical trial to evaluate the efficacy of TC as a strategy to reduce stress in healthy individuals when compared to exercise and control groups; and the development of a stress questionnaire to aid in the pattern identification associated with stress as perceived in the CM paradigm and identify the symptoms most commonly associated with stress. The following are recommendations and future directions for further research regarding TC and stress as well as the diagnostics and treatment of stress within a CM paradigm.

The TC RCT provided evidence that both TC and exercise are beneficial for the reduction of stress and while TC was significantly better than a wait list, the number of participants required to allow a sufficiently powered comparison between TC and exercise were insufficient. To accomplish this, a larger and more statistically powered study needs to be conducted to evaluate if there are indeed any significant differences between TC and exercise. A power analysis indicates that at least 1096 participants per group are required to evaluate whether TC is truly superior to exercise.

A multisite study version of this study with site monitoring may be feasible as this will remove any potential bias due to the instructor or any cultural biases. Whilst the RCT showed strong results for the self-reporting outcome measures to suggest that TC is a superior to a wait list group, the objective outcomes such as blood pressure and HRV showed no changes. Therefore there needs to be further measures taken to improve the reliability and validity of these objective outcomes (i.e. 24 hour monitoring) or the use of other valid outcome measures for stress. This will of course be dependent on funding, as outcomes such as cortisol levels, either salivary or in serum, while relevant are more costly. Future studies with positive findings may prove instrumental in policy making regarding mental health prevention and care which empowers the patient without the

need for more strenuous exercise or the accompanied social stigma associated with receiving Cognitive Behaviour Therapy or pharmaceutical interventions.

The questionnaire demonstrated that stress is more commonly expressed as a deficiency CM diagnostic pattern than the common assumption of *Liver Qi depression,* an excess CM diagnostic pattern. Whilst the instrument is statistically reliable it would be beneficial to have a larger sample size for testing reliability and the possibility of translations to different languages to see if the cultural understanding of stress will impact upon the symptoms expressed.

The CM diagnostic pattern results however may prove useful for clinicians as the change in diagnostic understanding will also change the treatment principle and subsequent treatment with acupuncture or herbal medicine. Future CM research studies should include this questionnaire either as a diagnostic aid or as an outcome measure for acupuncture or herbal medicine studies. While this questionnaire deals mainly with the CM paradigm, it will be equally beneficial to administer this questionnaire in the biomedical diagnosis of stress utilising its extensive listing of symptoms associated with stress. It may also facilitate further understanding on idiopathic disorders which may be defined as "comorbidities" to stress disorders.

The combined results from the RCT and questionnaire may lead to future studies which incorporates the questionnaire in stress RCTs and can be used in conjunction with other stress outcome measures. This may be useful in identifying whether meaningful correlations exist between stress levels obtained by conventional or well recognised outcomes measures and changes in symptom expression and conversely any changes for CM pattern identification.

It is hoped that these recommendations are incorporated into the design of future clinical trials for stress and TC and that these recommendations may, through future research, be transformed to more practical benefits in a clinical setting.

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Appendices

Appendix 1

Information Pack

University of Technology, Sydney

Subject Information Statement
The effect of six weeks of tai chi practice on anxiety in healthy but stressed people compared to an exercise only comparison group
HREC 2011-107A

WHO IS DOING THE RESEARCH?
My name is Shuai Zheng and I am a student studying Doctor of Philosophy at UTS. My supervisor is Associate Professor Chris Zaslawski.

WHAT IS THIS RESEARCH ABOUT?
This research is to determine whether 12 weeks of Tai Chi practice (six weeks supervised and six weeks self-practise) can successfully and significantly reduce levels of stress in healthy but stressed individuals.

WHAT IS TAI CHI?
Tai Ji 太极 or *Tai Chi* (TC) is an ancient Chinese mind body exercise that is practised worldwide by millions of people daily with the belief that it has the potent healing effects upon the practitioner and a fundamental path for longevity(1). Whilst the mechanisms behind TC are not fully understood it is a general consensus among the general population that TC calms the mind and benefits health. There has been growing interest in the scientific community to evaluate the efficacy of TC in various physiological and psychological conditions ranging from fear of falling in the elderly (2-4), balance (5-7), metabolic disorders (8-10), arthritis (3, 11-16) and psychological health (9, 17, 18).

IF I SAY YES, WHAT WILL IT INVOLVE?
You will be screened using a questionnaire to see if you fulfil the selection criteria. Once you qualify for selection you will be asked to complete several questionnaires and undergo the collection of two physiological tests at University of Technology, Sydney. These tests and assessments will be conducted a total of three times, once initially before starting the tai chi, once after six weeks and once after twelve weeks.
You will be randomly allocated to one of three groups and will be assigned to either study Tai Chi for twelve weeks (six weeks contact and six weeks self practice), participate in a exercise program for twelve weeks or be part of a wait group for twelve weeks.

At the completion of the twelve weeks the wait group will also receive six weeks of Tai Chi training and a DVD in appreciation for their participation in this trial.

WHAT ARE THE SELECTION CRITERIA?

Inclusion criteria
Participants must be 18-60 years of age and have no serious medical conditions (Screened using the Lifestyle Appraisal Questionnaire(19))
Must be able to understand and sign the consent form
Score above the cut off on the State Trait Anxiety Inventory (20)

Exclusion criteria
Currently training or have trained Tai Chi in the last 12 months
Currently exercising on a regular basis

WHAT COMMITMENTS ARE REQUIRED FROM ME?
If you are randomly allocated to either Tai Chi or Gym group you will need to be able commit at least five hours a week (for the duration of 12 weeks) to either practising Tai Chi or exercising. For the Tai Chi group at least two of the five hours per week must consist of face to face lessons with the Tai Chi instructor (during the first six weeks). The exercise group is expected to spend at least two hours per week at the UTS Fitness centre.

WHERE WILL THE TRIAL TAKE PLACE?
All activities will be conducted at the University of Technology, Sydney city campus. The Tai Chi lessons will be conducted in the Tower building, level 12 in the Traditional Chinese Medicine teaching rooms whilst the exercise sessions will be at the UTS Fitness Centre in building 4.
Due to the location of the trial it is highly recommended that only those who can commit to the weekly travel to UTS should apply.

WHEN WILL THE TRIAL START AND HOW LONG WILL IT RUN FOR?
The trial is scheduled to commence in September and will finish in November. However those who are allocated to the Tai Chi group will only be required to attend regularly during the initial six weeks.

ARE THERE ANY RISKS?
There are very few if any risks because the research has been carefully designed and Tai Chi is a very gentle form of exercise which puts minimal strain on the body and is relatively safe. Also all participants will be supervised by a trained professional and an instructor of the Australian Kung Fu Sport Association whilst conducting the trial.

WHY HAVE I BEEN ASKED?
Because you have identified that you may be stressed and want to participate in learning Tai Chi.

DO I HAVE TO SAY YES?
You don’t have to say yes.

WHAT WILL HAPPEN IF I SAY NO?
Nothing. I will thank you for your time so far and won’t contact you about this research again.

IF I SAY YES, CAN I CHANGE MY MIND LATER?
You can change your mind at any time and you don't have to say why. I will thank you for your time so far and won't contact you about this research again.

WHO DO I CONTACT IF I NEED MORE INFORMATION?
For general enquires please feel free to email: taichiUTS@y7mail.com
Alternatively if you have more specific questions please contact

Mr. Shuai Zheng
Shuai.Zheng@student.uts.edu.au
(02) 9514 1780

or

Associate Professor Chris Zaslawski
Chris.Zaslawski@uts.edu.au
(02) 9514 7856

WHAT IF I HAVE CONCERNS OR A COMPLAINT?
If you have concerns about the research that you think I or my supervisor can help you with, please feel free to contact me (us) on 9514 7856.
If you would like to talk to someone who is not connected with the research, you may contact the Research Ethics Officer on 02 9514 9772, and quote this number *HREC 2011-107A*

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Consent Form

UNIVERSITY OF TECHNOLOGY, SYDNEY
STUDENT RESEARCH

I _____ agree to participate in the research project

"The effect of six weeks of tai chi practice on anxiety in healthy but stressed people compared to an exercise only comparison group"
(HREC approval number 2011-107A) being conducted by Shuai Zheng, of Building 4 level 3, room 44 of the University of Technology, Sydney for his Doctor of Philosophy degree.
I understand that the purpose of this study is to collect psychological and physiological data.

1. The procedures required for the project have been explained to me, and any questions I have about the project have been answered to my satisfaction;

2. I have read the Subject Information Statement and have been given the opportunity to discuss the information and my involvement in the project with family and /or friends.

3. I do not have an implanted cardiac pacemaker or auto defibrillator.

4. I have been made aware of the small risks and inconveniences associated with the project;

I am aware that I can contact Shuai Zheng or his supervisor Associate Professor Chris Zaslawski (02 9514 7856) if I have any concerns about the research. I also understand that I am free to withdraw my participation from this research project at any time I wish, without consequences, and without giving a reason.
I agree that Shuai Zheng has answered all my questions fully and clearly.
I agree that the research data gathered from this project may be published in a form that does not identify me in any way.

_____ ____/____/____
Signature (participant)

_____ ____/____/____
Signature (researcher or delegate)

NOTE:
This study has been approved by the University of Technology, Sydney Human Research Ethics Committee. If you have any complaints or reservations about any aspect of your participation in this research which you cannot resolve with the researcher, you may contact the Ethics Committee through the Research Ethics Officer (ph: +61 2 9514 9772 Research.Ethics@uts.edu.au) and quote the UTS HREC reference number. Any complaint you make will be treated in confidence and investigated fully and you will be informed of the outcome.

Appendix 2
Lifestyle Appraisal Questionnaire

LIFESTYLE APPRAISAL QUESTIONNAIRE

Please circle the appropriate number

1. (a) Have you ever regularly smoked cigarettes?

No	0
Yes	1

(b) Do you presently smoke cigarettes?

No	0
Yes	3

* If you presently smoke – answer Questions 2 & 3. If not – go to Q. 4.

2. How frequently do you smoke?

Only socially (once a week or less)	1
Once or twice a day	2
Up to 10 a day	3
More than 10 a day	4

3. Have you ever attempted to give up smoking?

Never	1
Yes, but have not been successful	2

4. Systolic blood pressure (mmHg) ..... Syst.

Less than 130	0
130 – 139	1
140 – 149	2
150 – 159	3
160 +	4

5. Diastolic blood pressure (mmHg) ..... Diast.

Less than 80	0
80 – 84	1
85 – 89	2
90 – 95	3
95 +	4

6. Body Mass Index
height (without shoes) ..... cms
weight (light clothes/no shoes ... kilos

Less than 20	1
20 – 24	0
25 – 29	2
30 – 34	3
35 +	4

7. Do you drink alcohol?

No, or up to 2 drinks per day	0
3 – 4 drinks per day	1
5 – 8 drinks per day	2
9 – 15 drinks per day	3
More than 16 drinks per day	4

8. Do you take any drugs or medication other than tea, coffee, alcohol and nicotine (eg. sleeping tablets, anti-anxiety drugs such as valium, anti-depressants, hallucinogens, barbiturates, pain-killers, etc.)?

No	0
Only once or twice a year	1
Once or twice a month	2
Once or twice a week	3
Every day	4

9. Does anyone in your immediate family (father, mother, brother, sister) have a history of:

Heart disease	No	0
	Yes	1
Cancer	No	0
	Yes	1
High blood pressure	No	0
	Yes	1

10. How often do you exercise or go for a walk? (For at least 15 minutes each time)

3 or more times a week	0
About once a week	1
About once a month	2
Not at all	3

11. How frequently do you participate in an activity or recreation you enjoy (eg. gardening, reading, hobbies, sport etc.)?

Every day	0
Once a week	1
Once a month	2
Not at all	3

12. How often do you do any relaxation exercises?

At least once a week	0
About once a month	1
Once every 6 months	2
Not at all	3

13. How frequently do you eat a meal that is composed of a mixture of vegetables, fruit, bread, and lean meat?

At least once a day	0
2 – 3 times a week	1
Once a week	2
Once a month	3
Rarely	4

14. How often do you eat fatty or sweet foods (such as fat on meat, pies, fried foods, cheeses, full cream products, chocolate etc.)?

Once or twice a week	0
About once a day	1
A few times each day	2
At least 4 times a day	3

15. Do you have close friends and family to help you with problems?

Always available	0
Often available	1
Sometimes available	2
Rarely or never available	3

16. How often do you give and receive affection?

Frequently each day	0
Occasionally each day	1
Once or twice a week	2
Once or twice a month	3
Rarely or never	4

17. In the last 6 months, how many major stressful events have you experienced (such as any experiences that cause upset or create pressure, eg. loss of a loved one, divorce, financial crisis, illness, robbery, loss of employment, accident etc.)?

None	0
1 – 2	1
3 – 6	2
7 – 12	3
More than 12	4

18. Do you, at present suffer from any chronic disease or illness (such as cancer, heart disease, asthma, diabetes, arthritis, etc.)?

No	0
Yes	2

If yes please list the disease(s) .....

19. Do you suffer from physical symptoms (such as headache, backache, poor appetite, dizziness, sleep disturbance, loss of sexual interest, nausea, fatigue etc.)?

Not at all	0
A few times a year	1
Once or twice a month	2
Once or twice a week	3
Every day	4

If yes, please list these symptoms ...

20. How often do you have a good nights sleep?

Most nights	0
About every second night	1
About once a week	2
Rarely	3

21. Do you drink tea or coffee?

No, or up to 3 cups per day	0
4 – 8 cups per day	1
9 – 12 cups per day	2
13 – 20 cups per day	3
More than 20 cups per day	4

Please select the box which is most appropriate to the frequency you feel the statements below

		Almost never	Sometimes	Often	Almost always
1	My life is controlled by luck and chance				
2	I feel nervous and not in control				
3	I worry too much about things				
4	I have difficulty making decisions				
5	For me, it is a waste of time exercising and relaxing				
6	It is better to avoid life's pressure than face them				
7	There is not much I can do to solve my problems				
8	I get stressed very easily				
9	Managing my time is difficult				
10	It is difficult to concentrate on what I am doing				
11	I have no confidence in what I do				
12	I feel things are getting on top of me				
13	I cannot control the stress I experience				
14	My work causes me to become stressed				
15	I am no satisfied with the way I am managing my life				
16	I feel angry and frustrated				
17	I get very upset when I fail to achieve what I want				
18	I 'bottle up' my feelings				
19	I try to do too many things at once				
20	I get impatient with life				
21	I feel guilty when I take 'time-out' to enjoy myself				
22	I am not confident about managing my future				
23	Other people cannot help me manage my stress				
24	I am unable to enjoy my day-to-day activities				
25	At the end of the day I have been feeling very hassled				

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State Trait Anxiety Inventory

SELF-EVALUATION QUESTIONNAIRE STAI Form Y-1

Please provide the following information:

Name_____ Date_____ S_____

Age_____ Gender (*Circle*) M F T_____

DIRECTIONS:

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel *right* now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	1	2	3	4
2. I feel secure	1	2	3	4
3. I am tense	1	2	3	4
4. I feel strained	1	2	3	4
5. I feel at ease	1	2	3	4
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel satisfied	1	2	3	4
9. I feel frightened	1	2	3	4
10. I feel comfortable	1	2	3	4
11. I feel self-confident	1	2	3	4
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel indecisive	1	2	3	4
15. I am relaxed	1	2	3	4
16. I feel content	1	2	3	4
17. I am worried	1	2	3	4
18. I feel confused	1	2	3	4
19. I feel steady	1	2	3	4
20. I feel pleasant	1	2	3	4

SELF-EVALUATION QUESTIONNAIRE

STAI Form Y-2

Name_____ Date_____

DIRECTIONS

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	1	2	3	4
22. I feel nervous and restless	1	2	3	4
23. I feel satisfied with myself	1	2	3	4
24. I wish I could be as happy as others seem to be	1	2	3	4
25. I feel like a failure	1	2	3	4
26. I feel rested	1	2	3	4
27. I am "calm, cool, and collected"	1	2	3	4
28. I feel that difficulties are piling up so that I cannot overcome them	1	2	3	4
29. I worry too much over something that really doesn't matter	1	2	3	4
30. I am happy	1	2	3	4
31. I have disturbing thoughts	1	2	3	4
32. I lack self-confidence	1	2	3	4
33. I feel secure	1	2	3	4
34. I make decisions easily	1	2	3	4
35. I feel inadequate	1	2	3	4
36. I am content	1	2	3	4
37. Some unimportant thought runs through my mind and bothers me	1	2	3	4
38. I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39. I am a steady person	1	2	3	4
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

Perceived Stress Scale 14

Instructions for the Perceived Stress Scale(1)

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate.

