EFFECTS OF TAI CHI ON SUBTHRESHOLD DEPRESSION, STRESSORS, RESILIENCE, BURNOUT, NEGATIVE EMOTION REGULATION AND COPING STYLES AMONG CHINESE MEDICAL STUDENTS IN YANCHENG CITY, CHINA

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by

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LIST OF ABBREVIATIONS

CES-D	Center for Epidemiology Research Self-Rating Depression Scale
CERQ	Cognitive Emotion Regulation Questionnaire
DSM-V	Diagnostic and Statistical Manual of Mental Disorders
MDD	Major Depressive Disorder
MSSQ	Medical Student Stressor Questionnaire
MeRS	Medical Professionals Resilience Scale
OLBI	Oldenburg Burnout Inventory
StD	Subthreshold depression
SCSQ	Simple Coping Style Questionnaire
PA	Positive Affect
SC	Somatic Complaints
DA	Depressed Affect
ARS	Academic Related Stressors
IRS	Intrapersonal and Interpersonal Related Stressors
TLRS	Teaching and Learning-Related Stressors
SRS	Social Related Stressors
DRS	Drive and Desire Related Stressors
GARS	Group Activities Related Stressors
GR	Growth
IN	Involvement
CO	Control
RE	Resourceful
EXH	Exhaustion
DIS	Disengagement
SB	Self-Blame
RU	Rumination
CA	Catastrophising
OB	Other blame
SEP	Sufficiency Economy Philosophy
VSLB	Voluntary Simplicity Lifestyle Behaviours
ESG	Environmental, Social and Governance

GRA	Gratitude
INO	Injunctive Norm
DNO	Descriptive Norm
PNO	Personal Norm
COW	Consumer Wisdom
RSP	Responsibility
PUR	Purpose
FLE	Flexibility
PES	Perspective
REA	Reasoning
SUS	Sustainability
SOR	Social Responsibility
MAT	Material Simplicity
SEL	Self-Sufficiency
SPI	Spiritual Life
CMV	Common Method Variance
SPSS	Statistical Package for Social Sciences
PLS	Partial Least Squares

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Appendix B Multivariate normality for CFA

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KESAN TAI CHI KE ATAS KEMURUNGAN SEPARA AMBANG, STRESOR, KETAHANAN, KEPENATAN, REGULASI EMOSI NEGATIF DAN DAYA TINDAK MENGATASI DALAM KALANGAN PELAJAR PERUBATAN CINA DI BANDAR YANCHENG, CHINA

ABSTRAK

Kemurungan subthreshold ialah kehadiran gejala kemurungan yang tidak mencukupi untuk diagnosis kemurungan utama dan sangat lazim dalam kalangan pelajar perubatan yang menghadapi beban kerja yang tinggi dan tekanan persaingan. Kajian ini bertujuan untuk mengkaji hubungan antara kumurungan subthreshold, punca-punca tekanan, ketahanan psikologi, keletihan kerja, pengaturan emosi negatif, dan gaya mengatasi negatif dalam kalangan pelajar perubatan Cina. Kajian turut menilai kesan intervensi Tai Chi di Kolej Perubatan Jiangsu, Bandar Yancheng melalui dua fasa: kajian keratan rentas dan ujian terkawal rawak. Pada fasa pertama, 811 peserta melengkapkan soal selidik, yang diterjemahkan menggunakan kaedah terjemahan ke hadapan dan ke belakang, dan model persamaan struktur digunakan untuk mengkaji hubungan di antara pembolehubah kajian. Versi Bahasa Cina bagi Skala Kemurungan Penarafan Sendiri (CES-D), Soal Selidik Tekanan Pelajar Perubatan (MSSQ), Skala Ketahanan Profesional Perubatan (MeRS), Inventori Burnout Oldenburg (OLBI), Soal Selidik Kawalan Emosi Kognitif (CERQ), dan Soal Selidik Gaya Penangunan Mudah (SCSQ) digunakan untuk mengukur kemurungan, tekanan, daya tahan, keletihan, peraturan emosi, dan gaya penangunan di kalangan pelajar perubatan. Selepas menetapkan kesahihan dan kebolehpercayaan soal selidik dan menentukan hubungan antara pembolehubah, fasa kedua kajian dijalankan. Fasa kedua menilai keberkesanan intervensi Tai Chi terhadap kemurungan subthreshold di

kalangan pelajar perubatan. Percubaan terkawal rawak dilakukan dengan 72 peserta yang dibahagikan secara rawak kepada kumpulan eksperimen (program Tai Chi 24 bentuk selama 10 minggu, tiga sesi 40 minit seminggu) atau kumpulan kawalan tanpa intervensi. Kedua-dua kumpulan melengkapkan soal selidik sebelum dan selepas intervensi. Analisis data telah dijalankan menggunakan perisian SPSS 29.0 dan Mplus 8.3. Analisis varians pengukuran berulang (RM ANOVA) dan analisis varians multivariat pengukuran berulang (RM MANOVA) digunakan untuk menganalisis keputusan Fasa 2. Pada fasa pertama, model struktur akhir menunjukkan kesesuaian yang baik dengan data ($\chi 2/df = 1.446$, CFI = 0.984, TLI = 0.982, RMSEA = 0.023, SRMR = 0.030), menunjukkan bahawa stresor, keletihan, pengaturan emosi negatif, dan gaya daya tindak negatif berkait positif dengan kemurungan subthreshold, manakala daya tahan berkait negatif. Pada fasa kedua, kemurungan subthreshold, sumber tekanan, cara penanganan negatif, dan daya tahan menunjukkan kesan masa dan kesan interaksi yang signifikan ($p < 0.001$), keletihan menunjukkan kesan interaksi yang signifikan ($p < 0.001$), dan pengaturan emosi negatif menunjukkan kesan kumpulan yang signifikan ($p < 0.001$). Secara keseluruhannya, kajian ini: 1) mengesahkan kebolehpercayaan dan kesahihan skala tersebut dalam kalangan pelajar perubatan di China; 2) mendedahkan hubungan antara kemurungan subthreshold, sumber tekanan, daya tahan, keletihan, pengaturan emosi negatif dan cara penanganan negatif; 3) menekankan impak positif program Tai Chi selama 10 minggu dalam mengurangkan tahap kemurungan subthreshold dalam kalangan pelajar perubatan di China.

