DETERMINANTS OF POSTTRAUMATIC GROWTH AMONG PATIENTS WITH ACUTE CORONARY SYNDROME

NAN TANG

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR DOCTOR DEGREE OF PHILOSOPHY
(INTERNATIONAL PROGRAM)
IN NURSING SCIENCE
FACULTY OF NURSING
BURAPHA UNIVERSITY
2024

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ดุษฎีนิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปรัชญาดุษฎีบัณฑิต (หลักสูตรนานาชาติ)
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NAN TANG : DETERMINANTS OF POSTTRAUMATIC GROWTH AMONG PATIENTS WITH ACUTE CORONARY SYNDROME. ADVISORY COMMITTEE: KHEMARADEE MASINGBOON, D.S.N. PORNPAT HENGUDOMSUB, Ph.D. 2024.

Posttraumatic growth (PTG) could emerge under the influence of traumatic events and treatments, which has a positive impact on the patients with acute coronary syndrome (ACS). However, low to moderate PTG was reported in ACS patients in China. This cross-sectional model testing design aimed to test a hypothesized model of PTG among ACS patients. Systematic sampling technique was used to recruit 396 ACS patients, who had been discharged for 1 to 6 months, from clinics in the tertiary care hospitals in Jiangsu Province, China. Research instruments included the Herth Hope Index, the Core Beliefs Inventory, the Patients Health Questionnaire Depression Scale, the Multidimensional Scale of Perceived Social Support, the Connor-Davidson Resilience Scale, the Event Related Rumination Inventory, and the Posttraumatic Growth Inventory. Their Cronbach alpha reliability ranged from .88 to .96. Descriptive statistics and Structural Equation Modeling were used to analyze the data.

The results revealed that the modified model fit the data well. Challenges to core beliefs, depression, social support, deliberate rumination, and resilience explained 57% of the total variance for PTG in the modified model. Depression, deliberate rumination, and resilience had a direct effect on posttraumatic growth, whereas deliberate rumination and resilience were mediators between challenges to core beliefs, depression, social support, and posttraumatic growth. These findings suggest that development of an intervention to promote PTG among patients with ACS is important. The intervention should focus on improving challenges to core beliefs; promoting social support, deliberate rumination, and resilience; and preventing depression.

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Nan Tang

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CHAPTER 1
INTRODUCTION

Statement and significance of the problem

Acute coronary syndrome (ACS) is a name given to three types of coronary artery disease, which are prevalent in the world and China. The American Heart Association (AHA) has reported that the corresponding number of inpatient hospital discharges was 1,266,000 unique hospitalizations for acute coronary syndrome (Tsao et al., 2023). Compared to the higher-income regions, the mortality rate of acute coronary syndrome in Asia and Latin America is steadily increasing from 2000 to 2020 (Timmis et al., 2023). China as an Asian country, the mortality of cardiovascular disease still ranked first among diseases in 2020, higher than that of tumors and other diseases (Wang & Hu, 2023). ACS patients in China in 2018 accounted for the total number of coronary heart disease was 22.73%, and the ratio of the number of ST elevation myocardial infarction (STEMI) to non-ST elevation myocardial infarction (NSTEMI) patients was 1.3:1 (Hu et al., 2019). The mortality of acute coronary syndrome was steadily increasing from 2002 to 2020, which had seen a significant increase in the rural areas, surpassing the urban level by 2012 (Hu Shengshou, 2023). The total number of registered cases of coronary intervention therapy in mainland China in 2021 increased by 20.18% compared to 2020 (Wang & Hu, 2023). A nationwide study showed that the standardized rate of participants with a high risk of cardiovascular disease in the east of China was above the middle level among seven regions in China (Li, Wu, et al., 2020). Jiangsu Province lies in the east of China. In summary, ACS patients in China needs the attention of nursing researchers.

Drug therapy, percutaneous coronary intervention (PCI), and coronary artery bypass grafting (CABG) are common treatment for acute coronary syndrome in China (Zhang et al., 2019). ACS patients always experienced complications, psychological problems, and social issues after treatment. Treatment with antiplatelet and thrombolytic drugs can lead to complications such as bleeding and thrombus recurrence in ACS patients (Liu & Ren, 2023; Zhang et al., 2019). Coronary artery or aortic injury, bleeding, infection, renal failure, stroke, myocardial infarction are the complications of percutaneous coronary intervention (Ferreira et al., 2018). In early