Please circle the most correct option.

1. In the last month, how often have you been upset because of something that happened unexpectedly?
   0. never 1. almost never 2. sometimes 3. fairly often 4. very often

2. In the last month, how often have you felt that you were unable to control the important things in your life?
   0. never 1. almost never 2. sometimes 3. fairly often 4. very often

3. In the last month, how often have you felt nervous and "stressed"?
   0. never 1. almost never 2. sometimes 3. fairly often 4. very often

4. In the last month, how often have you dealt successfully with irritating life hassles?
   0. very often 1. fairly often 2. sometimes 3. almost never 4. never

5. In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?
   0. very often 1. fairly often 2. sometimes 3. almost never 4. never

6. In the last month, how often have you felt confident about your ability to handle your personal problems?
   0. very often 1. fairly often 2. sometimes 3. almost never 4. never

7. In the last month, how often have you felt that things were going your way?
   0. very often 1. fairly often 2. sometimes 3. almost never 4. never

8. In the last month, how often have you found that you could not cope with all the things that you had to do?

   0. never 1. almost never 2. sometimes 3. fairly often 4. very often

9. In the last month, how often have you been able to control irritations in your life?

   0. very often 1. fairly often 2. sometimes 3. almost never 4. never

10. In the last month, how often have you felt that you were on top of things?

    0. very often 1. fairly often 2. sometimes 3. almost never 4. never

11. In the last month, how often have you been angered because of things that happened that were outside of your control?

    0. never 1. almost never 2. sometimes 3. fairly often 4. very often

12. In the last month, how often have you found yourself thinking about things that you have to accomplish?

    0. never 1. almost never 2. sometimes 3. fairly often 4. very often

13. In the last month, how often have you been able to control the way you spend your time?

    0. very often 1. fairly often 2. sometimes 3. almost never 4. never

14. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

    0. never 1. almost never 2. sometimes 3. fairly often 4. very often

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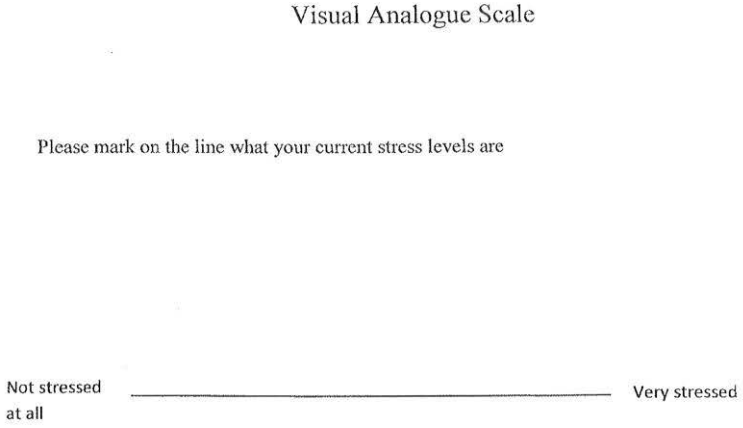
Visual Analogue Scale



Short Form 36

ID No:

SF36 Health Survey

INSTRUCTIONS: This set of questions asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. Answer every question by marking the answer as indicated. If you are unsure about how to answer a question please give the best answer you can.

1. In general, would you say your health is: (Please tick **one** box.)
   - Excellent ☐
   - Very Good ☐
   - Good ☐
   - Fair ☐
   - Poor ☐

2. Compared to one year ago, how would you rate your health in general now? (Please tick **one** box.)
   - Much better than one year ago ☐
   - Somewhat better now than one year ago ☐
   - About the same as one year ago ☐
   - Somewhat worse now than one year ago ☐
   - Much worse now than one year ago ☐

3. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much? **(Please circle one number on each line.)**

	Activities	Yes, Limited A Lot	Yes, Limited A Little	Not Limited At All
3(a)	**Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports	1	2	3
3(b)	**Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
3(c)	Lifting or carrying groceries	1	2	3
3(d)	Climbing **several** flights of stairs	1	2	3
3(e)	Climbing **one** flight of stairs	1	2	3
3(f)	Bending, kneeling, or stooping	1	2	3
3(g)	Waling **more than a mile**	1	2	3
3(h)	Walking **several blocks**	1	2	3
3(i)	Walking **one block**	1	2	3
3(j)	Bathing or dressing yourself	1	2	3

4. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health? **(Please circle one number on each line.)**

		Yes	No
4(a)	Cut down on the **amount of time** you spent on work or other activities	1	2
4(b)	Accomplished less than you would like	1	2
4(c)	Were **limited** in the **kind** of work or other activities	1	2
4(d)	Had **difficulty** performing the work or other activities (for example, it took extra effort)	1	2

5. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (e.g. feeling depressed or anxious)? **(Please circle one number on each line.)**

		Yes	No
5(a)	Cut down on the **amount of time** you spent on work or other activities	1	2
5(b)	Accomplished less than you would like	1	2
5(c)	Didn't do work or other activities as **carefully** as usual	1	2

PLEASE TURN OVER

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours, or groups? (Please tick **one** box.)

- Not at all ☐
- Slightly ☐
- Moderately ☐
- Quite a bit ☐
- Extremely ☐

7. How much physical pain have you had during the past 4 weeks? (Please tick **one** box.)

- None ☐
- Very mild ☐
- Mild ☐
- Moderate ☐
- Severe ☐
- Very Severe ☐

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)? (Please tick **one** box.)

- Not at all ☐
- A little bit ☐
- Moderately ☐
- Quite a bit ☐
- Extremely ☐

9. These questions are about how you feel and how things have been with you during the past 4 weeks. Please give the one answer that is closest to the way you have been feeling for each item.

	(Please circle one number on each line.)	All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	None of the Time
9(a)	Did you feel full of life?	1	2	3	4	5	6
9(b)	Have you been a very nervous person?	1	2	3	4	5	6
9(c)	Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
9(d)	Have you felt calm and peaceful?	1	2	3	4	5	6
9(e)	Did you have a lot of energy?	1	2	3	4	5	6
9(f)	Have you felt downhearted and blue?	1	2	3	4	5	6
9(g)	Did you feel worn out?	1	2	3	4	5	6
9(h)	Have you been a happy person?	1	2	3	4	5	6
9(i)	Did you feel tired?	1	2	3	4	5	6

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives etc.) (Please tick **one** box.)

- All of the time ☐
- Most of the time ☐
- Some of the time ☐
- A little of the time ☐
- None of the time ☐

11. How TRUE or FALSE is each of the following statements for you?

	(Please circle one number on each line.)	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
11(a)	I seem to get sick a little easier than other people	1	2	3	4	5
11(b)	I am as healthy as anybody I know	1	2	3	4	5
11(c)	I expect my health to get worse	1	2	3	4	5
11(d)	My health is excellent	1	2	3	4	5

Thank You!

Appendix 3

Table of Tai Chi RCT Outcome Results

	Tai Chi			Exercise			Waiting List		
	Week 0	Week 6	Week 12	Week 0	Week 6	Week 12	Week 0	Week 6	Week 12
Stress and Anxiety Based Questionnaires									
State Anxiety†	55.35 ± 1.910	47.00 ± 1.910	39.65 ± 1.910	55.71 ± 1.910	46.41 ± 1.910	42.94 ± 1.910	50.75 ± 1.968	49.63 ± 1.968	50.00 ± 1.968
Trait Anxiety†	56.18 ± 1.273	47.47 ± 1.273	45.12 ± 1.273	57.24 ± 1.273	48.94 ± 1.273	47.24 ± 1.273	54.31 ± 1.312	53.31 ± 1.312	52.56 ± 1.312
Perceived Stress Scale†	38.88 ± 1.147	28.06 ± 1.147	26.65 ± 1.147	37.47 ± 1.147	28.88 ± 1.147	26.47 ± 1.147	35.38 ± 1.183	32.63 ± 1.183	31.25 ± 1.183
Visual Analogue Scale‡	77.53 ± 4.207	49.00 ± 4.207	43.94 ± 4.207	71.59 ± 4.207	51.24 ± 4.207	46.12 ± 4.207	62.63 ± 4.336	54.63 ± 4.336	52.94 ± 4.336
Blood Pressure (mm/Hg)									
Mean Arterial Pressure	89.16 ± 1.000	87.22 ± 1.000	86.65 ± 1.000	85.08 ± 1.000	85.70 ± 1.000	84.96 ± 1.000	86.96 ± 1.031	87.35 ± 1.031	85.84 ± 1.031
Systolic Blood Pressure	113.8 ± 1.212	112.3 ± 1.212	111.9 ± 1.212	110.3 ± 1.212	109.5 ± 1.212	109.5 ± 1.212	110.9 ± 1.249	111.8 ± 1.249	109.6 ± 1.249
Diastolic Blood Pressure	76.84 ± 1.018	74.70 ± 1.018	74.02 ± 1.018	72.45 ± 1.018	73.80 ± 1.018	72.72 ± 1.018	74.97 ± 1.050	75.13 ± 1.050	73.95 ± 1.050
Short Form 36 Health Survey Domain Subscales									
Physical Functioning†	86.18 ± 2.045	91.18 ± 2.045	93.53 ± 2.045	85.29 ± 2.045	86.18 ± 2.045	93.53 ± 2.045	87.81 ± 2.107	89.06 ± 2.107	89.69 ± 2.107
Role - Physical†	48.24 ± 5.246	49.41 ± 5.246	60.00 ± 5.246	49.41 ± 5.246	54.12 ± 5.246	57.65 ± 5.246	52.50 ± 5.407	63.75 ± 5.407	62.50 ± 5.407

Bodily Pain†	72.76 ± 3.035	72.35 ± 3.035	76.06 ± 3.035	63.76 ± 3.035	69.82 ± 3.035	73.41 ± 3.035	69.69 ± 3.129	75.38 ± 3.129	73.19 ± 3.129
General Health†	41.18 ± 2.288	52.18 ± 2.288	57.24 ± 2.288	45.29 ± 2.288	56.41 ± 2.288	60.82 ± 2.288	61.56 ± 2.358	58.37 ± 2.358	62.69 ± 2.358
Vitality†	27.35 ± 3.157	45.59 ± 3.157	49.41 ± 3.157	30.00 ± 3.157	47.94 ± 3.157	51.47 ± 3.157	33.44 ± 3.255	35.94 ± 3.255	41.56 ± 3.255
Social Functioning†	48.53 ± 3.942	66.91 ± 3.942	74.26 ± 3.942	47.06 ± 3.942	64.71 ± 3.942	72.06 ± 3.942	55.47 ± 4.063	64.06 ± 4.063	64.53 ± 4.063
Role - Emotional†	31.37 ± 7.052	60.78 ± 7.052	62.75 ± 7.052	15.69 ± 7.052	56.86 ± 7.052	70.59 ± 7.052	43.75 ± 7.269	29.17 ± 7.269	43.75 ± 7.269
Mental Health†	41.18 ± 2.588	63.06 ± 2.588	67.76 ± 2.588	40.47 ± 2.588	58.35 ± 2.588	60.47 ± 2.588	52.50 ± 2.667	50.50 ± 2.667	54.00 ± 2.667
Heart Rate Variability									
VLF (ms^2)	797.9 ± 299.6	1243 ± 299.6	1095.5 ± 299.6	1620.2 ± 338.0	1564.8 ± 338.0	1367.6 ± 338.0	1569.1 ± 338.0	1572.5 ± 338.0	2107.5 ± 338.0
LF (ms2)	846.8 ± 348.3	946.3 ± 348.3	924.8 ± 348.3	2057.2 ± 392.9	1373.3 ± 392.9	1244.4 ± 392.9	2323.6 ± 392.9	1685.9 ± 392.9	1927.3 ± 392.9
HF (ms2)	1340.3 ± 479.7	720.8 ± 479.7	744.0 ± 479.7	2091.7 ± 541.2	905.0 ± 41.2	1173.2 ± 541.2	1673.5 ± 541.2	2129.2 ± 541.2	1679.1 ± 541.2
Total (ms2)	2985 ± 962.9	2910 ± 962.9	2764 ± 962.9	5769 ± 1086.3	3843 ± 1086.3	3785 ± 1086.3	5566 ± 1086.3	5387 ± 1086.3	5714 ± 1086.3
Ratio	3.348 ± 0.4611	3.268 ± 0.4611	2.740 ± 0.4611	1.523 ± 0.5202	1.741 ± 0.5202	1.680 ± 0.5202	2.024 ± 0.5202	1.435 ± 0.5202	1.478 ± 0.5202
LF normalised units	0.6555 ± 0.03793	0.6576 ± 0.03793	0.6416 ± 0.03793	0.5646 ± 0.04279	0.5788 ± 0.04279	0.5726 ± 0.04279	0.6131 ± 0.04279	0.5130 ± 0.04279	0.5432 ± 0.04279
HF normalised units	0.3445 ± 0.03793	0.3424 ± 0.03793	0.3584 ± 0.03793	0.4354 ± 0.04279	0.4212 ± 0.04279	0.4274 ± 0.04279	0.3869 ± 0.04279	0.4870 ± 0.04279	0.4568 ± 0.04279

All values are mean values ± Standard Error of the mean unless otherwise stated. P values are calculated via a two-way ANOVA with repeated measures followed by Bonferroni's post-hoc test.
†Lower scores indicate improved state
‡Higher scores indicate improved state
*p<0.05, **p<0.01, ***p<0.001

Appendix 4

General Linear Model: State Anxiety (Y-1) versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      50  a1, a10, a11, a12, a13, a14, a15, a16, a17, a2,
                               a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12,
                               b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7,
                               b8, b9, c1, c10, c11, c12, c13, c14, c15, c16,
                               c2, c3, c4, c5, c6, c7, c8, c9
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Y-1, using Adjusted SS for Tests

Source           DF    Seq SS    Adj SS  Adj MS     F      P
Subject(Group)   47  12480.23  12480.23  265.54  4.28  0.000
Group             2    196.46    196.46   98.23  1.58  0.210
Time(Group)       6   3591.13   3591.13  598.52  9.66  0.000
Error            94   5826.87   5826.87   61.99
Total           149  22094.69


S = 7.87325   R-Sq = 73.63%   R-Sq(adj) = 58.20%


Least Squares Means for Y-1

(Group)Time   Mean  SE Mean
 1     1     55.35    1.910
 1     2     47.00    1.910
 1     3     39.65    1.910
 2     1     55.71    1.910
 2     2     46.41    1.910
 2     3     42.94    1.910
 3     1     50.75    1.968
 3     2     49.63    1.968
 3     3     50.00    1.968
```

General Linear Model: Trait Anxiety (Y-2) versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      50  a1, a10, a11, a12, a13, a14, a15, a16, a17, a2,
                               a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12,
                               b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7,
                               b8, b9, c1, c10, c11, c12, c13, c14, c15, c16,
                               c2, c3, c4, c5, c6, c7, c8, c9
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Y-2, using Adjusted SS for Tests
```