EFFECTS OF TAI CHI ON SUBTHRESHOLD DEPRESSION, STRESSORS, RESILIENCE, BURNOUT, NEGATIVE EMOTION REGULATION AND COPING STYLES AMONG CHINESE MEDICAL STUDENTS IN YANCHENG CITY, CHINA

ABSTRACT

Subthreshold depression represents specific depressive symptoms in individuals that fall short of meeting the diagnostic criteria for major depression and is highly prevalent among medical students facing heavy workloads and competitive pressures. This study examined the relationships among subthreshold depression, stressors, resilience, burnout, negative emotion regulation, and negative coping styles, and evaluated the effect of Tai Chi among Chinese medical students. The study also investigated the effect of Tai Chi intervention on subthreshold depression among students at Jiangsu Medicine College in Yancheng City through two study phases: a cross-sectional survey and a subsequent randomized controlled trial. In the phase 1,811 participants completed questionnaires, which were translated using forward and backward translation methods, and a structural equation model was used to examine the relationships between study variables. The Chinese version of the Center for Epidemiology Research Self-Rating Depression Scale (CES-D), Medical Student Stressor Questionnaire (MSSQ), Medical Professionals Resilience Scale (MeRS), Oldenburg Burnout Inventory (OLBI), Cognitive Emotion Regulation Questionnaire (CERQ), and Simple Coping Style Questionnaire (SCSQ) were used to measure subthreshold depression, stressors, resilience, burnout, emotion regulation, and coping styles among medical students. After establishing the validity and reliability of the questionnaires and determining the relationships between

variables, the second phase of the study was conducted. The phase 2 assessed the effectiveness of Tai Chi intervention on subthreshold depression among medical students. A randomized controlled trial was conducted with 72 participants who were randomly assigned to either a 10-week Tai Chi program (three 40-minute sessions per week) or a no-intervention control group. Both groups completed questionnaires before and after the intervention. Data analysis was conducted using SPSS 29.0 and Mplus 8.3 software. Repeated measures analysis of variance (RM ANOVA) and repeated measures multivariate analysis of variance (RM MANOVA) were used to analyse the results of Phase 2. In the phase 1, the final structural model showed good fit with the data ($\chi 2/df = 1.446$, CFI = 0.984, TLI = 0.982, RMSEA = 0.023, SRMR = 0.030), revealing that stressors, burnout, negative emotion regulation, and negative coping styles were positively associated with subthreshold depression, whereas resilience was negatively associated. In the second phase, there were significant time and interaction effects for subthreshold depression, stressors, negative coping styles, and resilience ($p < 0.001$), burnout was significant in the interaction effect ($p < 0.001$), and negative emotion regulation was significant in the group effect ($p < 0.001$). In summary, this study: 1) confirmed the reliability and validity of the above scales among Chinese medical students; 2) revealed the relationships among subthreshold depression, stressors, resilience, burnout, negative emotion regulation, and negative coping styles; and 3) emphasised the positive effects of a 10-week Tai Chi course in reducing the level of subclinical depression among Chinese medical students.

CHAPTER 1

INTRODUCTION

1.1 Background

Subthreshold depression (StD), referred to as subclinical or subsyndromal depressive symptom, is characterized by the presence of two or more depressive symptoms persisting most or all of the time for a duration exceeding two weeks, accompanied by a certain level of social impairment. However, it does not meet the diagnostic criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) for Major Depressive Disorder (MDD) (Judd et al., 1994). Despite not meeting the criteria for MDD, StD can still result in social dysfunction and increased medical visits (Cuijpers et al., 2004; Lin et al., 2014). Patients with StD exhibit symptoms such as persistent fatigue, memory loss, insomnia, impaired concentration that significantly impact their daily lives and may even lead to suicidal behaviour (Li et al., 2017; Park et al., 2015).

The high prevalence of depression has led the World Health Organization to rank it as the third most prevalent disease in terms of global burden, with projections indicating that it will become the leading disease by 2030(Q. Liu et al., 2020). This presents a significant public health challenge and places a substantial strain on healthcare services (Hao et al., 2023). As a highly prevalent disorder, numerous studies have observed a notable increase in rates of StD after the age of 12, persisting throughout mid-adolescence (ages 14-16) (Allgaier et al., 2012; Rohde et al., 2009; Sihvola et al., 2007). Among adults, StD ranges from 3% to 10% within clinical settings and from 1% to 17% within community populations (Rodríguez et al., 2012). In elderly individuals, the prevalence of subclinical depression typically exceeds that of major depressive disorder by at least two to three times (Meeks et al., 2011).