follow-up of ACS patients, it was found that at least 88.4% of patients reported depression (Leong et al., 2021). The study showed that 33.08% of ACS patients experienced psychological problems after PCI, with 59.09% experiencing mild to moderate depression (Ren et al., 2023). 39.7% of ACS patients after 5 weeks of interventional treatment experienced physical activity limitation, especially in poor physical health (Goodwin et al., 2019). After invasive treatment, there was a moderate improvement in the quality of life of ACS patients, but it was lower than the average of the normal population (Beska et al., 2021; Parisi et al., 2021). PCI had slightly lower quality of life gains compared to those on CABG (Kaambwa et al., 2020). ACS patients who only received medication treatment still faced angina, limited physical activity, limited social interaction, and disharmony between illness and work (Du & Chen, 2018). Nearly half of ACS patients three months after PCI treatment presented low to moderate self-care, and taking 1-2 medications predicted low self-care (Amiri et al., 2023; Feng et al., 2021). Thus, ACS patients after treatment exhibit changes in symptoms, physical function, quality of life, social activities and self-care.

The occurrence, severity, and perceived pressure of traumatic events can promote posttraumatic growth (Tedeschi et al., 2018). For 84 cardiac patients,75% of the sample endorsed their cardiac event as a traumatic event (Magid et al., 2019). Thus, under the influence of traumatic events and treatment methods, posttraumatic growth of the patients with acute coronary syndrome emerged.

Posttraumatic Growth (PTG) is defined as the positive psychological changes experienced as a result of the struggle with traumatic or highly challenging life circumstances (Tedeschi & Calhoun, 1996). Such positive changes has been reported to include appreciation of life, relating to others, personal strength, new possibilities, and spiritual change (Tedeschi & Calhoun, 2004). In addition, posttraumatic growth results from individuals trying to re-establish some basic cognitive guides that are useful for survival after trauma. The formation process of post-traumatic growth in ACS patients is as follows. When ACS patients face sudden acute coronary artery disease, the core beliefs of ACS patients will be challenged, and their emotional distress will increase after suffering a disease. Then the cognition of ACS patients comes into the intrusive rumination. When intrusive rumination is successful in coping, it will also lead to more deliberate rumination for ACS patients.

At the same time, under the influence of social support, ACS patients will gradually accept the changes in their personal world caused by acute coronary syndrome, and finally show the growth after trauma to cope with the constant distress, which is called post-traumatic growth (Tedeschi et al., 2018).

ACS patients undergoing treatment could experience different levels of post-traumatic growth. A study on acute myocardial infarction revealed that patients who received treatment for the first time for 3 months had moderate PTG (Zhou et al., 2023). Young and middle-aged myocardial infarction patients who do not receive treatment for the first time have a high level of post-traumatic growth (Ali & Mahmood, 2022).1,497 coronary heart disease outpatients were assessed that South Asian reported the greatest PTG, followed by Black, White, and Chinese participants (Leung et al., 2010). Studies showed that Chinese patients with undergoing percutaneous coronary intervention (PCI) experience low PTG (Luo et al., 2021; Zhang & Song, 2018b; Zhang, Zhou, et al., 2018). In addition, other Chinese studies have shown that posttraumatic growth in myocardial infarction patients after PCI was at medium level (Chen, 2018a; Huang et al., 2021; Pan & Chen, 2017). However, patients with Coronary heart disease who underwent PCI for the first time experienced low PTG one month after treatment, while experiencing moderate PTG three months after treatment (Huang., 2020). Thus it can be seen, low to moderate posttraumatic growth was in the most of ACS patients and patients undergoing interventional surgery, especially Chinese. Meanwhile, the results of post-traumatic growth after initial and non-initial treatment are inconsistent.

A survey of patients diagnosed with acute coronary syndrome within six months found that 47.5% of the study sample reported moderate to high PTG (Bluvstein et al., 2013b). While a systematic review concluded that people who had less than six months since experiencing the traumatic event reported moderate-to-high PTG (Wu et al., 2019). Studies discovered negative direct relationships between PTG and time since the event (Leung et al., 2010; Zeng et al., 2018), especially 2 month after diagnosis of AMI relatively decreased than before discharge (Zhao et al., 2015). Further research has found that high posttraumatic growth occurred in ACS patients 3 months after initial PCI treatment (Dong & Shuang, 2021). Score of PTG over time increased over the first 12 months following diagnosis (Danhauer, Russell, et al.,

2013). It can be seen that ACS patients experienced moderate to high levels of PTG within six months after treatment, so exploring the PTG during this time is beneficial for identifying factors that promote the improvement of PTG.