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Subject(Group)	47	13461.87	13461.87	286.42	10.40	0.000
Group	2	361.46	361.46	180.73	6.56	0.002
Time(Group)	6	2151.53	2151.53	358.59	13.02	0.000
Error	94	2588.47	2588.47	27.54		
Total	149	18563.33				

S = 5.24756 R-Sq = 86.06% R-Sq(adj) = 77.90%

Least Squares Means for Y-2

(Group)	Time	Mean	SE Mean
1	1	56.18	1.273
1	2	47.47	1.273
1	3	45.12	1.273
2	1	57.24	1.273
2	2	48.94	1.273
2	3	47.24	1.273
3	1	54.31	1.312
3	2	53.31	1.312
3	3	52.56	1.312

General Linear Model: Perceived Stress Scale 14 (PSS14) versus Group, Subject, Time

Factor	Type	Levels	Values
Subject(Group)	fixed	50	a1, a10, a11, a12, a13, a14, a15, a16, a17, a2, a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12, b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7, b8, b9, c1, c10, c11, c12, c13, c14, c15, c16, c2, c3, c4, c5, c6, c7, c8, c9
Group	fixed	3	1, 2, 3
Time(Group)	fixed	9	1, 2, 3, 1, 2, 3, 1, 2, 3

Analysis of Variance for PSS14, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Subject(Group)	47	7139.86	7139.86	151.91	6.79	0.000
Group	2	134.14	134.14	67.07	3.00	0.055
Time(Group)	6	2801.21	2801.21	466.87	20.86	0.000
Error	94	2103.46	2103.46	22.38		
Total	149	12178.67				

S = 4.73046 R-Sq = 82.73% R-Sq(adj) = 72.62%

Least Squares Means for PSS14

(Group)	Time	Mean	SE Mean
1	1	38.88	1.147
1	2	28.06	1.147
1	3	26.65	1.147
2	1	37.47	1.147

2	2	28.88	1.147
2	3	26.47	1.147
3	1	35.38	1.183
3	2	32.63	1.183
3	3	31.25	1.183

General Linear Model: Visual Analogue Scale (VAS) versus Group, Subject, Time

Factor	Type	Levels	Values
Subject(Group)	fixed	50	a1, a10, a11, a12, a13, a14, a15, a16, a17, a2, a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12, b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7, b8, b9, c1, c10, c11, c12, c13, c14, c15, c16, c2, c3, c4, c5, c6, c7, c8, c9
Group	fixed	3	1, 2, 3
Time(Group)	fixed	9	1, 2, 3, 1, 2, 3, 1, 2, 3

Analysis of Variance for VAS, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Subject(Group)	47	45146.5	45146.5	960.6	3.19	0.000
Group	2	7.5	7.5	3.7	0.01	0.988
Time(Group)	6	18179.3	18179.3	3029.9	10.07	0.000
Error	94	28278.0	28278.0	300.8		
Total	149	91611.3				

S = 17.3445 R-Sq = 69.13% R-Sq(adj) = 51.07%

Least Squares Means for VAS

(Group)	Time	Mean	SE Mean
1	1	77.53	4.207
1	2	49.00	4.207
1	3	43.94	4.207
2	1	71.59	4.207
2	2	51.24	4.207
2	3	46.12	4.207
3	1	62.63	4.336
3	2	54.63	4.336
3	3	52.94	4.336

General Linear Model: Mean Arterial Pressure versus Group, Subject, Time

Factor	Type	Levels	Values
Subject(Group)	fixed	50	a1, a10, a11, a12, a13, a14, a15, a16, a17, a2, a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12, b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7, b8, b9, c1, c10, c11, c12, c13, c14, c15, c16, c2, c3, c4, c5, c6, c7, c8, c9
Group	fixed	3	1, 2, 3
Time(Group)	fixed	9	1, 2, 3, 1, 2, 3, 1, 2, 3

Analysis of Variance for Mean Arterial Pressure, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Subject(Group)	47	9804.93	9804.93	208.62	12.27	0.000
Group	2	152.90	152.90	76.45	4.50	0.014
Time(Group)	6	84.19	84.19	14.03	0.83	0.553
Error	94	1598.41	1598.41	17.00		
Total	149	11640.43				

S = 4.12364 R-Sq = 86.27% R-Sq(adj) = 78.23%

Least Squares Means for Mean Arterial Pressure

(Group)	Time	Mean	SE Mean
1	1	89.16	1.000
1	2	87.22	1.000
1	3	86.65	1.000
2	1	85.08	1.000
2	2	85.70	1.000
2	3	84.96	1.000
3	1	86.96	1.031
3	2	87.35	1.031
3	3	85.84	1.031

General Linear Model: Systolic Blood Pressure versus Group, Subject, Time

Factor	Type	Levels	Values
Subject(Group)	fixed	50	a1, a10, a11, a12, a13, a14, a15, a16, a17, a2, a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12, b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7, b8, b9, c1, c10, c11, c12, c13, c14, c15, c16, c2, c3, c4, c5, c6, c7, c8, c9
Group	fixed	3	1, 2, 3
Time(Group)	fixed	9	1, 2, 3, 1, 2, 3, 1, 2, 3

Analysis of Variance for Systolic Blood Pressure, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Subject(Group)	47	17680.13	17680.13	376.17	15.07	0.000
Group	2	220.35	220.35	110.17	4.41	0.015
Time(Group)	6	82.00	82.00	13.67	0.55	0.771
Error	94	2347.11	2347.11	24.97		
Total	149	20329.58				

S = 4.99692 R-Sq = 88.45% R-Sq(adj) = 81.70%

Least Squares Means for Systolic Blood Pressure

(Group)	Time	Mean	SE Mean
1	1	113.8	1.212

```
 1     2     112.3    1.212
 1     3     111.9    1.212
 2     1     110.3    1.212
 2     2     109.5    1.212
 2     3     109.5    1.212
 3     1     110.9    1.249
 3     2     111.8    1.249
 3     3     109.6    1.249
```

General Linear Model: Diastolic Blood Pressure versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      50  a1, a10, a11, a12, a13, a14, a15, a16, a17, a2,
                               a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12,
                               b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7,
                               b8, b9, c1, c10, c11, c12, c13, c14, c15, c16,
                               c2, c3, c4, c5, c6, c7, c8, c9
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Diastolic Blood Pressure, using Adjusted SS for Tests

Source           DF    Seq SS   Adj SS  Adj MS      F      P
Subject(Group)   47   8330.57  8330.57  177.25  10.06  0.000
Group             2    134.43   134.43   67.22   3.81  0.026
Time(Group)       6    104.45   104.45   17.41   0.99  0.438
Error            94   1656.75  1656.75   17.63
Total           149  10226.20


S = 4.19822   R-Sq = 83.80%   R-Sq(adj) = 74.32%


Least Squares Means for Diastolic Blood Pressure

(Group)Time   Mean   SE Mean
 1     1     76.84    1.018
 1     2     74.70    1.018
 1     3     74.02    1.018
 2     1     72.45    1.018
 2     2     73.80    1.018
 2     3     72.72    1.018
 3     1     74.97    1.050
 3     2     75.13    1.050
 3     3     73.95    1.050
```

General Linear Model: SF36 Physical Functioning versus Group, Subject, Time

```
Factor          Type   Levels  Values
```

```
Subject(Group)  fixed      50  a1, a10, a11, a12, a13, a14, a15, a16, a17, a2,
                               a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12,
                               b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7,
                               b8, b9, c1, c10, c11, c12, c13, c14, c15, c16,
                               c2, c3, c4, c5, c6, c7, c8, c9
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Physical Functioning, using Adjusted SS for Tests

Source           DF    Seq SS    Adj SS  Adj MS     F      P
Subject(Group)   47  20482.57  20482.57  435.80  6.13  0.000
Group             2    104.93    104.93   52.47  0.74  0.481
Time(Group)       6   1203.68   1203.68  200.61  2.82  0.014
Error            94   6679.66   6679.66   71.06
Total           149  28470.83


S = 8.42972   R-Sq = 76.54%   R-Sq(adj) = 62.81%


Least Squares Means for Physical Functioning

(Group)Time   Mean  SE Mean
 1     1     86.18    2.045
 1     2     91.18    2.045
 1     3     93.53    2.045
 2     1     85.29    2.045
 2     2     86.18    2.045
 2     3     93.53    2.045
 3     1     87.81    2.107
 3     2     89.06    2.107
 3     3     89.69    2.107
```

General Linear Model: SF36 Role Physical versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      50  a1, a10, a11, a12, a13, a14, a15, a16, a17, a2,
                               a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12,
                               b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7,
                               b8, b9, c1, c10, c11, c12, c13, c14, c15, c16,
                               c2, c3, c4, c5, c6, c7, c8, c9
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Role Physical, using Adjusted SS for Tests

Source           DF    Seq SS   Adj SS  Adj MS     F      P
Subject(Group)   47   91152.5  91152.5  1939.4  4.15  0.000
Group             2    1391.5   1391.5   695.8  1.49  0.231
Time(Group)       6    3224.5   3224.5   537.4  1.15  0.341
Error            94   43975.5  43975.5   467.8
Total           149  139744.0


S = 21.6292   R-Sq = 68.53%   R-Sq(adj) = 50.12%
```

```
Least Squares Means for Role Physical

(Group)Time   Mean  SE Mean
 1     1     48.24    5.246
 1     2     49.41    5.246
 1     3     60.00    5.246
 2     1     49.41    5.246
 2     2     54.12    5.246
 2     3     57.65    5.246
 3     1     52.50    5.407
 3     2     63.75    5.407
 3     3     62.50    5.407
```

General Linear Model: SF36 Bodily Pain versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      50  a1, a10, a11, a12, a13, a14, a15, a16, a17, a2,
                               a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12,
                               b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7,
                               b8, b9, c1, c10, c11, c12, c13, c14, c15, c16,
                               c2, c3, c4, c5, c6, c7, c8, c9
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Bodily Pain, using Adjusted SS for Tests

Source           DF   Seq SS   Adj SS  Adj MS     F      P
Subject(Group)   47  26470.5  26470.5   563.2  3.60  0.000
Group             2    632.2    632.2   316.1  2.02  0.139
Time(Group)       6   1212.0   1212.0   202.0  1.29  0.269
Error            94  14720.7  14720.7   156.6
Total           149  43035.4


S = 12.5141   R-Sq = 65.79%   R-Sq(adj) = 45.78%


Least Squares Means for Bodily Pain

(Group)Time   Mean  SE Mean
 1     1     72.76    3.035
 1     2     72.35    3.035
 1     3     76.06    3.035
 2     1     63.76    3.035
 2     2     69.82    3.035
 2     3     73.41    3.035
 3     1     69.69    3.129
 3     2     75.38    3.129
 3     3     73.19    3.129
```

General Linear Model: SF36 General Health versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      50  a1, a10, a11, a12, a13, a14, a15, a16, a17, a2,
```

```
                                a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12,
                                b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7,
                                b8, b9, c1, c10, c11, c12, c13, c14, c15, c16,
                                c2, c3, c4, c5, c6, c7, c8, c9
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for General Health, using Adjusted SS for Tests

Source           DF    Seq SS    Adj SS   Adj MS      F      P
Subject(Group)   47  42774.70  42774.70   910.10  10.23  0.000
Group             2   2868.13   2868.13  1434.07  16.12  0.000
Time(Group)       6   4629.46   4629.46   771.58   8.67  0.000
Error            94   8362.54   8362.54    88.96
Total           149  58634.83


S = 9.43203   R-Sq = 85.74%   R-Sq(adj) = 77.39%


Least Squares Means for General Health

(Group)Time   Mean  SE Mean
 1     1     41.18    2.288
 1     2     52.18    2.288
 1     3     57.24    2.288
 2     1     45.29    2.288
 2     2     56.41    2.288
 2     3     60.82    2.288
 3     1     61.56    2.358
 3     2     58.37    2.358
 3     3     62.69    2.358
```

General Linear Model: SF36 Vitality versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      50  a1, a10, a11, a12, a13, a14, a15, a16, a17, a2,
                               a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12,
                               b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7,
                               b8, b9, c1, c10, c11, c12, c13, c14, c15, c16,
                               c2, c3, c4, c5, c6, c7, c8, c9
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Vitality, using Adjusted SS for Tests

Source           DF   Seq SS   Adj SS  Adj MS     F      P
Subject(Group)   47  38787.0  38787.0   825.3  4.87  0.000
Group             2    951.2    951.2   475.6  2.81  0.066
Time(Group)       6   9785.5   9785.5  1630.9  9.62  0.000
Error            94  15931.1  15931.1   169.5
Total           149  65454.8


S = 13.0185   R-Sq = 75.66%   R-Sq(adj) = 61.42%
```

Least Squares Means for Vitality

(Group)	Time	Mean	SE Mean
1	1	27.35	3.157
1	2	45.59	3.157
1	3	49.41	3.157
2	1	30.00	3.157
2	2	47.94	3.157
2	3	51.47	3.157
3	1	33.44	3.255
3	2	35.94	3.255
3	3	41.56	3.255

General Linear Model: SF36 Social Functioning versus Group, Subject, Time

Factor	Type	Levels	Values
Subject(Group)	fixed	50	a1, a10, a11, a12, a13, a14, a15, a16, a17, a2, a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12, b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7, b8, b9, c1, c10, c11, c12, c13, c14, c15, c16, c2, c3, c4, c5, c6, c7, c8, c9
Group	fixed	3	1, 2, 3
Time(Group)	fixed	9	1, 2, 3, 1, 2, 3, 1, 2, 3

Analysis of Variance for Social Functioning, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Subject(Group)	47	70487.0	70487.0	1499.7	5.68	0.000
Group	2	124.5	124.5	62.3	0.24	0.790
Time(Group)	6	12420.1	12420.1	2070.0	7.84	0.000
Error	94	24825.8	24825.8	264.1		
Total	149	107857.3				

S = 16.2513 R-Sq = 76.98% R-Sq(adj) = 63.52%

Least Squares Means for Social Functioning

(Group)	Time	Mean	SE Mean
1	1	48.53	3.942
1	2	66.91	3.942
1	3	74.26	3.942
2	1	47.06	3.942
2	2	64.71	3.942
2	3	72.06	3.942
3	1	55.47	4.063
3	2	64.06	4.063
3	3	64.53	4.063

General Linear Model: SF36 Role Emotional versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      50  a1, a10, a11, a12, a13, a14, a15, a16, a17, a2,
                               a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12,
                               b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7,
                               b8, b9, c1, c10, c11, c12, c13, c14, c15, c16,
                               c2, c3, c4, c5, c6, c7, c8, c9
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Role Emotional, using Adjusted SS for Tests

Source           DF    Seq SS    Adj SS  Adj MS     F      P
Subject(Group)   47  137559.9  137559.9  2926.8  3.46  0.000
Group             2    4188.2    4188.2  2094.1  2.48  0.089
Time(Group)       6   40525.6   40525.6  6754.3  7.99  0.000
Error            94   79474.4   79474.4   845.5
Total           149  261748.1


S = 29.0770   R-Sq = 69.64%   R-Sq(adj) = 51.87%


Least Squares Means for Role Emotional

(Group)Time   Mean  SE Mean
 1     1     31.37    7.052
 1     2     60.78    7.052
 1     3     62.75    7.052
 2     1     15.69    7.052
 2     2     56.86    7.052
 2     3     70.59    7.052
 3     1     43.75    7.269
 3     2     29.17    7.269
 3     3     43.75    7.269
```

General Linear Model: SF36 Mental Health versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      50  a1, a10, a11, a12, a13, a14, a15, a16, a17, a2,
                               a3, a4, a5, a6, a7, a8, a9, b1, b10, b11, b12,
                               b13, b14, b15, b16, b17, b2, b3, b4, b5, b6, b7,
                               b8, b9, c1, c10, c11, c12, c13, c14, c15, c16,
                               c2, c3, c4, c5, c6, c7, c8, c9
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Mental Health, using Adjusted SS for Tests