Among them, the youth individuals constitute a unique group characterized by relatively high levels of intelligence, idealism, and self-esteem. Typically positioned at the developmental stage of emerging adulthood, this group navigates the transition from academic settings to broader societal roles, necessitating adaptation to academic competition, social challenges, and unfamiliar living environments (Lew et al., 2019). During encounters with adverse life events and negative emotions, the intense competitive atmosphere and psychological pressures can provoke stress responses, such as academic decline and poor interpersonal relationships (Sokratous et al., 2013; Tang et al., 2015). Furthermore, emotional disorders among the youth are often exacerbated by a reluctance to seek help due to stigma and embarrassment associated with admitting psychological difficulties (Ebert et al., 2019). Previous studies have shown that approximately 17% to 31% of young college students who do not receive psychiatric services have experienced significant depressive symptoms (Yun et al., 2017). Medical students, as a distinct professional group, face the future responsibility of treating and saving patients. They often grapple with the dual challenges of a rigorous medical curriculum and complex doctor-patient relationships. Consequently, prioritizing the psychological health of medical students is of urgent necessity.

Many studies have proved that stress, mental resilience, burnout, emotional regulation and coping styles play an important role in the mental health of medical students. High levels of stress are major triggers for StD in medical students due to heavy academic workloads, demanding clinical training, and intense competition, all of which lead to significant psychological pressure (Fares et al., 2016; Sreeramareddy et al., 2007). Resilience, the individual's capacity to adapt to stress and adversity, is a dynamic attribute (Howe et al., 2012). Although no observed

correlation exists between the resilience of medical students and their academic performance, previous research has demonstrated a positive association between resilience and the well-being of medical students (Burgis-Kasthala et al., 2019). For instance, prior cross-sectional studies have revealed links between resilience in medical students and reduced levels of psychological distress, increased life satisfaction and overall well-being, improved quality of life, decreased symptoms of anxiety, as well as heightened subjective well-being (Aboalshamat et al., 2018; Helou et al., 2019; Shi et al., 2015). However, a Canadian study has shown that medical students perceive greater stress, have poorer coping skills, and are less resilient than the general population(Rahimi et al., 2014). Burnout is a measure of physical and mental exhaustion and distress, primarily triggered by occupational and professional demands (Cecil et al., 2014). Numerous studies have shown the heightened levels of burnout and depression prevalent among medical students (Dyrbye et al., 2010; Kuan et al., 2019; Rotenstein et al., 2016). Prevalence among medical students is approximately 49% in the United States and 28-61% in Australia (IsHak et al., 2013). There is evidence of a link between burnout and suicidal ideation among medical students. Cross-sectional data from seven medical schools indicate that among the surveyed students, those who have experienced burnout are two to three times more likely to have had suicidal thoughts compared to other students (Dyrbye et al., 2010). Emotion regulation is a cognitive process, and impaired emotion regulation is an important cause of the onset, persistence and recurrence of depression (Goldsmith et al., 2013). One meta-analysis showed that the link between negative emotion regulation and psychopathology was stronger and more sustained than positive emotion (Aldao et al., 2010). Coping style is a cognitive behavioural style, and negative coping style can aggravate depression, and the United

States has even prevented suicide by intervening in coping skills (Abdollahi et al., 2018; Horwitz et al., 2018).

StD is considered as the prodromal stage of major depression, which can serve as a predictive factor for the onset of MDD (Cuijpers et al., 2007; Karsten et al., 2011). A recent study in 2020 further substantiated that StD may represent an intermediate phase between a state of well-being and major depression, providing additional evidence that StD falls within the spectrum of mood disorders alongside major depression (Zhang et al., 2020). As symptoms of StD do not yet meet the diagnostic criteria for MDD, they are often overlooked; thus, medical professionals should pay sufficient attention to varying degrees of depressive symptoms (Klein et al., 2000). Consequently, early prevention and treatment strategies targeting StD among young individuals become particularly crucial.

In 2016, the United States Preventive Services Task Force issued recommendations for the early prevention and treatment of depression in adults to reduce the incidence of depression (Sinyor et al., 2016). A systematic review conducted in 2017 suggested that aerobic exercise could be an efficacious intervention for depression or subthreshold depressive symptoms among young individuals (Bailey et al., 2018; Gujral et al., 2017). Psychosomatic exercise therapy, as a form of low to medium intensity aerobic exercise, has demonstrated favorable effects on mental health across diverse populations, encompassing depression, anxiety, stress management, and enhancement of self-efficacy (Artemiou et al., 2018; Bo et al., 2017; D'Silva et al., 2012; Rodkjaer et al., 2017).

Exercise therapy, as a non-pharmacological intervention for StD, has been clinically proven to be effective against depression, stress and other adverse emotions. Some scholars have used Tai Chi alone as an intervention for MDD in the

elderly and have achieved good results. As a traditional Chinese physical and mental exercise, the effects of Tai Chi in improving depression and relieving negative emotions such as stress have been confirmed in several Meta-analyses (Yeung et al., 2017). A study on StD adolescents showed that the use of an 8-week period of mindfulness Tai Chi training significantly reduced the depression levels of StD adolescents and concluded that mindfulness Tai Chi was an effective way to reduce StD (Zhang et al., 2018). It suggests that Tai Chi can be used for the prevention and treatment of StD. However, the mechanism of Tai Chi on medical students with StD is still unclear, which limits its popularization and application.

This study aims to comprehensively understand the influencing factors of StD in Chinese medical students and observe whether Tai Chi can reduce the symptoms of StD in medical students through 10-week Tai Chi training, and explore its mechanism, so as to provide scientific basis for the rehabilitation treatment of StD.