More posttraumatic Growth is shown to be associated with better functional status, more self-management behavior, better quality of life and positive mental health. Optimism and positive affect were related to initiation and continuation of physical activity and healthy eating (Huffman et al., 2016). Results of review indicated a positive association such that greater levels of PTG were associated with higher leisure-time physical activity (Chen et al., 2021). Patients with coronary heart disease in the high-level posttraumatic growth group had a higher ability to reduce negative emotion regulation (Chen, 2018b). The high posttraumatic growth experienced by Chinese patients with coronary heart disease after PCI was beneficial for enhancing self-management behavior and promoting their health (Chen., 2020). Posttraumatic growth also was an important factor in enhancing health promoting behavior in elderly patients with coronary heart disease (Wang., 2020). It is worth mentioning that individuals who experienced traumatic events could experience higher quality of life when their PTG levels increased (Martz et al., 2018). A systematic review also concluded a positive relationship between PTG and quality of life in survivors (Liu. et al., 2020).

Considering the positive effects of posttraumatic growth, exploring the promoting factors of PTG is of great significance. The Revised Model of Posttraumatic Growth Tedeschi et al. (2018) explains the general psychological processes that lead to posttraumatic growth. In this model, personality traits, mental health status, challenges to core belief, rumination, social support are expected to affect post-traumatic growth (Tedeschi et al., 2018). Personality traits emphasized that hopeful cognitive was more efficient toward PTG, more deliberate rumination affected PTG. In addition, results from previous studies show that hope, challenges to core belief, depression, resilience, deliberate rumination, and social support were associated with PTG. Hope had a significantly positive effect on PTG (Heidarzadeh et al., 2016; Jeong & Kim, 2019; Yating., 2019). Challenges to core beliefs had a direct positive effect on PTG (Eze et al., 2020a; Lindstrom et al., 2013; Wang, 2018). While depression had a direct negative effect on PTG (Garnefski et al., 2008; Leung et al.,

2010). Resilience rarely led to posttraumatic growth in the model, but previous studies support this relationship. There was a positive correlation between resilience and posttraumatic growth in acute coronary syndrome (Crebbin, 2015; Dong & Liu, 2021; Shen et al., 2021; Yating., 2019). Results of previous studies indicated that deliberate rumination was positively related to PTG (Song, 2016b; Záhorcová & Prielomková, 2020). Studies also revealed that social support were positively correlated with PTG in patients with myocardial infarction (Javed & Dawood, 2016; Rahimi et al., 2016; Senol-Durak & Ayvasik, 2010).

From the literature, it can conclude that ACS patients who had not received treatment for the first time after 1 to 6 months may experience physiological, psychological, and social problems, which can lead to the development of PTG. Furthermore, high-level PTG can bring positive outcomes to ACS patients after treatment, such as better functional status, more self-management behavior, better quality of life and positive mental health. However, few previous studies focused on posttraumatic growth of ACS patients, and low to moderate posttraumatic growth in the patients with myocardial infarction or PCI. Thus, my research focused on how to promote PTG in ACS patients after 1 to 6 months of treatment. This required further exploration of which factors could affect the development of PTG, while few studies explored the causal relationships using the Structural Equation Modeling to test the contributing factors to PTG among ACS patients after treatment for 1 to 6 months. Therefore, this study focused on the ACS patients after treatment for 1 to 6 months in Jiangsu Province and applied the structural equation modeling (SEM) to test the relationships of hope, challenges to core beliefs, depression, resilience, deliberate rumination, and social support to PTG. Results from this study can help health care providers understand factors influencing the PTG and develop interventions for ACS patients to effectively deal with the trauma in the early posttraumatic phase, improving their quality of life.

Research objective

To develop and test a hypothesized model of posttraumatic growth among acute coronary syndrome by testing the relationships of hope, challenges to core

belief, depression, resilience, deliberate rumination, and social support to posttraumatic growth.

Hypotheses

Based on the Revised Model of Posttraumatic Growth (Tedeschi et al., 2018) and the literature reviews, the study hypotheses are as follows:

1. Hope has a direct positive effect on PTG among patients with Acute coronary syndrome and has an indirect positive effect on PTG mediated by deliberate rumination.

2. Challenges to core belief has a direct positive effect on PTG among patients with acute coronary syndrome and has an indirect positive effect on PTG mediated by deliberate rumination.

3. Depression has a direct negative effect on PTG among patients with Acute coronary syndrome and has an indirect negative effect on PTG mediated by resilience.

4. Social support has a direct positive effect on PTG among patients with acute coronary syndrome, has an indirect positive effect on PTG mediated by deliberate rumination, and has an indirect positive effect on PTG mediated by resilience.

5. Resilience has a direct positive effect on PTG among patients with acute coronary syndrome.

6. Deliberate rumination has a direct positive effect on PTG among patients with Acute coronary syndrome.

Conceptual framework

The conceptual framework of this study was guided by the Revised Model of Posttraumatic Growth (Tedeschi et al., 2018) and a literature review that has identified the factors that influence post-traumatic growth among patients with acute coronary syndrome. The Revised Model of Posttraumatic Growth explains the general psychological processes that lead to posttraumatic growth. The mechanism of PTG development includes the following aspects in the model: the person pre-trauma,

traumatic event, challenges to core belief, intrusive rumination, coping, deliberate rumination, social support, posttraumatic growth, enduring distress from trauma.