Source           DF   Seq SS   Adj SS  Adj MS      F      P
Subject(Group)   47  44253.2  44253.2   941.6   8.27  0.000
Group             2    728.6    728.6   364.3   3.20  0.045
Time(Group)       6  11047.7  11047.7  1841.3  16.17  0.000
```

```
Error            94  10701.6  10701.6   113.8
Total           149  66731.1


S = 10.6699   R-Sq = 83.96%   R-Sq(adj) = 74.58%


Least Squares Means for Mental Health

(Group)Time   Mean  SE Mean
 1     1     41.18    2.588
 1     2     63.06    2.588
 1     3     67.76    2.588
 2     1     40.47    2.588
 2     2     58.35    2.588
 2     3     60.47    2.588
 3     1     52.50    2.667
 3     2     50.50    2.667
 3     3     54.00    2.667
```

Results for: HRV

General Linear Model: VLF versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      36  1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,
                               15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27,
                               28, 29, 30, 31, 33, 34, 35, 36, 37, 38
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for VLF, using Adjusted SS for Tests

Source           DF     Seq SS    Adj SS   Adj MS     F      P
Subject(Group)   33   71090483  71090483  2154257  1.71  0.032
Group             2    9766553   9766553  4883277  3.89  0.025
Time(Group)       6    3940442   3940442   656740  0.52  0.789
Error            66   82930421  82930421  1256522
Total           107  167727899


S = 1120.95   R-Sq = 50.56%   R-Sq(adj) = 19.84%


Least Squares Means for VLF

(Group)Time    Mean  SE Mean
 1     1      797.9    299.6
 1     2     1243.1    299.6
 1     3     1095.5    299.6
 2     1     1620.2    338.0
 2     2     1564.8    338.0
 2     3     1367.6    338.0
 3     1     1569.1    338.0
 3     2     1572.5    338.0
 3     3     2107.5    338.0
```

General Linear Model: LF versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      36  1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,
                               15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27,
                               28, 29, 30, 31, 33, 34, 35, 36, 37, 38
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for LF, using Adjusted SS for Tests

Source           DF     Seq SS     Adj SS    Adj MS     F      P
Subject(Group)   33  181921568  181921568   5512775  3.25  0.000
Group             2   22020699   22020699  11010350  6.48  0.003
Time(Group)       6    6556025    6556025   1092671  0.64  0.695
Error            66  112070244  112070244   1698034
Total           107  322568536


S = 1303.09   R-Sq = 65.26%   R-Sq(adj) = 43.67%


Least Squares Means for LF

(Group)Time    Mean  SE Mean
 1     1      846.8    348.3
 1     2      946.3    348.3
 1     3      924.8    348.3
 2     1     2057.2    392.9
 2     2     1373.3    392.9
 2     3     1244.4    392.9
 3     1     2323.6    392.9
 3     2     1685.9    392.9
 3     3     1927.3    392.9
```

General Linear Model: HF versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      36  1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,
                               15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27,
                               28, 29, 30, 31, 33, 34, 35, 36, 37, 38
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for HF, using Adjusted SS for Tests

Source           DF     Seq SS     Adj SS   Adj MS     F      P
Subject(Group)   33  238777810  238777810  7235691  2.25  0.003
Group             2   14799738   14799738  7399869  2.30  0.109
Time(Group)       6   13477369   13477369  2246228  0.70  0.653
Error            66  212613506  212613506  3221417
Total           107  479668422
```

```
S = 1794.83   R-Sq = 55.67%   R-Sq(adj) = 28.14%


Least Squares Means for HF

(Group)Time    Mean  SE Mean
 1     1     1340.3    479.7
 1     2      720.8    479.7
 1     3      744.0    479.7
 2     1     2091.7    541.2
 2     2      905.0    541.2
 2     3     1173.2    541.2
 3     1     1673.5    541.2
 3     2     2129.2    541.2
 3     3     1679.1    541.2
```

General Linear Model: LF/HF Ratio versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      36  1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,
                               15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27,
                               28, 29, 30, 31, 33, 34, 35, 36, 37, 38
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Ratio, using Adjusted SS for Tests

Source           DF   Seq SS   Adj SS  Adj MS     F      P
Subject(Group)   33  203.516  203.516   6.167  2.07  0.006
Group             2   55.599   55.599  27.799  9.34  0.000
Time(Group)       6    5.712    5.712   0.952  0.32  0.924
Error            66  196.480  196.480   2.977
Total           107  461.307


S = 1.72539   R-Sq = 57.41%   R-Sq(adj) = 30.95%


Least Squares Means for Ratio

(Group)Time   Mean  SE Mean
 1     1     3.348   0.4611
 1     2     3.268   0.4611
 1     3     2.740   0.4611
 2     1     1.523   0.5202
 2     2     1.741   0.5202
 2     3     1.680   0.5202
 3     1     2.024   0.5202
 3     2     1.435   0.5202
 3     3     1.478   0.5202
```

General Linear Model: Total Power versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      36  1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,
                               15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27,
                               28, 29, 30, 31, 33, 34, 35, 36, 37, 38
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Total Power, using Adjusted SS for Tests

Source           DF      Seq SS      Adj SS    Adj MS     F      P
Subject(Group)   33  1101030082  1101030082  33364548  2.57  0.001
Group             2   135435680   135435680  67717840  5.22  0.008
Time(Group)       6    28987518    28987518   4831253  0.37  0.894
Error            66   856695842   856695842  12980240
Total           107  2122149123


S = 3602.81   R-Sq = 59.63%   R-Sq(adj) = 34.55%


Least Squares Means for Total Power

(Group)Time  Mean  SE Mean
 1     1     2985    962.9
 1     2     2910    962.9
 1     3     2764    962.9
 2     1     5769   1086.3
 2     2     3843   1086.3
 2     3     3785   1086.3
 3     1     5566   1086.3
 3     2     5387   1086.3
 3     3     5714   1086.3
```

General Linear Model: LFnu (normalised units) versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      36  1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,
                               15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27,
                               28, 29, 30, 31, 33, 34, 35, 36, 37, 38
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Lfnu, using Adjusted SS for Tests

Source           DF   Seq SS   Adj SS   Adj MS     F      P
Subject(Group)   33  1.60509  1.60509  0.04864  2.41  0.001
Group             2  0.19984  0.19984  0.09992  4.96  0.010
Time(Group)       6  0.06128  0.06128  0.01021  0.51  0.801
Error            66  1.32941  1.32941  0.02014
Total           107  3.19562
```

```
S = 0.141925   R-Sq = 58.40%   R-Sq(adj) = 32.56%


Least Squares Means for Lfnu

(Group)Time    Mean  SE Mean
 1     1     0.6555  0.03793
 1     2     0.6576  0.03793
 1     3     0.6416  0.03793
 2     1     0.5646  0.04279
 2     2     0.5788  0.04279
 2     3     0.5726  0.04279
 3     1     0.6131  0.04279
 3     2     0.5130  0.04279
 3     3     0.5432  0.04279
```

General Linear Model: HFnu (normalised units) versus Group, Subject, Time

```
Factor          Type   Levels  Values
Subject(Group)  fixed      36  1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,
                               15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27,
                               28, 29, 30, 31, 33, 34, 35, 36, 37, 38
Group           fixed       3  1, 2, 3
Time(Group)     fixed       9  1, 2, 3, 1, 2, 3, 1, 2, 3


Analysis of Variance for Hfnu, using Adjusted SS for Tests

Source           DF   Seq SS   Adj SS   Adj MS     F      P
Subject(Group)   33  1.60509  1.60509  0.04864  2.41  0.001
Group             2  0.19984  0.19984  0.09992  4.96  0.010
Time(Group)       6  0.06128  0.06128  0.01021  0.51  0.801
Error            66  1.32941  1.32941  0.02014
Total           107  3.19562


S = 0.141925   R-Sq = 58.40%   R-Sq(adj) = 32.56%


Least Squares Means for Hfnu

(Group)Time    Mean  SE Mean
 1     1     0.3445  0.03793
 1     2     0.3424  0.03793
 1     3     0.3584  0.03793
 2     1     0.4354  0.04279
 2     2     0.4212  0.04279
 2     3     0.4274  0.04279
 3     1     0.3869  0.04279
 3     2     0.4870  0.04279
 3     3     0.4568  0.04279
```

Appendix 5

Chinese Medicine Stress Signs and Symptoms Questionnaire

This questionnaire is to collect data about your physical, psychological and emotional changes when you feel **"Stressed"** and the level of severity of these signs and symptoms that you feel right **now**. Please mark an "**X**" in the appropriate box on the severity of the following signs and symptoms. Please note that sections 9 and 10 are **Gender Specific**, so please only complete the appropriate section. Section 9 is for Female participants only and Section 10 is Male participants only.

Age: _____ **Gender:** Male ☐ Female ☐ **Date completed:** _____/____/_____

1. **Cognitive**	Not present	Mild	Moderate	Severe
Poor Memory	☐	☐	☐	☐
Inability to concentrate	☐	☐	☐	☐
Listlessness/ Indifferent	☐	☐	☐	☐
Anxious or racing thoughts	☐	☐	☐	☐
Constant worrying	☐	☐	☐	☐

2. **Emotional**	Not present	Mild	Moderate	Severe
Moodiness	☐	☐	☐	☐
Irritability or short temper	☐	☐	☐	☐
Agitation, inability to relax	☐	☐	☐	☐
Depression or general unhappiness	☐	☐	☐	☐

3. **Physical (General)**	Not present	Mild	Moderate	Severe
Aches and pains	☐	☐	☐	☐
Weakness in the knees	☐	☐	☐	☐
Oedema/ swelling due to water retention	☐	☐	☐	☐
Frequent sighing	☐	☐	☐	☐
Sweating (Daytime)	☐	☐	☐	☐
Sweating (Night time)	☐	☐	☐	☐
Frequent colds	☐	☐	☐	☐
Easily fatigued	☐	☐	☐	☐
Muscle cramp	☐	☐	☐	☐
Loss of sex drive	☐	☐	☐	☐
General feeling of cold	☐	☐	☐	☐
General feeling of heat	☐	☐	☐	☐
Hot sensations in the palms and soles of foot	☐	☐	☐	☐
Frequent urination	☐	☐	☐	☐
Copious pale urine	☐	☐	☐	☐
Scanty urine	☐	☐	☐	☐
Dark Urine	☐	☐	☐	☐

4. Head, Face and Throat	Not present	Mild	Moderate	Severe
Dizziness	☐	☐	☐	☐
Headache	☐	☐	☐	☐
Dry eyes	☐	☐	☐	☐
Red eyes	☐	☐	☐	☐
Blurred vision/ floaters	☐	☐	☐	☐
Night blindness	☐	☐	☐	☐
Tinnitus/Deafness	☐	☐	☐	☐
Flushed face	☐	☐	☐	☐
Thirst	☐	☐	☐	☐
Bitter taste in the mouth	☐	☐	☐	☐
Dry throat	☐	☐	☐	☐
Stuck sensation in the throat	☐	☐	☐	☐
Stuttering	☐	☐	☐	☐
Teeth grinding	☐	☐	☐	☐
Bad breath	☐	☐	☐	☐
Mouth Ulcers	☐	☐	☐	☐
Bleeding Gums	☐	☐	☐	☐

5. Chest Region	Not present	Mild	Moderate	Severe
Tightness in the chest	☐	☐	☐	☐
Chest pain	☐	☐	☐	☐
Palpitation	☐	☐	☐	☐
Cough	☐	☐	☐	☐
Difficulty Breathing/ Shortness of Breath	☐	☐	☐	☐

6. Appetite and Digestion	Not present	Mild	Moderate	Severe
Diarrhoea	☐	☐	☐	☐
Constipation	☐	☐	☐	☐
Nausea	☐	☐	☐	☐
Weight change	☐	☐	☐	☐
Abdominal distension	☐	☐	☐	☐
Sour regurgitation / acid reflux	☐	☐	☐	☐

7. Limbs and Extremities	Not present	Mild	Moderate	Severe
Numbness or Tingling in limbs	☐	☐	☐	☐
Dry hair and skin	☐	☐	☐	☐
Brittle nails	☐	☐	☐	☐

8. **Behavioural**	Not present	Mild	Moderate	Severe
Increased appetite	☐	☐	☐	☐
Reduced appetite	☐	☐	☐	☐
Insomnia or sleep disturbances	☐	☐	☐	☐
Vivid dreams	☐	☐	☐	☐
Sleep talking	☐	☐	☐	☐
Speak with a louder voice	☐	☐	☐	☐
Speak with a softer voice	☐	☐	☐	☐
Feeling timid	☐	☐	☐	☐

9. **Female Specific**				
Irregular Menses	☐	☐	☐	☐
Premenstrual tension	☐	☐	☐	☐
Premenstrual breast distension	☐	☐	☐	☐
Amenorrhoea/Scanty periods	☐	☐	☐	☐
Oligomenorrhea/Late periods	☐	☐	☐	☐

10. **Male Specific**				
Impotence	☐	☐	☐	☐
Premature ejaculation	☐	☐	☐	☐
Nocturnal emissions	☐	☐	☐	☐

End

Thank you!

Appendix 6

Results for: Male

Item Analysis of Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, ...

```
* NOTE * The following variables had zero variation and were omitted from the
calculations:
   Q2, Q4, Q67, Q68