1.2 Problem statement

In the modern medical education environment, medical students face a high level of academic and clinical stress, which can lead to mental health problems such as depression, burnout, excessive stress, and negative emotion regulation (Dyrbye et al., 2005; Pacheco et al., 2017; Ruzhenkova et al., 2018). In addition, medical students often adopt negative coping styles to deal with these pressures, which further exacerbates their psychological burden (Baqutayan, 2015). Existing research has shown that stress, burnout, resilience, emotional regulation, and coping strategies are closely related to depressive states. However, there is much research on the influencing factors of obvious depressive symptoms, while there is little research on the influencing factors of StD. Especially in the special group of medical students.

Moreover, previous studies have mostly examined single or a few factors, neglecting a comprehensive examination of the factors influencing StD in medical students. Furthermore, most research has focused on the regulation of emotional intensity rather than coping strategies. Therefore, exploring the interactions between StD, stress, burnout, resilience, emotional regulation, and coping strategies remains an unresolved issue.

With the increasing academic and professional pressure faced by medical students, their mental health problems are becoming more and more obvious, which may seriously affect their learning efficiency and career (Hill et al., 2018). Negative emotional regulation and coping strategies may further worsen these psychological states (Doulougeri et al., 2016). Therefore, finding effective interventions to enhance mental resilience, improve emotional regulation, reduce negative coping styles, and alleviate symptoms of depression and burnout is critical to improving the mental health of medical students.

Tai Chi, as a traditional Chinese physical activity with profound cultural heritage, is regarded as an effective way to improve physical and mental health through its emphasis on the unity of mind and body and the combination of movement and movement (Solloway et al., 2016; Wang et al., 2020). Although the positive effects of tai chi on groups such as the elderly have been studied, the specific group of medical students has been relatively understudied. This study aims to explore how Tai Chi can improve the psychological state of medical students through its effects on their StD, resilience, burnout, stress, negative emotion regulation and negative coping styles, and provide new intervention strategies for medical education.

1.3 Rationale and Significance

In modern society, mental health issues are increasingly becoming an important topic of global concern (Patel et al., 2007). Especially in the medical education environment, medical students face high levels of academic and clinical stress, which can lead to mental health problems such as depression, burnout, stress overload, and negative emotion regulation (Cuttilan et al., 2016).

As future healthcare providers, the mental health status of medical students is not only directly related to their academic performance and career development, but also has a profound impact on their future careers and the patients they serve. Studies have shown that the incidence of depression among medical students is significantly higher than that of the general population (Brenneisen Mayer et al., 2016). Nearly one third of medical students worldwide suffer from depression, but treatment rates are relatively low (Puthran et al., 2016). Behind this phenomenon is the result of the multiple pressures that medical students endure over time, such as academic pressure, clinical practice pressure, and future employment pressure(Stewart et al., 1995). As medical students often have to cope with complex medical knowledge, heavy academic tasks, and high-intensity clinical practice, they easily fall into a state of psychological burnout and low mood(Silva et al., 2017). In addition, medical students generally lack effective coping strategies and are prone to adopt negative coping methods such as avoidance and self-blame, which further aggravate their psychological burden (Fitzgibbon & Murphy, 2023).

Although modern psychology has developed a variety of interventions, such as cognitive behavioral therapy and medication, the application of these methods in the medical student population is not satisfactory. On the one hand, medical students have a tight schedule and find it difficult to spare enough time for systematic

psychotherapy; on the other hand, medical students have a sense of shame about mental illnesses and are often reluctant to take the initiative to seek psychological help (Givens & Tjia, 2002). Furthermore, although medication can relieve symptoms in the short term, long-term use may bring side effects and is not suitable as a long-term intervention. Therefore, finding a psychological intervention that suits the characteristics of medical students has become an urgent problem.

Tai Chi, as a physical and mental training method originating from traditional Chinese culture, has a long history and rich practical experience. Its unique movements, breathing regulation and psychological adjustment methods are believed to be effective in improving the mental health of individuals(Lan et al., 2013). Specifically, Tai Chi has the following unique advantages: (1) Easy to operate: the movements of Tai Chi are relatively simple and learning and practice do not require complicated equipment or venues, so medical students can practice it conveniently in dormitories, campuses and other environments. (2) Flexible time: the practice time of Tai Chi can be adjusted according to the individual's schedule, and medical students can practice it for a short period of time after class without causing too much impact on their academic and clinical practice. It will not affect their studies and clinical practice too much. (3) Balance between body and mind: Tai Chi not only emphasizes physical exercise, but also focuses on psychological adjustment. Through slow rhythmic movements and deep breathing, practitioners can achieve the effect of relaxing the body and mind and balancing the emotions, which in turn improves the psychological flexibility and the ability to cope with pressure. (4) Cultural identity: as a traditional Chinese cultural movement, Tai Chi has a high degree of acceptance and identity among Chinese medical students, which helps to improve its promotion and application among medical students.

It has been shown that Tai Chi has significant positive effects on mental health. For example, a study noted that Tai Chi can effectively reduce stress, improve emotional regulation, and increase psychological resilience (Laird et al., 2019). In addition, Tai Chi is also believed to indirectly promote mental health by improving physical health and enhancing an individual's self-efficacy and self-esteem (Dechamps et al., 2007). a. Reducing stress: Through deep breathing and slow movements, Tai Chi helps to relax the nervous system, reduce physical and psychological tension, and lower stress levels (Sandlund & Norlander, 2000). b. Improve emotional regulation: Tai Chi 's meditation and breathing regulation methods help to improve an individual's ability to regulate their emotions, enabling them to better cope with negative emotions and reduce the incidence of depression and anxiety (Wang et al., 2023). c. Improves mental resilience: Continuous practice of Tai Chi enhances an individual's mental resilience, enabling them to maintain a positive mindset and coping ability in the face of stress and frustration (Waechter & Wekerle, 2015). d. Promotes positive coping: By enhancing individuals' self-awareness and self-regulation, Tai Chi encourages practitioners to adopt more positive and constructive coping strategies and reduce the use of negative coping styles (Webster et al., 2016).

Although the mental health benefits of Tai Chi have been somewhat validated in the general population, research on its application in the medical student population is still relatively limited. This study will focus on the medical student population and use structural equation modelling to explore the mechanisms through which Tai Chi affects the mental health of medical students, to reveal the interrelationships between StD, stress, burnout, resilience, cognitive emotion regulation and coping styles, and to test the practical effects of Tai Chi as a mental

health intervention through Tai Chi interventions, so as to provide a scientific basis for the promotion and application of Tai Chi.

1.4 Operational definition

1.4.1 Confirmatory factor analysis (CFA)

Confirmatory factor Analysis (CFA) is a type of structural equation model (SEM) that deals specifically with measurement models, i.e. the relationship between observed measurements or metrics (such as test items, test scores, behavioral observation ranges) and underlying variables or factors (Brown & Moore, 2012). It is primarily used to test the fit between data and a specific theoretical model, often evaluated using statistical indices like the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA).

1.4.2 Structural Equation Modelling (SEM)

Structural Equation Modeling (SEM) is a comprehensive statistical technique that combines features of factor analysis and multiple regression analysis to analyze complex relationships among observed and latent variables (Kline, 2023). In this study, SEM was used to analyze the relationships among StD, stress, resilience, burnout, negative emotion regulation and negative coping styles.

1.4.3 Subthreshold depression (StD)

This study used the Center for Epidemiologic Studies Depression Scale (CES-D) to assess StD levels, which was designed for epidemiological studies to assess the extent of depressive symptoms and to identify individuals at risk for depression in the general population and has been validated in a variety of Chinese samples. Therefore, the three-factor questionnaire validated by Jiang et al. (2019)

was used in this study. The factors included in the questionnaire were Positive Affect (PA), Somatic Complaints (SC), and Depressed Affect (DA).

1.4.4 Stressors

In this study, the Medical Student Stressor was adopted the Medical Student Stressor Questionnaire (MSSQ) is used to measure the sources of stress for medical students. MSSQ is a six-factor questionnaire developed by Yusoff et al.(2010), which is specially applied to measure the stressors of medical students. The questionnaire contains six factors, which are as follows: Academic Related Stressors (ARS), Intrapersonal and Interpersonal Related Stressors (IRS), Teaching and Learning-Related Stressors (TLRS), Social Related Stressors (SRS), Drive and Desire Related Stressors (DRS), and Group Activities Related Stressors (GARS).

1.4.5 Resilience

In this study, the level of psychological resilience of medical students was measured using the Medical Professionals Resilience Scale (MeRS), a questionnaire developed by Rahman et al.(2021) to assess the level of psychological resilience of medical professionals, which consists of four factors: Growth, Involvement, Control, and Resourceful.

1.4.6 Burnout

In this study, the level of burnout among medical students was measured using the Oldenburg Burnout Inventory (OLBI), which was developed by Professors Demerouti & Nachreiner (1998) to quantify burnout based on the Job Demands-Resources Burnout Model, which contains 2 dimensions namely: Exhaustion, Disengagement.

1.4.7 Cognitive Emotion regulation

In this study, Cognitive Emotion Regulation Questionnaire (CERQ) was used to measure the cognitive emotion regulation of medical students. CERQ was developed by Garnefski et al (2002). The questionnaire contains 9 dimensions, which are: self-blame, acceptance, rumination, putting into perspective, positive refocus, refocus on planning, positive reappraisal, catastrophizing and other blame. Some studies have pointed out that cognitive coping strategies are significantly correlated with depression and anxiety symptoms in individuals who have recently experienced major stressors. Self-blame, reflection, catastroatization and positive reappraisal are the strongest predictors of such symptoms among various stressors(Garnefski et al., 2001, 2003). Therefore, only negative cognitive emotion regulation strategies are selected in this study, namely: self-blame, rumination, catastrophizing, other blame.

1.4.8 Coping styles

In this study, Simplified Coping Style Questionnaire (SCSQ) was used to measure the coping style of medical students. SCSQ was compiled by Chinese scholar Xie (1998). The questionnaire contains two dimensions: Positive coping and negative coping. Previous studies have shown that negative coping styles are positively correlated with mental illness (Wang et al., 2006). Therefore, this study uses a dimension of negative coping styles.

1.5 Research questions, research hypothesis, objective

According to the research questions, research hypotheses and objectives, it is divided into the Phase 1 and Phase 2 according to the progress of the research.

1.5.1 Research questions

1.5.1(a) Phase 1

1. Are the Chinese translated version of Center for Epidemiology Research Self-rating Depression Scale (CES-D), Medical Student Stressor Questionnaire (MSSQ), Medical Professionals Resilience Scale (MeRS), Oldenburn Burnout Inventory (OLBI) questionnaire, Cognitive Emotion Regulation Questionnaire (CERQ) and Simple Coping Style Questionnaire (SCSQ) valid and reliable?

2. Are there any relationships between StD, stressors, resilience, burnout, negative emotion regulation and negative coping styles among Chinese Medical Students in Yancheng City, China?

1.5.1(b) Phase 2

3. Is there any time effect of Tai Chi intervention on StD, stressors, resilience, burnout, negative emotion regulation and negative coping styles among Chinese Medical Students in Yancheng City, China?