Correlation Matrix

          Q1      Q3      Q5      Q6      Q7      Q8      Q9     Q10     Q11
Q3     0.545
Q5     0.383   0.447
Q6     0.561   0.218  -0.098
Q7     0.153  -0.218  -0.098   0.429
Q8    -0.174  -0.149  -0.067  -0.098  -0.098
Q9     0.234   0.667   0.447   0.218  -0.218   0.447
Q10    0.127   0.234  -0.174   0.153   0.153  -0.174  -0.078
Q11    0.051   0.509   0.228  -0.048  -0.048  -0.293   0.218   0.323
Q12    0.324   0.277   0.124   0.182   0.182  -0.537  -0.092   0.324   0.222
Q13    0.234   0.333  -0.149   0.218  -0.218   0.447   0.667  -0.078  -0.073
Q14    0.051   0.509   0.228  -0.048  -0.048  -0.293   0.218   0.323   0.492
Q15    0.164   0.389   0.174  -0.153  -0.153   0.174   0.389   0.164   0.221
Q16   -0.035   0.149  -0.333   0.293   0.293   0.200   0.149   0.244   0.358
Q17    0.221   0.655   0.293   0.048   0.048   0.293   0.655   0.221   0.524
Q18    0.164   0.078   0.174   0.255   0.255  -0.383  -0.234   0.455   0.221
Q19    0.405   0.577   0.258   0.378   0.378  -0.258   0.289   0.405   0.630
Q20    0.164   0.389   0.174   0.255   0.255  -0.383   0.078   0.164   0.764
Q21    0.389   0.333   0.149   0.218   0.218  -0.447   0.000   0.389   0.364
Q22    0.255   0.218   0.098   0.143   0.143   0.098   0.218   0.255   0.048
Q23    0.164   0.389   0.174   0.255   0.255   0.174   0.389   0.164   0.493
Q24    0.324   0.277   0.124   0.182   0.182  -0.537  -0.092   0.324   0.222
Q25    0.324   0.277   0.124   0.182   0.182   0.124   0.277  -0.022   0.545
Q26   -0.035   0.149  -0.333   0.293   0.293   0.200   0.149   0.522   0.098
Q27    0.323   0.218   0.228  -0.048  -0.048  -0.293  -0.073   0.051  -0.016
Q28   -0.035   0.149   0.200   0.293  -0.098   0.200   0.447  -0.035  -0.163
Q29    0.244   0.149   0.200   0.293   0.293  -0.333   0.149  -0.035   0.098
Q30    0.455   0.389   0.174   0.255   0.255   0.174   0.389   0.455   0.221
Q31    0.323   0.509   0.228   0.333   0.333  -0.293   0.218   0.323   0.746
Q32    0.324   0.277   0.124   0.182   0.182   0.124   0.277   0.324   0.222
Q33    0.255   0.218   0.098   0.143   0.143   0.098   0.218   0.255   0.048
Q34    0.255   0.218   0.098   0.143   0.143   0.098   0.218   0.255  -0.333
Q35    0.595   0.509   0.228   0.333   0.333   0.228   0.509   0.051   0.238
Q36    0.455   0.389   0.174   0.255   0.255   0.174   0.389   0.455  -0.051
Q37    0.078   0.333   0.149   0.218   0.218   0.149   0.333   0.389   0.364
Q38    0.078   0.333   0.149   0.218   0.218   0.149   0.333   0.389   0.364
Q39   -0.153  -0.218   0.098   0.143   0.143   0.098   0.218  -0.153  -0.333
Q40   -0.135   0.289  -0.258   0.000   0.000  -0.258   0.000   0.135   0.126
Q41    0.323   0.509   0.228   0.333  -0.048  -0.293   0.218   0.323   0.238
Q42   -0.127   0.078   0.174   0.255   0.255   0.174   0.389   0.164   0.221
Q43    0.164   0.389   0.174   0.255   0.255   0.174   0.389   0.455   0.221
Q44   -0.035   0.149   0.200   0.293  -0.098   0.200   0.447  -0.035   0.098
Q45    0.324   0.277   0.124   0.182  -0.303   0.124   0.277  -0.022  -0.101
Q46    0.455   0.389   0.174   0.255   0.255  -0.383   0.078   0.455   0.221
Q47    0.244   0.447   0.200   0.293  -0.098   0.200   0.447  -0.035   0.358
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Q48	0.244	0.447	0.200	0.293	-0.098	0.200	0.447	0.244	0.098
Q49	0.164	0.389	0.174	0.255	0.255	0.174	0.389	0.455	0.221
Q50	0.164	0.389	0.174	0.255	0.255	0.174	0.389	0.164	0.493
Q51	0.255	0.218	0.098	0.143	0.143	0.098	0.218	0.255	0.048
Q52	0.405	0.577	0.258	0.378	0.378	-0.258	0.289	0.405	0.630
Q53	0.405	0.577	0.258	0.378	0.378	-0.258	0.289	0.405	0.630
Q54	0.389	0.333	0.149	0.218	0.218	-0.447	0.000	0.389	0.364
Q55	0.164	0.389	0.174	0.255	-0.153	0.174	0.389	0.164	0.221
Q56	-0.035	0.149	-0.333	0.293	0.293	-0.333	-0.149	0.522	0.358
Q57	-0.383	0.149	0.067	0.098	0.098	0.067	0.149	0.174	0.293
Q58	0.164	0.389	0.174	-0.153	-0.153	0.174	0.389	0.455	0.493
Q59	0.244	0.149	0.200	0.293	-0.098	0.200	0.447	-0.592	-0.163
Q60	-0.174	-0.149	-0.067	-0.098	-0.098	-0.067	-0.149	0.383	-0.293
Q61	-0.244	0.149	-0.200	-0.293	-0.293	-0.200	-0.149	0.313	0.423
Q62	0.455	0.389	0.174	0.255	0.255	-0.383	0.078	0.455	0.221
Q63	-0.035	0.149	0.200	-0.098	-0.098	0.200	0.149	-0.313	-0.163
Q64	-0.022	0.277	0.124	0.182	0.182	0.124	0.277	0.324	0.222
Q65	0.244	0.447	0.200	-0.098	-0.488	0.200	0.447	-0.035	0.098
Q66	0.324	0.277	0.124	0.182	0.182	-0.537	-0.092	0.324	-0.101

	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q13	-0.092								
Q14	0.545	-0.073							
Q15	0.367	0.389	0.764						
Q16	0.289	0.149	0.358	0.313					
Q17	0.101	0.364	0.524	0.595	0.423				
Q18	0.713	-0.545	0.493	0.127	0.313	0.051			
Q19	0.480	0.000	0.630	0.405	0.516	0.630	0.405		
Q20	0.367	-0.234	0.493	0.127	0.592	0.323	0.418	0.674	
Q21	0.832	0.000	0.364	0.234	0.447	0.218	0.545	0.577	0.545
Q22	0.787	0.218	0.429	0.561	0.488	0.333	0.561	0.378	0.153
Q23	0.367	0.078	0.493	0.418	0.592	0.595	0.418	0.674	0.418
Q24	1.000	-0.092	0.545	0.367	0.289	0.101	0.713	0.480	0.367
Q25	0.179	0.277	0.222	0.367	0.620	0.424	0.022	0.480	0.713
Q26	0.289	0.149	0.358	0.313	0.733	0.423	0.313	0.516	0.313
Q27	0.545	-0.073	0.238	0.221	-0.163	0.016	0.221	0.378	-0.051
Q28	0.289	0.149	0.358	0.313	0.200	0.163	0.313	0.258	0.035
Q29	0.620	0.149	0.098	0.035	0.200	0.163	0.313	0.258	0.313
Q30	0.367	0.389	0.221	0.418	0.313	0.595	0.127	0.674	0.127
Q31	0.222	-0.073	0.492	0.221	0.358	0.524	0.221	0.882	0.764
Q32	0.179	0.277	-0.101	0.022	0.289	0.424	0.022	0.480	0.022
Q33	0.787	0.218	0.429	0.561	0.488	0.333	0.561	0.378	0.153
Q34	0.303	0.218	0.429	0.561	0.098	0.333	0.153	0.378	-0.255
Q35	0.222	0.509	0.238	0.493	0.358	0.778	-0.051	0.630	0.221
Q36	0.367	0.389	0.221	0.418	0.313	0.323	0.127	0.405	0.127
Q37	0.462	0.000	0.364	0.234	0.745	0.509	0.545	0.577	0.545
Q38	0.462	0.000	0.364	0.234	0.745	0.509	0.545	0.577	0.545
Q39	0.303	0.218	0.048	0.153	0.098	-0.048	0.153	0.000	-0.255
Q40	0.160	0.000	0.630	0.405	0.258	0.378	0.135	0.250	0.135
Q41	0.545	-0.073	0.492	0.221	0.358	0.270	0.493	0.630	0.493
Q42	0.367	0.078	0.221	0.127	0.592	0.323	0.418	0.405	0.418
Q43	0.367	0.078	0.493	0.418	0.313	0.595	0.418	0.674	0.127
Q44	0.289	0.149	0.098	0.035	0.200	0.163	0.313	0.258	0.035
Q45	0.179	0.277	0.222	0.367	-0.041	0.101	0.022	0.160	0.022
Q46	0.713	0.078	0.493	0.418	0.313	0.323	0.418	0.674	0.418
Q47	0.289	0.149	0.358	0.313	0.733	0.423	0.313	0.516	0.592
Q48	0.289	0.149	0.358	0.313	0.200	0.423	0.313	0.516	0.035
Q49	0.022	0.078	-0.051	-0.164	0.313	0.323	0.127	0.405	0.127
Q50	0.022	0.078	0.221	0.127	0.313	0.323	0.127	0.405	0.418
Q51	0.303	0.218	0.429	0.561	0.098	0.333	0.153	0.378	0.153

Q52	0.480	0.000	0.630	0.405	0.516	0.630	0.405	1.000	0.674
Q53	0.480	0.000	0.378	0.135	0.516	0.378	0.405	0.750	0.674
Q54	0.832	0.000	0.364	0.234	0.149	0.218	0.545	0.577	0.234
Q55	0.367	0.078	0.221	0.127	0.313	0.323	0.418	0.405	0.127
Q56	0.620	-0.149	0.358	0.035	0.733	0.163	0.592	0.516	0.592
Q57	-0.124	-0.447	0.293	-0.174	0.333	0.228	0.383	0.258	0.383
Q58	0.022	0.389	0.221	0.418	0.035	0.595	-0.164	0.405	0.127
Q59	0.289	0.447	0.098	0.313	0.200	0.163	0.035	0.000	0.035
Q60	0.124	-0.149	-0.293	-0.383	-0.333	-0.228	0.174	-0.258	-0.383
Q61	0.372	-0.149	0.163	-0.035	0.333	0.098	0.244	0.258	0.244
Q62	0.713	0.078	0.493	0.418	0.035	0.323	0.418	0.674	0.127
Q63	0.289	-0.149	0.098	0.035	0.200	0.163	0.313	0.000	0.035
Q64	0.179	-0.092	0.545	0.367	0.289	0.424	0.367	0.480	0.367
Q65	-0.041	0.447	0.098	0.313	-0.333	0.423	-0.244	0.000	-0.244
Q66	0.590	-0.092	0.545	0.367	-0.041	0.101	0.367	0.480	0.022

	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29
Q22	0.655								
Q23	0.234	0.561							
Q24	0.832	0.787	0.367						
Q25	0.462	0.303	0.367	0.179					
Q26	0.447	0.488	0.313	0.289	0.289				
Q27	0.364	0.429	0.221	0.545	-0.101	0.098			
Q28	0.149	0.488	0.313	0.289	-0.041	0.467	0.358		
Q29	0.745	0.488	0.035	0.620	0.289	0.200	0.098	0.200	
Q30	0.545	0.561	0.418	0.367	0.367	0.592	0.493	0.313	0.313
Q31	0.364	0.048	0.493	0.222	0.545	0.358	0.238	0.098	0.098
Q32	0.462	0.303	0.367	0.179	0.179	0.289	0.222	-0.041	0.289
Q33	0.655	1.000	0.561	0.787	0.303	0.488	0.429	0.488	0.488
Q34	0.218	0.429	0.153	0.303	-0.182	0.488	0.429	0.488	0.098
Q35	0.364	0.429	0.493	0.222	0.545	0.358	0.238	0.098	0.358
Q36	0.545	0.561	0.127	0.367	0.367	0.592	0.221	0.313	0.313
Q37	0.667	0.655	0.545	0.462	0.462	0.745	0.073	0.447	0.447
Q38	0.667	0.655	0.545	0.462	0.462	0.745	0.073	0.447	0.447
Q39	0.218	0.429	0.153	0.303	-0.182	0.098	0.048	0.488	0.488
Q40	0.000	0.000	0.135	0.160	-0.160	0.258	-0.126	0.000	0.000
Q41	0.655	0.429	0.221	0.545	0.222	0.618	0.492	0.618	0.358
Q42	0.545	0.561	0.418	0.367	0.367	0.592	-0.051	0.592	0.592
Q43	0.234	0.561	0.709	0.367	0.022	0.592	0.493	0.592	0.035
Q44	0.149	0.488	0.592	0.289	-0.041	0.200	0.358	0.733	0.200
Q45	0.092	0.303	0.022	0.179	0.179	0.289	0.545	0.620	-0.041
Q46	0.856	0.561	0.127	0.713	0.367	0.592	0.493	0.313	0.592
Q47	0.447	0.488	0.592	0.289	0.620	0.467	0.098	0.467	0.200
Q48	0.149	0.488	0.592	0.289	-0.041	0.467	0.618	0.733	-0.067
Q49	0.234	0.153	0.418	0.022	0.022	0.313	-0.051	0.035	0.035
Q50	-0.078	0.153	0.709	0.022	0.367	0.035	-0.051	0.035	-0.244
Q51	0.218	0.429	0.153	0.303	0.303	0.488	0.429	0.488	0.098
Q52	0.577	0.378	0.674	0.480	0.480	0.516	0.378	0.258	0.258
Q53	0.577	0.378	0.674	0.480	0.480	0.258	0.126	0.000	0.258
Q54	0.667	0.655	0.545	0.832	0.092	0.149	0.655	0.149	0.447
Q55	0.234	0.561	0.709	0.367	0.022	0.313	0.493	0.592	0.035
Q56	0.745	0.488	0.313	0.620	0.289	0.733	0.098	0.200	0.467
Q57	-0.149	-0.098	0.383	-0.124	-0.124	0.333	-0.228	0.333	-0.200
Q58	0.234	0.153	0.127	0.022	0.367	0.313	0.221	0.035	0.035
Q59	0.149	0.488	0.313	0.289	0.289	-0.067	0.098	0.467	0.467
Q60	0.149	0.098	-0.383	0.124	-0.537	0.200	0.228	0.200	0.200
Q61	0.447	0.293	0.244	0.372	0.041	0.333	0.423	0.067	0.067
Q62	0.545	0.561	0.418	0.713	0.022	0.313	0.764	0.313	0.313
Q63	0.149	0.488	0.313	0.289	-0.041	0.200	0.358	0.467	0.200
Q64	0.092	0.303	0.367	0.179	0.179	0.620	0.222	0.620	-0.041

Q65	-0.149	0.098	0.035	-0.041	-0.041	-0.067	0.358	0.200	-0.067
Q66	0.462	0.303	0.022	0.590	-0.231	0.289	0.545	0.289	0.289

	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38
Q31	0.493								
Q32	0.713	0.222							
Q33	0.561	0.048	0.303						
Q34	0.561	0.048	0.303	0.429					
Q35	0.764	0.492	0.545	0.429	0.429				
Q36	0.709	0.221	0.367	0.561	0.561	0.493			
Q37	0.545	0.364	0.462	0.655	0.218	0.364	0.545		
Q38	0.545	0.364	0.462	0.655	0.218	0.364	0.545	1.000	
Q39	0.153	-0.333	0.303	0.429	0.429	0.048	0.153	0.218	0.218
Q40	-0.135	0.126	-0.160	0.000	0.378	0.126	-0.135	0.000	0.000
Q41	0.493	0.492	0.222	0.429	0.429	0.238	0.493	0.655	0.655
Q42	0.418	0.221	0.367	0.561	0.153	0.221	0.418	0.856	0.856
Q43	0.709	0.493	0.367	0.561	0.561	0.493	0.418	0.545	0.545
Q44	0.313	0.098	0.289	0.488	0.098	0.098	0.035	0.447	0.447
Q45	0.367	0.222	-0.231	0.303	0.303	0.222	0.367	0.092	0.092
Q46	0.709	0.493	0.367	0.561	0.561	0.493	0.709	0.545	0.545
Q47	0.313	0.358	0.289	0.488	0.098	0.358	0.313	0.745	0.745
Q48	0.592	0.358	0.289	0.488	0.488	0.358	0.313	0.447	0.447
Q49	0.418	0.221	0.713	0.153	0.153	0.221	0.418	0.545	0.545
Q50	0.127	0.493	0.022	0.153	-0.255	0.221	0.127	0.234	0.234
Q51	0.561	0.429	-0.182	0.429	0.429	0.429	0.561	0.218	0.218
Q52	0.674	0.882	0.480	0.378	0.378	0.630	0.405	0.577	0.577
Q53	0.405	0.630	0.480	0.378	0.000	0.378	0.405	0.577	0.577
Q54	0.545	0.364	0.462	0.655	0.218	0.364	0.234	0.333	0.333
Q55	0.418	0.221	0.367	0.561	0.153	0.221	0.127	0.545	0.545
Q56	0.313	0.358	0.289	0.488	0.098	0.098	0.313	0.745	0.745
Q57	-0.174	0.293	-0.124	-0.098	-0.098	-0.228	-0.174	0.447	0.447
Q58	0.709	0.493	0.367	0.153	0.153	0.493	0.418	0.234	0.234
Q59	0.035	-0.163	-0.041	0.488	0.098	0.358	0.035	0.149	0.149
Q60	0.174	-0.293	0.124	0.098	0.098	-0.293	0.174	0.149	0.149
Q61	0.244	0.163	0.372	0.293	-0.098	-0.098	-0.035	0.447	0.447
Q62	0.709	0.493	0.367	0.561	0.561	0.493	0.418	0.234	0.234
Q63	0.035	-0.163	-0.041	0.488	0.098	0.098	0.035	0.447	0.447
Q64	0.367	0.545	-0.231	0.303	0.303	0.222	0.367	0.462	0.462
Q65	0.313	0.098	-0.041	0.098	0.098	0.358	0.035	-0.149	-0.149
Q66	0.367	0.222	0.179	0.303	0.787	0.222	0.367	0.092	0.092

	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47
Q40	0.000								
Q41	0.048	0.126							
Q42	0.561	-0.135	0.493						
Q43	0.153	0.135	0.493	0.418					
Q44	0.488	-0.258	0.358	0.592	0.592				
Q45	-0.182	-0.160	0.545	0.022	0.367	0.289			
Q46	0.153	0.135	0.764	0.418	0.418	0.035	0.367		
Q47	0.098	0.000	0.618	0.592	0.313	0.467	0.289	0.313	
Q48	0.098	0.000	0.618	0.313	0.870	0.733	0.620	0.313	0.467
Q49	0.153	-0.135	0.221	0.418	0.418	0.313	-0.324	0.127	0.313
Q50	-0.255	-0.135	-0.051	0.127	0.418	0.313	0.022	-0.164	0.313
Q51	-0.143	0.000	0.429	0.153	0.561	0.098	0.787	0.561	0.098
Q52	0.000	0.250	0.630	0.405	0.674	0.258	0.160	0.674	0.516
Q53	0.000	0.000	0.378	0.405	0.405	0.258	-0.160	0.405	0.516
Q54	0.218	0.000	0.364	0.234	0.545	0.447	0.092	0.545	0.149
Q55	0.153	-0.135	0.493	0.418	0.709	0.870	0.367	0.127	0.592
Q56	0.098	0.258	0.618	0.592	0.313	0.200	-0.041	0.592	0.467
Q57	-0.098	0.258	0.293	0.383	0.383	0.333	-0.124	-0.174	0.333

Q58	-0.255	-0.135	0.221	0.127	0.418	0.035	0.367	0.418	0.035
Q59	0.488	0.000	0.098	0.313	0.035	0.467	0.289	0.035	0.467
Q60	0.098	-0.258	0.228	0.174	0.174	0.200	0.124	0.174	-0.333
Q61	-0.098	0.000	0.423	0.244	0.244	0.333	0.041	0.244	0.333
Q62	0.153	0.135	0.493	0.127	0.709	0.313	0.367	0.709	0.035
Q63	0.098	0.000	0.358	0.313	0.313	0.467	0.289	0.035	0.467
Q64	-0.182	0.160	0.545	0.367	0.713	0.289	0.590	0.367	0.289
Q65	-0.293	0.000	0.098	-0.244	0.313	0.200	0.620	0.035	-0.067
Q66	0.303	0.480	0.545	0.022	0.367	-0.041	0.179	0.713	-0.041

	Q48	Q49	Q50	Q51	Q52	Q53	Q54	Q55	Q56
Q49	0.313								
Q50	0.313	0.418							
Q51	0.488	-0.255	0.153						
Q52	0.516	0.405	0.405	0.378					
Q53	0.258	0.674	0.674	0.000	0.750				
Q54	0.447	0.234	0.234	0.218	0.577	0.577			
Q55	0.870	0.418	0.418	0.153	0.405	0.405	0.545		
Q56	0.200	0.313	0.035	0.098	0.516	0.516	0.447	0.313	
Q57	0.333	0.383	0.383	-0.098	0.258	0.258	-0.149	0.383	0.333
Q58	0.313	0.127	0.127	0.561	0.405	0.135	0.234	0.127	0.035
Q59	0.200	-0.244	0.035	0.098	0.000	0.000	0.149	0.313	-0.067
Q60	0.200	0.174	-0.383	0.098	-0.258	-0.258	0.149	0.174	0.200
Q61	0.333	0.244	-0.035	-0.098	0.258	0.258	0.447	0.522	0.600
Q62	0.592	0.127	0.127	0.561	0.674	0.405	0.856	0.418	0.313
Q63	0.467	0.035	0.035	0.098	0.000	0.000	0.149	0.592	0.200
Q64	0.620	0.022	0.367	0.787	0.480	0.160	0.092	0.367	0.289
Q65	0.467	-0.244	0.035	0.488	0.000	-0.258	0.149	0.313	-0.333
Q66	0.289	0.022	-0.324	0.303	0.480	0.160	0.462	0.022	0.289

	Q57	Q58	Q59	Q60	Q61	Q62	Q63	Q64	Q65
Q58	-0.174								
Q59	-0.200	-0.244							
Q60	0.067	0.174	-0.333						
Q61	0.200	0.244	-0.200	0.333					
Q62	-0.174	0.418	0.035	0.174	0.244				
Q63	0.333	-0.244	0.467	0.200	0.333	0.035			
Q64	0.537	0.367	-0.041	0.124	0.041	0.367	0.289		
Q65	-0.200	0.592	0.200	0.200	0.067	0.313	0.200	0.289	
Q66	-0.124	0.022	-0.041	0.124	0.041	0.713	-0.041	0.179	-0.041

Cell Contents: Pearson correlation

Item and Total Statistics

Variable	Total Count	Mean	StDev
Q1	16	0.688	0.479
Q3	16	0.750	0.447
Q5	16	0.938	0.250
Q6	16	0.875	0.342
Q7	16	0.875	0.342
Q8	16	0.938	0.250
Q9	16	0.750	0.447
Q10	16	0.688	0.479
Q11	16	0.438	0.512
Q12	16	0.188	0.403
Q13	16	0.750	0.447
Q14	16	0.438	0.512

Q15	16	0.313	0.479
Q16	16	0.375	0.500
Q17	16	0.563	0.512
Q18	16	0.313	0.479
Q19	16	0.500	0.516
Q20	16	0.313	0.479
Q21	16	0.250	0.447
Q22	16	0.125	0.342
Q23	16	0.313	0.479
Q24	16	0.188	0.403
Q25	16	0.188	0.403
Q26	16	0.375	0.500
Q27	16	0.438	0.512
Q28	16	0.375	0.500
Q29	16	0.375	0.500
Q30	16	0.313	0.479
Q31	16	0.438	0.512
Q32	16	0.188	0.403
Q33	16	0.125	0.342
Q34	16	0.125	0.342
Q35	16	0.438	0.512
Q36	16	0.313	0.479
Q37	16	0.250	0.447
Q38	16	0.250	0.447
Q39	16	0.125	0.342
Q40	16	0.500	0.516
Q41	16	0.438	0.512
Q42	16	0.313	0.479
Q43	16	0.313	0.479
Q44	16	0.375	0.500
Q45	16	0.188	0.403
Q46	16	0.313	0.479
Q47	16	0.375	0.500
Q48	16	0.375	0.500
Q49	16	0.313	0.479
Q50	16	0.313	0.479
Q51	16	0.125	0.342
Q52	16	0.500	0.516
Q53	16	0.500	0.516
Q54	16	0.250	0.447
Q55	16	0.313	0.479
Q56	16	0.375	0.500
Q57	16	0.063	0.250
Q58	16	0.313	0.479
Q59	16	0.375	0.500
Q60	16	0.938	0.250
Q61	16	0.625	0.500
Q62	16	0.313	0.479
Q63	16	0.375	0.500
Q64	16	0.188	0.403
Q65	16	0.375	0.500
Q66	16	0.188	0.403
Total	16	25.500	15.345

Cronbach's Alpha = 0.9590

Omitted Item Statistics

Omitted Variable	Adj. Total Mean	Adj. Total StDev	Item-Adj. Total Corr	Squared Multiple Corr	Cronbach's Alpha
Q1	24.81	15.16	0.367964	*	0.958909
Q3	24.75	15.08	0.593304	*	0.958117
Q5	24.56	15.28	0.236633	*	0.959090
Q6	24.63	15.22	0.349400	*	0.958865
Q7	24.63	15.28	0.182034	*	0.959291
Q8	24.56	15.36	-0.059687	*	0.959639
Q9	24.75	15.14	0.443033	*	0.958623
Q10	24.81	15.15	0.395863	*	0.958809
Q11	25.06	15.12	0.417815	*	0.958765
Q12	25.31	15.08	0.647695	*	0.957991
Q13	24.75	15.26	0.175838	*	0.959512
Q14	25.06	15.04	0.593358	*	0.958089
Q15	25.19	15.10	0.498579	*	0.958441
Q16	25.13	15.06	0.560007	*	0.958217
Q17	24.94	15.01	0.637570	*	0.957917
Q18	25.19	15.11	0.489214	*	0.958474
Q19	25.00	14.91	0.831052	*	0.957152
Q20	25.19	15.11	0.489214	*	0.958474
Q21	25.25	15.04	0.684108	*	0.957809
Q22	25.38	15.09	0.740480	*	0.957859
Q23	25.19	15.01	0.687054	*	0.957758
Q24	25.31	15.08	0.647695	*	0.957991
Q25	25.31	15.17	0.425880	*	0.958664
Q26	25.13	15.01	0.650461	*	0.957875
Q27	25.06	15.12	0.426543	*	0.958732
Q28	25.13	15.08	0.523976	*	0.958353
Q29	25.13	15.13	0.407460	*	0.958790
Q30	25.19	14.98	0.763075	*	0.957480
Q31	25.06	15.04	0.593358	*	0.958089
Q32	25.31	15.16	0.458987	*	0.958564
Q33	25.38	15.09	0.740480	*	0.957859
Q34	25.38	15.19	0.453020	*	0.958601
Q35	25.06	15.02	0.619869	*	0.957986
Q36	25.19	15.06	0.592537	*	0.958101
Q37	25.25	14.99	0.785574	*	0.957463
Q38	25.25	14.99	0.785574	*	0.957463
Q39	25.38	15.28	0.169212	*	0.959323
Q40	25.00	15.28	0.109839	*	0.959947
Q41	25.06	14.96	0.735303	*	0.957536
Q42	25.19	15.05	0.611395	*	0.958033
Q43	25.19	14.97	0.782137	*	0.957411
Q44	25.13	15.09	0.497009	*	0.958454
Q45	25.31	15.20	0.359840	*	0.958863
Q46	25.19	14.99	0.725019	*	0.957620
Q47	25.13	15.02	0.641391	*	0.957909
Q48	25.13	14.99	0.695891	*	0.957702
Q49	25.19	15.15	0.386558	*	0.958843
Q50	25.19	15.18	0.321574	*	0.959074
Q51	25.38	15.17	0.505011	*	0.958467
Q52	25.00	14.91	0.831052	*	0.957152
Q53	25.00	15.01	0.645211	*	0.957885
Q54	25.25	15.05	0.643691	*	0.957946
Q55	25.19	15.03	0.639725	*	0.957930
Q56	25.13	15.05	0.587087	*	0.958115
Q57	25.44	15.29	0.201623	*	0.959155
Q58	25.19	15.14	0.405173	*	0.958776
Q59	25.13	15.22	0.238755	*	0.959417

Q60	24.56	15.34	-0.007603	*	0.959543
Q61	24.88	15.17	0.336199	*	0.959056
Q62	25.19	15.01	0.687054	*	0.957758
Q63	25.13	15.19	0.300692	*	0.959188
Q64	25.31	15.12	0.558657	*	0.958262
Q65	25.13	15.26	0.159487	*	0.959710
Q66	25.31	15.18	0.403841	*	0.958731

Results for: Female

Item Analysis of Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, ...

Correlation Matrix

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Q2	0.367								
Q3	0.242	0.165							
Q4	0.128	-0.067	0.114						
Q5	0.128	-0.067	0.114	1.000					
Q6	0.041	0.297	0.018	0.205	0.205				
Q7	-0.037	-0.110	0.107	-0.076	-0.076	0.238			
Q8	0.081	0.337	0.207	0.550	0.550	0.373	0.277		
Q9	-0.020	0.145	0.170	0.100	0.100	0.268	0.243	0.327	
Q10	0.256	0.110	0.213	-0.152	-0.152	-0.043	0.050	-0.139	-0.035
Q11	0.183	0.055	-0.107	-0.076	-0.076	-0.087	-0.050	-0.139	-0.173
Q12	-0.094	-0.145	-0.170	-0.100	-0.100	-0.403	-0.243	-0.327	-0.351
Q13	0.010	-0.069	0.182	0.290	0.290	-0.063	-0.263	-0.018	-0.166
Q14	0.017	0.243	-0.152	-0.054	-0.054	0.081	0.130	0.171	0.092
Q15	0.248	0.199	0.052	-0.100	-0.100	-0.132	0.069	0.106	-0.135
Q16	-0.064	-0.163	0.087	0.211	0.211	-0.071	-0.079	-0.009	-0.161
Q17	0.055	0.230	0.443	-0.058	-0.058	-0.115	-0.094	-0.105	-0.170
Q18	-0.012	0.279	0.135	-0.241	-0.241	-0.110	0.032	0.088	-0.022
Q19	0.094	-0.027	0.059	0.100	0.100	-0.138	-0.069	0.038	-0.082
Q20	0.118	-0.069	0.182	0.290	0.290	0.065	-0.115	-0.018	-0.166
Q21	0.073	0.055	-0.320	-0.305	-0.305	-0.087	0.100	-0.139	-0.069
Q22	0.083	-0.004	0.109	0.123	0.123	-0.041	0.037	0.223	0.020
Q23	0.012	-0.122	-0.135	0.024	0.024	-0.137	-0.032	-0.088	-0.175
Q24	-0.037	-0.049	0.007	-0.034	-0.034	0.119	0.016	-0.326	0.049
Q25	-0.006	0.145	-0.114	-0.182	-0.182	0.039	-0.021	0.011	0.040
Q26	0.083	0.178	-0.125	-0.128	-0.128	0.101	-0.293	-0.233	-0.094
Q27	0.247	0.049	-0.007	-0.184	-0.184	0.130	-0.016	-0.203	-0.049
Q28	0.176	0.296	0.029	0.088	0.088	0.109	-0.085	0.160	-0.005
Q29	0.172	0.267	0.210	-0.034	-0.034	0.119	-0.127	0.071	0.148
Q30	-0.037	0.221	-0.000	0.152	0.152	0.173	-0.050	0.139	0.243
Q31	0.143	-0.007	0.188	-0.005	-0.005	-0.071	0.063	-0.009	-0.161
Q32	0.055	-0.209	-0.040	-0.144	-0.144	-0.361	0.019	-0.262	-0.367
Q33	-0.208	0.027	-0.170	-0.338	-0.338	-0.132	0.069	-0.038	-0.135
Q34	0.206	0.232	-0.077	-0.290	-0.290	-0.065	-0.033	-0.118	0.064
Q35	0.491	0.234	-0.050	-0.108	-0.108	-0.061	0.000	-0.033	-0.319
Q36	0.244	0.134	0.120	0.093	0.093	0.184	0.152	0.168	0.003
Q37	0.123	0.082	0.055	0.168	0.168	0.081	-0.162	0.171	-0.211
Q38	-0.069	-0.021	-0.161	0.115	0.115	-0.213	-0.151	0.052	-0.249
Q39	-0.008	-0.165	0.023	0.130	0.130	-0.157	0.053	-0.059	-0.170
Q40	0.220	-0.122	-0.236	0.024	0.024	-0.137	-0.032	-0.088	0.022
Q41	0.206	0.069	0.133	0.160	0.160	0.063	0.115	0.291	0.166
Q42	0.159	0.210	-0.029	-0.088	-0.088	0.288	0.085	-0.019	0.005
Q43	0.083	-0.004	0.109	0.123	0.123	0.244	0.201	0.223	0.134