4. Is there any group effect of Tai Chi intervention on StD, stressors, resilience, burnout, negative emotion regulation and negative coping styles among Chinese Medical Students in Yancheng City, China?

5. Is there any interaction effect (group*time) of Tai Chi intervention on StD, stressors, resilience, burnout, negative emotion regulation and negative coping styles among Chinese Medical Students in Yancheng City, China?

1.5.2 Research hypotheses

1.5.2(a) Phase 1

1. The Chinese translated version of CES-D, MSSQ, MeRS, OLBI, CERQ and SCSQ are valid and reliable.

2. There are significant relationships between StD, stressors, resilience, burnout, negative emotion regulation and negative coping styles among Chinese Medical Students in Yancheng City, China.

1.5.2(b) Phase 2

3. There is a significant time effect of on StD, stressors, resilience, burnout, negative emotion regulation and negative coping styles among Chinese Medical Students in Yancheng City after intervention of Tai Chi.

4. There is a significant group effect (intervention vs control group) of on StD, stressors, resilience, burnout, negative emotion regulation and negative coping styles among Chinese Medical Students in Yancheng City after intervention of Tai Chi.

5. There is a significant interaction effect (group*time) of on StD, stressors, resilience, burnout, negative emotion regulation and negative coping styles among Chinese Medical Students in Yancheng City after intervention of Tai Chi.

1.5.3 General objective

The overall goal of this study was to determine the relationships between StD, stressors, resilience, burnout, negative emotion regulation, and negative coping styles among Chinese medical students, as well as the effects of the Tai Chi intervention on the study variables in Yancheng City, China.

1.5.4 Specific objectives

1.5.4(a) Phase 1

1. To examine the validity and reliability of the Chinese translated version of CES-D, MSSQ, MeRS, OLBI, CERQ and SCSQ by using confirmatory factor analysis and internal consistency reliability.

2. To examine the inter-relationships between StD, stressors, resilience, burnout, negative emotion regulation and negative coping styles among Chinese Medical Students in Yancheng City by using structural equation modelling.

1.5.4(b) Phase 2

3. To determine the time effect of StD, stressors, resilience, burnout, negative emotion regulation and negative coping styles among Chinese Medical Students in Yancheng City after intervention of Tai Chi.

4. To determine the group effect of StD, stressors, resilience, burnout, negative emotion regulation and negative coping styles among Chinese Medical Students in Yancheng City after intervention of Tai Chi.

5. To determine the interaction effect (group*time) of StD, stressors, resilience, burnout, negative emotion regulation and negative coping styles among Chinese Medical Students in Yancheng City after intervention of Tai Chi.

1.6 Chapter Summary

This chapter presents the elements related to this study. This chapter includes an introduction to the study, the background of the study and the problem statement. Based on this the general and specific objectives of the study are presented. In addition, the operational definitions are presented with the aim of providing an understanding of the variables used throughout the process of the study. The next chapter, Chapter 2, is a review of relevant literature related to the study.

CHAPTER 2

LITERATURE REVIEW

2.1 Subthreshold depression

2.1.1 Definition

Major Depressive Disorder (MDD) is a mood disorder that is characterized by persistent low mood and lack of pleasure, and has a serious impact on an individual's thinking, mood, behavior, interpersonal interactions and sense of well-being (Otte et al., 2016). The incidence of depression has been on the rise in recent years, with about 5% of adults worldwide suffering from depression (Herrman et al., 2022). According to statistics, the 12-month and lifetime prevalence rates of MDD are 10.4 % and 20.6 % in the United States (Hasin et al., 2018), and 2.1 % and 3.4 % in China (Huang et al., 2019). It is worth noting that the prevalence of depression has increased by more than 25% globally due to the COVID-19 pandemic (Deng et al., 2021; Santomauro et al., 2021). The high prevalence, the tendency to become chronic, the ease of relapse and the low effectiveness of treatment contribute to the high disease burden of depression. WHO ranks depression as the largest single contributor to global disability accounting for 7.5 % of all years of disability, more than 700,000 people commit suicide each year, and depression is one of the leading causes of death by suicide (World Health Organization, 2017, 2021).

According to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) published by the American Psychiatric Association (2013), the diagnostic criteria for depression mainly include disease course criteria, symptom criteria and severity criteria, and must exclude bipolar disorder and organic mental disorders, psychoactive substances and non-addictive substances caused by depression. Specifically, the duration of the disease was defined as at least 2 weeks;

The criteria for symptoms were at least 5 of the following 9 symptoms (2 core symptoms and 7 additional symptoms), including at least 1 core symptom: The core symptoms included: (1) low mood (2) anhedonia; additional symptoms included: (3) abnormal weight gain or loss, (4) insomnia or hypersomnia, (5) psychomotor agitation or retardation, (6) fatigue, (7) insensitivity Feelings of worth or self-sin, (8) decreased attention and thinking ability, (9) thoughts or behaviors of self-harm or suicide; Severe criteria are severely impaired social functioning.

Subthreshold depression (StD), also known as subsyndromal depressive symptom, subclinical depression and minor depression, refers to a state or a class of individuals who have some depressive symptoms but do not meet the diagnostic criteria for MDD (Cuijpers & Smit, 2004). Although StD does not meet the diagnostic criteria for MDD, like MDD, it has a serious impact on an individual's life and social functioning and has a higher prevalence than MDD (Judd et al., 2002). Research suggests that StD, the prodromal stage of MDD (Cuijpers & Smit, 2004), increases an individual's risk of developing MDD or other adverse outcomes (substance abuse and dependence) (Lewinsohn et al., 2000). StD also predicts an individual's likelihood of developing MDD two years later (Karsten et al., 2011). There are currently two main perspectives on defining StD, the first of which suggests that the development of depressive disorders is a continuum, with no symptoms at one end and major depressive disorder at the other, and that StD resides between no depressive symptoms and major depressive disorder(Kessler et al., 1997). The second view is that StD is a state with its own unique characteristics that differs from other depressive symptoms(Fechner-Bates et al., 1994). More research now supports the first view, which suggests that depression develops along a

continuum and that both StD and major depressive disorder reflect the same biologic process with only slight differences in severity (Angst et al., 2000).

It is worth mentioning that for those who do not meet the above diagnostic criteria for depression, the DSM-V also provides for minor depression and recurrent brief depressive disorder (RBD) Diagnostic criteria for the two subtypes of StD. Among them, minor depression refers to that although the duration of depressive symptoms in an individual is more than two weeks, the number of depressive symptoms is only 2 to 4 (including at least one core symptom), that is, the number of depressive symptoms does not meet the diagnostic criteria for depression. RBD means that although the number of depressive symptoms in an individual reaches 2 to 4 (including at least 1 core symptom), the duration of depressive symptoms is less than two weeks, that is, the duration of depressive symptoms does not meet the diagnostic criteria for depression.

However, despite the fact that the DSM-5 clearly specifies the diagnostic criteria for the above two subtypes of StD (mainly the number and duration of depressive symptoms), the number, nature, and duration of depressive symptoms that should characterise StD have been subsequently disputed by researchers(Kroenke, 2006), which in turn has led to the operational definitions of StD that have so far not been harmonized by different researchers. For example, while most researchers screen individuals for StD primarily on the basis of the number of depressive symptoms, others suggest that individuals should be screened for StD based on the severity of depressive symptoms rather than the number of depressive symptoms(Karsten et al., 2010). The reasons for this are twofold: On the one hand, StD itself has strong heterogeneity, and minor depressive disorder and recurrent transient depressive disorder are not enough to include all subtypes of StD. On the

other hand, different researchers pay different attention to StD. Some researchers pay more attention to the number of depressive symptoms that StD individuals should have, some researchers pay more attention to the nature of depressive symptoms that StD individuals should have, and some researchers pay more attention to the duration of depressive symptoms that StD individuals should have.

The analysis found that although different researchers disagreed on the operational definition of StD, most researchers mainly used the following two operational definitions (Kroenke, 2017): First, researchers often used the diagnostic criteria of mild depressive disorder to screen StD individuals, that is, StD individuals referred to those with depressive symptoms lasting more than two weeks, but the number of depressive symptoms was only 2 to 2 Individuals with 4 symptoms (including at least 1 core symptom); Second, considering that the screening of StD individuals according to the first operational definition often requires the use of costly diagnostic interviews, other researchers often screen StD individuals through the demarcation of the self-rating depression scale, that is, StD refers to those individuals with high scores on the self-rating depression scale.

2.1.2 Epidemiological studies

StD is common worldwide. Previous studies have found that the global incidence of StD is estimated at 25% (Furukawa et al., 2012). Many people who experience symptoms of StD may not seek help because their symptoms do not meet typical diagnostic criteria for depression.

The condition is particularly common in adolescents and the elderly, who can be misdiagnosed or overlooked. Identity problems, academic stress, and relationship problems faced by adolescents can increase the risk of StD (Bertha & Balázs, 2013; Rohde et al., 2009). StD affects about 2%-24% of elderly (van Zoonen et al., 2016),

social support and loneliness are also important risk factors (Singh & Misra, 2009; Su et al., 2012; Verstraten et al., 2005).

Medical students face many types of stress in medical school: onerous academic demands and workloads, challenging curriculum and learning environments, personal life events, and psychological stress that is difficult to cope with (Dyrbye et al., 2009; Santen et al., 2010; Sreeramareddy et al., 2007). Medical students face much higher academic pressures than the general population (Rotenstein et al., 2016). Several studies have indicated that the prevalence of depressive symptoms among medical students ranges from 1.4% to 80.6% (Prinz et al., 2012; Z. Zhang et al., 2006). The COVID-19 outbreak poses serious new challenges to the mental health of medical students (Bashir et al., 2020; Qanash et al., 2020; Saraswathi et al., 2020).

In addition, it has been demonstrated that women are more likely to experience subthreshold depression than men, with a significantly higher prevalence of StD in women (13.8 %) than in men (9.68 %)(Zhang R. et al., 2023). This may be related to hormonal changes, socio-cultural expectations, and differences in role pressures in life. Women are more likely to exhibit internalised coping styles in the face of stress, such as anxiety and depression, whereas men are likely to exhibit externalised behaviours, such as aggression and substance abuse(Crockett et al., 2020; González & Vives, 2019).

2.1.3 Identification and screening of StD

There are two main ways to identify and screen for StD:

(1) Depression scales are used to identify and screen subthreshold depressed individuals. There are two kinds of depression scale, one is the other-report scale,

which is scored and rated by psychiatric professionals according to the individual's state. The other type is a self-report scale.

Hamilton Depression Rating Scale (HAMD): It's the other-report scale. Developed in the late 1950s (Hamilton, 1960), the HAMD is divided into 17-item, 21-item, and 24-item versions, with most of the items rated on a 5-point scale of 0-4, and a few items rated on a 3-point scale of 0-2. It is considered the "gold standard" for assessing the severity of depression (van Diermen et al., 2018). However, the full HAMD is time-consuming and has been criticised for its conceptual and psychometric shortcomings, particularly its multidimensionality and controversial sensitivity to mood changes (Bagby et al., 2004; Entsuah et al., 2002; Helmreich et al., 2012). Therefore, the use of total HAMD scores to assess depression severity may be methodologically flawed, as is common practice in clinical trials. And because of its multidimensional nature, the HAMD is relatively insensitive to improvements in classic depressive symptoms (e.g., depressed mood, guilt, and suicidal ideation) (Bech et al., 1981; Fenton & McLoughlin, 2021).