Q44	0.206	0.069	0.238	0.160	0.160	0.191	0.115	0.291	0.269
Q45	0.155	0.156	0.176	0.108	0.108	0.061	0.177	0.196	0.196
Q46	0.020	0.027	-0.059	0.137	0.137	0.274	0.225	0.250	-0.026
Q47	0.020	-0.145	-0.059	0.137	0.137	-0.268	-0.243	-0.038	-0.243
Q48	-0.208	-0.145	-0.059	0.137	0.137	0.003	0.069	0.106	-0.135
Q49	-0.069	0.167	-0.161	-0.144	-0.144	0.229	0.189	0.052	-0.131
Q50	-0.197	-0.079	-0.152	-0.054	-0.054	-0.171	-0.162	-0.099	-0.009
Q51	-0.008	0.012	0.023	-0.114	-0.114	0.120	0.213	0.089	0.163
Q52	-0.220	0.122	-0.169	-0.024	-0.024	0.137	-0.253	-0.044	0.077
Q53	-0.221	0.021	0.040	-0.202	-0.202	-0.279	0.094	-0.236	-0.203
Q54	-0.037	0.221	-0.107	-0.076	-0.076	0.043	-0.050	0.000	-0.069
Q55	-0.037	0.055	-0.000	-0.076	-0.076	0.043	0.100	0.139	-0.173
Q56	-0.159	-0.210	0.029	0.088	0.088	-0.156	0.068	0.019	-0.111
Q57	-0.143	-0.149	-0.188	-0.211	-0.211	-0.052	0.079	-0.122	-0.231
Q58	0.090	0.240	-0.159	0.054	0.054	0.171	0.162	0.099	-0.092
Q59	-0.008	0.012	0.023	0.130	0.130	0.120	-0.107	0.237	0.052
Q60	0.081	-0.123	0.059	0.550	0.550	0.373	0.485	0.423	0.183
Q61	-0.073	-0.055	-0.107	0.076	0.076	-0.043	-0.100	0.139	-0.139
Q62	0.055	0.167	0.322	0.115	0.115	0.082	0.019	0.210	-0.013
Q63	-0.146	-0.276	-0.000	-0.076	-0.076	-0.217	-0.050	-0.139	-0.173
Q64	0.180	-0.021	-0.161	-0.144	-0.144	-0.066	0.019	0.052	-0.013
Q65	0.349	0.149	0.188	0.211	0.211	0.052	0.204	0.384	0.133
Q69	0.363	0.199	-0.170	0.137	0.137	0.138	0.225	0.250	0.082
Q70	0.303	0.240	0.048	0.277	0.277	0.298	0.016	0.234	0.110
Q71	-0.010	0.069	-0.077	-0.065	-0.065	0.063	-0.033	0.018	-0.039
Q72	0.244	0.134	-0.018	0.093	0.093	0.015	0.152	0.168	0.138
Q73	0.109	0.188	-0.091	0.130	0.130	0.120	-0.107	0.237	0.052

	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18
Q11	0.400								
Q12	0.243	0.485							
Q13	0.263	0.230	0.269						
Q14	0.065	0.130	0.211	0.004					
Q15	0.139	0.277	0.135	0.166	0.413				
Q16	0.126	-0.126	0.161	0.169	0.155	-0.035			
Q17	0.378	0.189	0.170	0.174	0.024	-0.026	0.261		
Q18	0.348	0.221	0.121	0.010	0.133	0.219	0.109	0.239	
Q19	0.069	-0.069	-0.026	-0.064	-0.211	-0.135	0.133	0.223	-0.022
Q20	-0.230	-0.164	-0.039	0.224	-0.283	-0.141	0.355	-0.012	0.010
Q21	0.100	0.100	0.277	-0.066	0.616	0.277	0.251	0.000	0.221
Q22	0.402	0.366	0.436	0.098	0.303	0.208	0.375	0.152	0.324
Q23	0.032	0.253	0.274	0.363	0.143	0.274	0.159	-0.060	-0.010
Q24	0.032	0.159	0.051	0.071	-0.109	-0.049	0.064	-0.132	0.141
Q25	-0.041	0.288	0.217	0.103	0.357	0.217	0.010	-0.109	0.052
Q26	0.073	0.366	0.094	0.206	0.090	0.322	-0.143	-0.055	-0.092
Q27	0.445	0.318	-0.051	0.211	0.109	0.148	0.026	-0.048	0.131
Q28	0.441	0.170	0.111	0.002	0.128	0.111	-0.015	0.398	0.021
Q29	0.032	-0.127	-0.247	-0.211	-0.202	-0.148	0.154	0.228	0.231
Q30	0.100	0.300	0.069	0.033	0.227	-0.139	0.251	0.189	0.126
Q31	0.220	0.157	0.063	0.262	0.063	0.063	0.200	0.261	0.378
Q32	0.265	0.189	0.249	0.285	-0.086	-0.105	0.226	0.143	0.275
Q33	0.139	0.069	-0.190	-0.346	-0.092	0.026	-0.035	-0.026	0.515
Q34	0.328	0.164	0.039	0.067	0.283	0.141	0.109	0.012	0.363
Q35	0.236	0.354	0.196	0.209	0.046	0.196	-0.178	0.089	0.112
Q36	0.173	0.087	-0.138	0.191	-0.081	0.132	-0.052	0.115	-0.137
Q37	0.357	0.130	0.110	0.292	0.055	0.110	0.247	0.208	0.133
Q38	0.038	-0.038	0.249	0.174	0.024	0.131	0.119	-0.071	0.060
Q39	0.107	0.320	0.281	0.343	-0.055	-0.052	0.114	0.161	-0.034
Q40	0.032	-0.126	-0.022	-0.010	0.143	-0.121	0.070	-0.239	0.080
Q41	0.131	0.164	0.141	0.261	0.283	0.346	0.109	0.012	-0.291

Q42	0.272	0.034	0.101	-0.103	0.367	0.101	0.207	0.180	0.172
Q43	0.293	0.037	-0.134	0.098	0.090	-0.020	0.168	-0.055	0.012
Q44	0.131	-0.033	-0.166	0.164	-0.100	-0.064	-0.076	0.012	0.176
Q45	0.118	0.236	-0.074	0.139	-0.046	0.172	-0.044	0.134	0.112
Q46	-0.069	-0.243	-0.082	-0.141	0.009	-0.082	0.063	-0.223	0.022
Q47	0.139	0.069	0.351	0.371	0.009	0.026	0.259	0.170	0.121
Q48	-0.069	-0.035	0.026	0.064	0.009	-0.082	0.456	-0.026	0.219
Q49	0.038	0.076	0.013	0.174	0.135	0.131	0.012	-0.071	0.275
Q50	-0.032	-0.162	0.009	0.004	-0.040	0.009	0.155	-0.159	-0.143
Q51	0.213	0.213	0.059	0.028	0.152	0.059	0.114	0.161	-0.034
Q52	0.063	0.126	0.318	0.291	0.133	-0.175	-0.070	-0.120	0.100
Q53	0.094	0.189	0.203	0.050	-0.190	-0.092	-0.244	-0.071	0.209
Q54	0.200	0.400	0.173	0.131	0.227	0.173	0.157	0.189	0.221
Q55	0.300	0.500	0.069	0.131	-0.162	0.069	-0.220	0.000	0.316
Q56	0.136	0.170	0.111	0.303	-0.268	0.005	0.177	0.013	0.118
Q57	-0.031	-0.063	0.231	-0.169	-0.155	-0.063	-0.022	-0.083	0.249
Q58	0.130	0.065	0.294	0.283	0.040	0.092	-0.063	-0.024	-0.041
Q59	0.107	0.000	-0.163	0.343	0.048	-0.052	0.013	-0.040	0.169
Q60	-0.139	-0.139	-0.327	-0.018	-0.099	-0.183	-0.139	-0.105	-0.175
Q61	-0.100	-0.000	0.035	0.164	-0.227	0.035	-0.063	-0.189	0.158
Q62	-0.302	-0.265	-0.341	-0.161	-0.086	0.013	0.012	0.143	0.060
Q63	0.200	0.100	0.277	0.230	0.130	0.069	0.251	0.189	0.411
Q64	-0.076	-0.038	0.013	-0.050	-0.086	0.013	-0.202	-0.286	0.167
Q65	0.031	-0.031	-0.133	-0.017	-0.029	0.063	-0.156	-0.095	0.020
Q69	0.035	-0.035	0.026	-0.039	0.211	0.243	-0.035	-0.223	0.121
Q70	0.227	0.065	-0.110	0.187	0.229	-0.009	-0.063	-0.024	-0.133
Q71	0.230	0.164	0.039	0.067	0.187	0.244	-0.169	-0.174	-0.010
Q72	0.173	0.347	0.268	0.191	0.171	0.268	-0.052	-0.131	0.356
Q73	0.107	0.213	0.059	0.238	0.048	0.059	0.114	-0.040	0.270

	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27
Q20	-0.064								
Q21	-0.069	-0.164							
Q22	-0.094	-0.118	0.366						
Q23	0.022	0.083	0.158	0.197					
Q24	-0.051	0.353	0.064	-0.067	0.312				
Q25	-0.345	-0.262	0.288	0.141	0.299	0.191			
Q26	-0.436	-0.118	0.037	-0.083	-0.012	0.247	0.547		
Q27	-0.049	0.023	0.223	0.172	0.231	0.457	0.044	0.277	
Q28	0.101	-0.198	0.068	0.271	0.075	-0.106	0.061	0.159	0.203
Q29	0.049	0.259	0.064	-0.067	-0.322	0.180	0.073	0.037	0.002
Q30	-0.069	-0.066	0.200	0.256	-0.221	0.064	0.164	0.037	0.127
Q31	0.035	0.169	0.251	0.271	0.249	0.154	-0.106	-0.143	0.296
Q32	0.223	-0.050	0.189	0.069	0.263	-0.024	0.031	-0.180	0.024
Q33	0.082	-0.244	-0.035	-0.134	-0.219	-0.049	-0.040	-0.020	0.049
Q34	-0.244	-0.224	0.460	0.226	0.104	0.023	0.262	0.118	0.353
Q35	-0.074	-0.023	0.354	0.155	0.224	0.090	0.232	0.155	0.360
Q36	0.274	-0.065	-0.043	-0.101	-0.110	-0.119	-0.200	-0.101	-0.006
Q37	0.193	0.100	0.227	0.303	0.143	-0.109	-0.003	-0.017	0.295
Q38	0.223	0.062	0.189	0.193	0.371	0.084	0.031	-0.055	0.132
Q39	0.163	-0.077	-0.000	0.125	0.034	-0.109	-0.018	0.008	0.007
Q40	-0.077	0.176	0.253	-0.012	0.010	0.131	-0.052	-0.012	0.141
Q41	0.064	-0.127	0.164	0.226	0.010	-0.165	0.140	0.118	0.071
Q42	-0.101	0.098	0.543	0.288	-0.075	0.203	0.064	0.065	0.283
Q43	0.020	-0.118	0.146	0.278	0.092	0.247	0.277	0.158	0.382
Q44	-0.039	0.164	-0.131	0.010	0.104	0.023	0.019	-0.206	-0.117
Q45	0.074	-0.093	-0.118	0.103	0.112	0.022	0.203	0.103	-0.022
Q46	-0.026	0.064	-0.139	0.094	0.175	-0.148	-0.168	-0.248	-0.051
Q47	0.082	0.166	0.173	0.208	0.373	0.051	0.088	-0.020	0.247
Q48	0.082	0.269	0.173	0.208	0.274	0.249	-0.040	-0.248	0.148

Q49	-0.013	-0.050	0.076	-0.055	0.478	0.084	0.311	-0.055	0.024
Q50	-0.009	0.004	0.032	0.090	0.236	0.262	0.117	0.090	0.202
Q51	-0.170	-0.077	0.107	0.242	0.034	-0.007	0.245	0.125	0.210
Q52	-0.318	-0.176	-0.063	0.220	0.260	-0.040	0.286	0.220	-0.050
Q53	-0.007	-0.136	-0.189	-0.090	0.149	0.349	0.085	0.014	0.102
Q54	-0.277	0.033	0.100	0.256	0.063	-0.032	0.164	0.256	0.127
Q55	-0.069	-0.164	-0.200	0.256	0.158	0.064	0.041	0.146	0.318
Q56	0.313	0.203	-0.136	0.159	0.172	0.089	-0.190	-0.176	0.300
Q57	0.259	0.017	0.126	0.039	-0.070	0.026	-0.010	-0.168	-0.026
Q58	-0.092	-0.004	0.065	0.017	0.225	0.109	0.242	0.123	-0.016
Q59	0.052	0.028	-0.000	0.008	0.337	0.095	-0.018	0.008	0.210
Q60	0.038	0.118	-0.277	-0.081	-0.088	-0.062	-0.160	-0.233	-0.203
Q61	0.069	0.164	-0.100	-0.146	0.126	0.032	-0.041	-0.037	-0.032
Q62	0.105	0.285	-0.151	-0.304	-0.382	-0.024	-0.249	-0.180	-0.192
Q63	0.035	0.131	0.200	0.256	0.253	0.159	-0.082	-0.073	0.223
Q64	-0.131	-0.273	0.076	-0.055	-0.060	-0.240	0.171	0.069	-0.084
Q65	-0.161	0.076	-0.031	0.064	0.070	-0.116	0.127	-0.039	-0.064
Q69	-0.026	-0.039	0.277	0.208	0.175	-0.049	-0.040	-0.248	0.247
Q70	0.009	-0.100	-0.032	0.230	0.225	0.016	0.003	-0.090	0.355
Q71	-0.039	-0.321	0.066	0.010	0.104	0.023	0.140	0.118	0.259
Q72	-0.268	-0.065	0.217	0.469	0.137	0.006	0.282	0.041	0.119
Q73	0.163	0.028	0.107	0.242	0.034	-0.109	-0.018	-0.109	0.210

	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36
Q29	0.089								
Q30	0.068	0.159							
Q31	-0.015	0.154	-0.126						
Q32	-0.218	-0.024	-0.151	0.440					
Q33	-0.101	0.051	0.069	-0.035	0.249				
Q34	0.198	-0.071	0.263	0.109	0.161	0.141			
Q35	0.024	0.090	-0.000	0.378	0.267	-0.172	0.255		
Q36	0.156	0.006	0.217	-0.052	0.066	-0.138	0.065	0.215	
Q37	0.425	0.262	0.130	0.155	0.135	-0.193	0.187	0.275	0.298
Q38	0.128	-0.024	-0.151	0.226	0.357	-0.105	-0.062	0.267	-0.082
Q39	-0.029	-0.210	-0.000	0.416	0.524	-0.052	-0.028	0.176	0.157
Q40	-0.118	0.040	-0.126	0.159	0.263	0.077	0.010	0.224	0.014
Q41	0.098	-0.071	0.164	-0.169	-0.174	-0.371	0.127	0.139	0.450
Q42	0.348	0.300	0.238	0.207	-0.128	-0.111	0.203	0.216	0.109
Q43	0.271	0.142	0.037	0.168	-0.055	-0.134	0.226	0.155	0.184
Q44	0.098	0.117	-0.131	0.388	0.161	-0.064	0.030	0.023	0.194
Q45	0.216	0.022	-0.000	0.178	0.267	0.049	-0.023	-0.028	0.245
Q46	0.111	-0.247	-0.347	0.259	0.131	0.135	-0.064	-0.172	-0.138
Q47	0.322	-0.049	-0.035	0.161	0.249	-0.082	0.244	0.196	-0.003
Q48	-0.207	0.051	0.277	0.161	0.249	0.135	0.039	-0.049	-0.138
Q49	0.013	-0.132	-0.151	0.226	0.357	0.131	0.161	0.134	0.066
Q50	0.128	0.076	-0.162	0.063	0.024	-0.092	-0.004	-0.069	-0.081
Q51	0.405	-0.007	0.320	0.013	-0.201	-0.052	0.077	-0.075	0.157
Q52	0.118	-0.312	-0.063	-0.070	0.060	-0.175	0.176	-0.112	-0.260
Q53	-0.148	-0.192	0.000	0.024	0.286	0.301	0.043	0.089	0.033
Q54	0.373	0.064	0.200	0.063	-0.038	-0.139	0.361	-0.000	0.087
Q55	0.170	-0.127	0.000	0.157	0.189	0.277	0.164	0.236	0.087
Q56	-0.141	-0.106	0.068	0.177	0.244	0.111	-0.103	0.144	0.156
Q57	0.111	0.026	-0.063	-0.200	0.095	0.231	0.169	-0.044	0.052
Q58	0.169	-0.076	-0.032	0.120	0.086	-0.211	0.004	0.413	0.334
Q59	-0.029	-0.109	-0.107	0.214	0.161	0.059	-0.028	0.050	-0.120
Q60	0.019	-0.062	-0.139	-0.009	-0.105	-0.183	-0.255	-0.033	0.168
Q61	0.034	-0.064	-0.100	-0.063	0.151	0.139	0.033	-0.000	0.303
Q62	-0.218	0.301	-0.038	-0.095	-0.157	0.013	-0.174	-0.134	0.213
Q63	0.068	-0.127	-0.200	0.346	0.189	0.069	0.066	0.118	-0.173
Q64	-0.103	-0.132	-0.038	0.012	0.229	0.249	0.385	0.134	0.066