The Center for Epidemiology Research Self-Rating Depression Scale (CES-D): Radloff (1977) of the National Institutes of Mental Health of the United States developed this scale, which can better identify depressive emotions and moods. The study proved to show that the scale is applicable to all age groups and has good reliability and validity in the population. The CES-D scale has a total of 20 items. The evaluation time range of the scale is nearly one week, with a score of 0-3, of which 4 items are scored in reverse and the scores of 20 items are summed up. Less than 15 points have no depressive symptoms. A score of 16- 19 may have depressive symptoms, and a score of 20 and above definitely has depressive symptoms. In this

study, a CES-D score greater than 16 was used as the primary screening condition for StD.

The Self-Rating Depression Scale (SDS): A widely used self-report instrument for quantitatively describing depression as a mood disorder. Developed by William W. Zung in 1965, the SDS was specifically designed to quickly and easily identify and quantify symptoms of depression (Zung, 1965). It consists of 20 items, each of which relates to psychological and somatic symptoms associated with depression. The items cover all aspects of daily emotional and physical functioning, such as mood, sleep, appetite, and cognitive functioning. Each item on the SDS is rated on a scale of 1 to 4, depending on how often the symptom has occurred in the past few days. The scores are then added together, and the total score can range from 20 to 80. Higher scores indicate more severe depression.

The Beck Depression Inventory (BDI): Developed based on observations of attitudes and symptoms prevalent among depressed psychiatric patients and less common among non-depressed patients (Beck, 1961). Containing 21 questions and rated over a timeframe of nearly 2 weeks, the BDI is rated on a 4-point scale of 0-3, reflecting varying degrees of depressive symptoms. Scores are cumulative according to symptom severity, with no or very mild depression being <10; mild to moderate depression being 10-18; moderate to severe depression being 19-29; and severe depression being 30-63(Beck et al., 1988).

The 9-Item Patient Health Questionnaire (PHQ-9): A 9-item self-report scale of depressive symptoms, which corresponds to the 9 diagnostic symptoms of depression in the DSM-V (Spitzer et al., 1999). Each item is scored 0-3, with a total score of 0-27. A score of 0-4 indicates no depression, 5-9 suggests possible mild depression, 10-14 suggests possible moderate depression, 15-19 suggests possible moderate to

severe depression, and 20-27 suggests possible severe depression. The scale is simple and easy to administer and has good reliability and validity (Kroenke et al., 2001).

(2) Individuals with depressive symptoms lasting more than two weeks but with only 2 to 4 depressive symptoms (including at least 1 core symptom) were selected as subthreshold depressed individuals by clinical diagnostic interview and reference to the diagnostic criteria for depression. The following are commonly used clinical diagnosis interview methods:

The MINI International Neuropsychiatric Interview (MINI): A brief structured interview tool designed for the clinical assessment of psychiatric disorders. Developed by psychiatrists and clinicians in the United States and Europe, it was introduced as a concise alternative to longer diagnostic assessments such as the Structured Clinical Interview for DSM (SCID) and the Composite International Diagnostic Interview (CIDI) (Sheehan et al., 1998). It covers a wide range of psychiatric disorders, including MDD, bipolar disorder, various anxiety disorders (such as panic disorder, generalized anxiety disorder), substance abuse disorders, and more. It typically takes about 15-30 minutes to complete, which is significantly less time than other comprehensive diagnostic tools.

The Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS): A diagnostic interview tool designed to assess and diagnose psychiatric disorders in children and adolescents. The K-SADS is widely used in clinical and research settings to evaluate affective disorders and schizophrenia in the pediatric population, including children and adolescents from the age of 6 up to 18 years (Kaufman et al., 1997). There are several versions of the K-SADS, including the original version (K-SADS-P), the Present and Lifetime Version (K-SADS-PL), and others that have been adapted for specific research needs and various

populations. All versions of K-SADS are formatted to interview both parents and children (Ambrosini, 2000).

The analysis shows that the above two screening methods have advantages and disadvantages. Specifically, it is more convenient and efficient to screen StD individuals through self-rating depression scale, which is suitable for preliminary screening and tracking of subjects in large sample studies, but it is rougher than screening StD individuals by clinical diagnostic interview. In contrast, the use of clinical diagnostic interview to screen individuals with StD is more rigorous and suitable for diagnosis and intervention in small sample studies, but it is more time-consuming and laborious than screening individuals with StD through self-rating depression scale. However, it should be noted that the above two screening methods not only theoretically meet the core characteristics of StD (i.e. screening out individuals with more depressive symptoms), but also have been adopted and proved effective in many empirical studies (Bertha & Balázs, 2013).

2.2 Theoretical model

At present, there is no mature theory specifically proposed for StD. As a subtype of depression, it is generally believed that depression-related theories are suitable for the study of StD. The cognitive-behavioral theory of depression mainly includes the Diathesis-stress theory, Beck's cognitive theory and Integrative model of depression.

Diathesis-stress theory is one of the theories to explain the causes of StD. Also known as the vulnerability-stress model, this theory was developed by Monroe and Simons, which suggests that depressive disorders arise through the interaction of diathesis factors and stress factors (Broerman, 2020). Among them, diathesis factors