Q65	0.273	-0.026	-0.031	-0.067	0.012	-0.133	0.295	0.156	0.194
Q69	0.217	-0.049	0.069	0.063	0.013	-0.190	0.448	0.319	0.268
Q70	0.367	-0.076	0.065	0.029	-0.024	-0.312	0.292	0.183	0.208
Q71	0.299	-0.165	0.066	0.017	0.161	0.244	0.224	-0.093	0.194
Q72	0.156	0.006	0.217	0.071	0.066	-0.138	0.450	0.215	-0.015
Q73	0.188	-0.007	0.320	0.214	0.040	-0.052	0.287	0.176	0.296

	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45
Q38	0.355								
Q39	0.048	0.161							
Q40	-0.041	0.155	0.034						
Q41	0.187	-0.062	-0.028	-0.176					
Q42	0.268	0.103	-0.188	0.021	0.203				
Q43	0.303	0.069	-0.109	-0.012	0.442	0.400			
Q44	0.091	-0.062	0.287	0.197	-0.164	-0.098	0.010		
Q45	0.069	-0.000	0.452	0.112	-0.023	-0.216	-0.026	0.557	
Q46	-0.092	0.131	0.059	0.077	-0.269	-0.005	-0.020	0.244	0.172
Q47	0.413	0.249	0.170	0.077	0.141	-0.005	0.208	0.039	0.049
Q48	0.110	0.249	-0.052	0.077	-0.064	-0.111	-0.020	-0.064	0.049
Q49	0.024	0.229	0.161	-0.060	-0.174	0.103	0.069	0.273	0.267
Q50	0.149	0.355	0.048	0.051	0.091	0.169	0.303	-0.004	0.183
Q51	0.152	-0.201	0.091	0.034	0.182	0.137	0.242	0.287	0.452
Q52	-0.051	0.060	0.067	-0.010	-0.104	-0.021	0.116	-0.010	0.000
Q53	-0.190	0.071	0.060	0.060	-0.143	-0.237	0.117	-0.143	0.134
Q54	0.227	0.076	0.107	-0.126	0.066	0.136	0.146	-0.033	0.118
Q55	0.130	0.189	0.213	-0.126	0.066	0.034	0.256	-0.033	0.118
Q56	0.326	0.359	0.297	-0.118	0.098	-0.067	0.159	-0.103	-0.024
Q57	0.212	0.095	-0.114	-0.159	-0.017	0.081	0.039	-0.202	-0.178
Q58	0.040	0.086	0.159	0.041	0.292	0.227	0.230	0.100	0.160
Q59	0.048	0.161	-0.136	0.135	-0.028	0.029	0.242	0.077	-0.176
Q60	0.036	-0.105	0.089	0.175	0.018	-0.160	0.223	0.291	0.196
Q61	0.259	0.038	0.107	0.126	0.033	-0.034	0.073	0.230	0.236
Q62	0.024	-0.286	-0.081	-0.060	0.050	-0.128	-0.055	0.161	0.134
Q63	0.032	0.076	0.107	0.158	-0.131	0.238	0.146	-0.131	-0.236
Q64	0.024	-0.029	0.040	0.048	-0.062	-0.128	-0.055	0.161	-0.000
Q65	0.338	0.119	-0.087	0.070	0.109	0.015	0.168	0.388	0.289
Q69	0.312	0.249	-0.052	0.077	0.244	0.207	0.208	0.039	0.049
Q70	0.324	0.086	0.055	-0.051	0.196	0.029	0.230	0.100	0.046
Q71	0.091	0.161	0.077	-0.083	0.127	0.103	0.226	0.127	0.325
Q72	0.298	0.066	0.157	0.014	0.065	-0.024	0.041	0.194	0.245
Q73	0.359	0.161	0.318	0.135	-0.028	-0.080	0.008	0.287	0.327

	Q46	Q47	Q48	Q49	Q50	Q51	Q52	Q53	Q54
Q47	0.026								
Q48	0.026	0.351							
Q49	0.367	0.131	0.131						
Q50	0.009	0.110	0.110	0.024					
Q51	-0.052	0.170	0.170	0.040	0.256				
Q52	0.219	0.121	-0.077	0.382	0.133	0.067			
Q53	0.007	0.105	0.203	0.179	0.178	0.060	0.209		
Q54	-0.139	0.069	-0.035	0.189	0.032	0.213	0.316	-0.094	
Q55	0.069	0.069	0.069	0.302	0.227	0.107	0.316	0.378	0.300
Q56	0.005	0.322	0.111	0.128	0.029	-0.137	-0.172	0.141	-0.034
Q57	0.133	0.427	0.133	0.202	-0.155	-0.114	-0.020	0.154	-0.063
Q58	0.193	0.294	-0.009	0.416	0.134	0.159	0.236	0.282	-0.032
Q59	0.059	0.059	0.170	0.040	0.048	-0.136	0.270	-0.040	-0.107
Q60	0.250	-0.038	-0.038	0.052	-0.234	0.089	-0.044	0.026	-0.139
Q61	0.035	0.347	0.139	0.265	0.162	0.213	0.158	0.283	-0.100
Q62	-0.223	0.013	0.131	-0.157	-0.086	0.040	-0.371	-0.036	-0.038
Q63	0.069	0.381	0.069	0.076	0.032	-0.107	0.221	0.000	0.100

Q64	0.249	0.013	-0.223	0.100	-0.196	-0.201	0.060	-0.036	-0.151
Q65	0.161	0.063	-0.133	-0.095	0.063	0.114	-0.070	-0.065	0.063
Q69	0.243	0.351	0.135	0.249	0.009	0.059	0.022	0.007	0.173
Q70	0.193	0.294	-0.009	0.086	0.040	-0.048	0.143	-0.086	0.162
Q71	0.244	0.141	0.039	0.161	0.283	0.287	0.083	0.323	0.066
Q72	-0.003	0.132	-0.003	0.066	-0.081	0.157	0.233	0.033	0.347
Q73	0.059	0.170	0.170	0.282	-0.055	0.318	0.169	-0.040	0.426

	Q55	Q56	Q57	Q58	Q59	Q60	Q61	Q62	Q63
Q56	0.272								
Q57	0.126	0.303							
Q58	0.162	0.070	0.155						
Q59	0.213	-0.029	-0.315	-0.048					
Q60	-0.000	0.019	0.009	0.099	-0.059				
Q61	0.200	0.136	0.251	0.227	0.107	0.139			
Q62	-0.265	-0.103	-0.012	-0.245	-0.201	0.210	0.265		
Q63	0.200	0.170	0.126	0.065	0.426	-0.139	0.100	-0.151	
Q64	0.076	0.013	0.309	0.086	0.040	-0.105	0.151	-0.286	-0.151
Q65	0.063	-0.111	-0.022	0.029	0.114	0.253	0.220	0.012	-0.220
Q69	0.069	0.111	0.329	0.294	-0.163	0.250	0.243	0.013	-0.035
Q70	0.162	0.070	0.063	0.149	0.055	0.234	-0.162	-0.135	-0.032
Q71	0.164	-0.103	-0.017	0.100	0.077	-0.118	0.230	-0.062	-0.131
Q72	0.217	0.024	0.174	0.081	-0.120	0.168	0.043	-0.229	-0.043
Q73	0.213	0.188	0.087	0.055	-0.136	0.089	0.213	0.040	-0.000

	Q64	Q65	Q69	Q70	Q71	Q72
Q65	0.440					
Q69	0.249	0.357				
Q70	-0.024	0.212	0.497			
Q71	0.050	0.202	0.244	0.196		
Q72	0.361	0.439	0.538	0.334	0.065	
Q73	0.040	0.013	0.392	0.159	0.077	0.434

Cell Contents: Pearson correlation

Item and Total Statistics

Variable	Total Count	Mean	StDev
Q1	45	0.756	0.435
Q2	45	0.911	0.288
Q3	45	0.733	0.447
Q4	45	0.956	0.208
Q5	45	0.956	0.208
Q6	45	0.844	0.367
Q7	45	0.889	0.318
Q8	45	0.867	0.344
Q9	45	0.711	0.458
Q10	45	0.667	0.477
Q11	45	0.333	0.477
Q12	45	0.289	0.458
Q13	45	0.644	0.484
Q14	45	0.378	0.490
Q15	45	0.289	0.458
Q16	45	0.489	0.506
Q17	45	0.933	0.252
Q18	45	0.444	0.503
Q19	45	0.711	0.458
Q20	45	0.644	0.484

Q21	45	0.333	0.477
Q22	45	0.244	0.435
Q23	45	0.556	0.503
Q24	45	0.422	0.499
Q25	45	0.178	0.387
Q26	45	0.244	0.435
Q27	45	0.578	0.499
Q28	45	0.689	0.468
Q29	45	0.422	0.499
Q30	45	0.333	0.477
Q31	45	0.489	0.506
Q32	45	0.222	0.420
Q33	45	0.289	0.458
Q34	45	0.356	0.484
Q35	45	0.800	0.405
Q36	45	0.156	0.367
Q37	45	0.378	0.490
Q38	45	0.222	0.420
Q39	45	0.267	0.447
Q40	45	0.556	0.503
Q41	45	0.356	0.484
Q42	45	0.311	0.468
Q43	45	0.244	0.435
Q44	45	0.356	0.484
Q45	45	0.200	0.405
Q46	45	0.289	0.458
Q47	45	0.289	0.458
Q48	45	0.289	0.458
Q49	45	0.222	0.420
Q50	45	0.378	0.490
Q51	45	0.267	0.447
Q52	45	0.444	0.503
Q53	45	0.533	0.505
Q54	45	0.333	0.477
Q55	45	0.333	0.477
Q56	45	0.689	0.468
Q57	45	0.511	0.506
Q58	45	0.622	0.490
Q59	45	0.267	0.447
Q60	45	0.867	0.344
Q61	45	0.667	0.477
Q62	45	0.222	0.420
Q63	45	0.333	0.477
Q64	45	0.222	0.420
Q65	45	0.489	0.506
Q69	45	0.289	0.458
Q70	45	0.622	0.490
Q71	45	0.356	0.484
Q72	45	0.156	0.367
Q73	45	0.267	0.447
Total	45	32.600	8.789

Cronbach's Alpha = 0.8293

Omitted Item Statistics

Omitted	Adj. Total	Adj. Total	Item-Adj.	Squared Multiple	Cronbach's

Variable	Mean	StDev	Total Corr	Corr	Alpha
Q1	31.844	8.678	0.230713	*	0.827287
Q2	31.689	8.723	0.215070	*	0.827761
Q3	31.867	8.766	0.025508	*	0.831163
Q4	31.644	8.765	0.103128	*	0.829047
Q5	31.644	8.765	0.103128	*	0.829047
Q6	31.756	8.752	0.079980	*	0.829701
Q7	31.711	8.764	0.061652	*	0.829749
Q8	31.733	8.708	0.215601	*	0.827626
Q9	31.889	8.822	-0.098044	*	0.833613
Q10	31.933	8.572	0.433816	*	0.823115
Q11	32.267	8.606	0.360068	*	0.824643
Q12	32.311	8.689	0.193773	*	0.828008
Q13	31.956	8.600	0.367357	*	0.824455
Q14	32.222	8.673	0.209621	*	0.827748
Q15	32.311	8.673	0.228426	*	0.827331
Q16	32.111	8.674	0.199836	*	0.827990
Q17	31.667	8.757	0.113173	*	0.828967
Q18	32.156	8.573	0.405621	*	0.823529
Q19	31.889	8.796	-0.041963	*	0.832549
Q20	31.956	8.780	-0.009150	*	0.832195
Q21	32.267	8.640	0.286912	*	0.826148
Q22	32.356	8.576	0.470042	*	0.822793
Q23	32.044	8.600	0.351781	*	0.824704
Q24	32.178	8.692	0.165526	*	0.828702
Q25	32.422	8.690	0.234181	*	0.827269
Q26	32.356	8.768	0.024388	*	0.831077
Q27	32.022	8.561	0.432735	*	0.822957
Q28	31.911	8.607	0.365219	*	0.824582
Q29	32.178	8.773	0.003227	*	0.832107
Q30	32.267	8.701	0.158900	*	0.828752
Q31	32.111	8.576	0.396062	*	0.823720
Q32	32.378	8.656	0.294908	*	0.826137
Q33	32.311	8.821	-0.095807	*	0.833571
Q34	32.244	8.579	0.410926	*	0.823538
Q35	31.800	8.628	0.378999	*	0.824727
Q36	32.444	8.691	0.248932	*	0.827073
Q37	32.222	8.528	0.512149	*	0.821321
Q38	32.378	8.658	0.288576	*	0.826252
Q39	32.333	8.676	0.228443	*	0.827328
Q40	32.044	8.733	0.082283	*	0.830479
Q41	32.244	8.676	0.206101	*	0.827809
Q42	32.289	8.636	0.303304	*	0.825833
Q43	32.356	8.584	0.451332	*	0.823148
Q44	32.244	8.650	0.261001	*	0.826674
Q45	32.400	8.635	0.360457	*	0.825052
Q46	32.311	8.736	0.090564	*	0.830010
Q47	32.311	8.562	0.474602	*	0.822452
Q48	32.311	8.681	0.211084	*	0.827670
Q49	32.378	8.624	0.371203	*	0.824754
Q50	32.222	8.712	0.128872	*	0.829427
Q51	32.333	8.642	0.305793	*	0.825846
Q52	32.156	8.702	0.144946	*	0.829152
Q53	32.067	8.724	0.100172	*	0.830115
Q54	32.267	8.635	0.298129	*	0.825918
Q55	32.267	8.593	0.388362	*	0.824058
Q56	31.911	8.676	0.216857	*	0.827567
Q57	32.089	8.733	0.082140	*	0.830505
Q58	31.978	8.598	0.364545	*	0.824483
Q59	32.333	8.718	0.134077	*	0.829122

Q60	31.733	8.773	0.025620	*	0.830388
Q61	31.933	8.651	0.264520	*	0.826606
Q62	32.378	8.861	-0.193864	*	0.834762
Q63	32.267	8.677	0.208779	*	0.827741
Q64	32.378	8.768	0.026031	*	0.830931
Q65	32.111	8.642	0.262988	*	0.826626
Q69	32.311	8.559	0.480542	*	0.822333
Q70	31.978	8.606	0.348052	*	0.824833
Q71	32.244	8.632	0.299631	*	0.825871
Q72	32.444	8.609	0.474564	*	0.823506
Q73	32.333	8.579	0.450229	*	0.823046