Pre-existing characteristics can affect PTG based on the Revised Model of Posttraumatic Growth (Tedeschi et al., 2018). Personal pre-trauma factors include (1) demographic characteristics, (2) personality traits, (3) pre-trauma mental health status. In this model, characteristics of the person pre-trauma are expected to affect how the person experiences the traumatic events, which challenge one's core beliefs and lead to intrusive rumination. Intrusive rumination refers to a cognitive process in which ACS patients focus their attention on negative perception of traumatic events, with traumatic events invading individuals' cognitive world uncontrollably. In addition, this experience will also produce nightmares, which will disturb their night and sleep. When intrusive rumination is successful in coping, it will also lead to more deliberate rumination. Meanwhile, under the influence of social support, individuals will gradually accept the changes in their world caused by trauma and finally show the growth after trauma to cope with the constant distress (Tedeschi et al., 2018).

In the model, personality traits emphasized that hopeful cognitive was more efficient toward PTG, so hope as an independent variable can affect PTG. The previous studies showed that hope has a direct positive effect on PTG among patients with myocardial infarction, cancer, stroke (Jeong & Kim, 2019; Yating., 2019; Zheng et al., 2017). Hope also has an indirect effect on PTG. Some studies showed that hope has an indirect positive effect on PTG mediated by deliberate rumination in patients with cancer, and myocardial infarction (Chen et al., 2020; Cui, 2020; Yuen et al., 2014).

According to the Revised Model of Posttraumatic Growth Tedeschi et al. (2018), pre-trauma mental health status is likely to affect PTG. Depression as an independent variable is a poor mental health status factor that is also likely to affect PTG. Previous studies also demonstrated that depression has a direct negative effect on PTG among patients with acute MI, coronary heart disease (Leung et al., 2010; Yuan. & Huang, 2017). In addition, previous research results showed that depression has an indirect negative effect on PTG mediated by resilience (Bai, 2019; Ketcham et al., 2020; Li, Kang, et al., 2019; Zhang et al., 2019).

Challenges to core belief as an independent variable can affect PTG based on the Revised Model of Posttraumatic Growth. Findings showed that challenges to core belief have a direct positive effect on PTG in survivors of terror attacks (Eze et al., 2020a; Lindstrom et al., 2013; Wang, 2018; Zhou et al., 2014). Challenges to core belief also have an indirect effect on PTG. Results showed that challenges to Core belief have an indirect positive effect on PTG mediated by deliberate rumination (Eze et al., 2020a; Freedle & Kashubeck-West, 2021; Záhorcová & Prielomková, 2020; Zhou et al., 2014).

Social support as a predictive variable can influence PTG based on the Revised Model of Posttraumatic Growth (Tedeschi et al., 2018). Previous studies also revealed social support were positively correlated with PTG in patients with myocardial infarction (Javed & Dawood, 2016; Leung et al., 2010; Zhang & Song, 2018b). Studies also found that social support has an indirect positive effect on PTG mediated by deliberate rumination (Chen, Zhao, et al., 2019; Gorini et al., 2017; Vélez et al., 2016) and resilience (Dong et al., 2017; Hajmohammadi & Shirazi, 2017; Yang. & Yang., 2021).

From the Revised Model of Posttraumatic Growth, we can find that deliberate rumination has a more efficient effect on PTG compared to the intrusive rumination. Empirical studies have consistently demonstrated that deliberate rumination was positively and directly related to PTG (Cann et al., 2011; Song, 2016b; Záhorcová & Prielomková, 2020). However, results from previous studies showed no significant correlation between intrusive rumination and posttraumatic growth in myocardial infarction or coronary heart disease (Kelly et al., 2018; Shen et al., 2021; Zhou et al., 2023).

Resilience as a predictor variable can influence PTG. The model proposed that emotional distress in a way that produces resilience, where the effects of the event lead to a sense of well-being, and it rarely leads to posttraumatic growth. However, previous studies supported a positive association between resilience and PTG (Crebbin, 2015; Dong & Liu, 2021; Shen et al., 2021).

In summary, independent variables included hope, challenges to core beliefs, depression, social support, resilience, and deliberate rumination. The dependent variable is posttraumatic growth. Resilience, and deliberate rumination were

mediators between fours variables and PTG. There were five indirect paths and six direct paths in the hypothesized model. The hypothesized model of this study was shown in Figure 1.

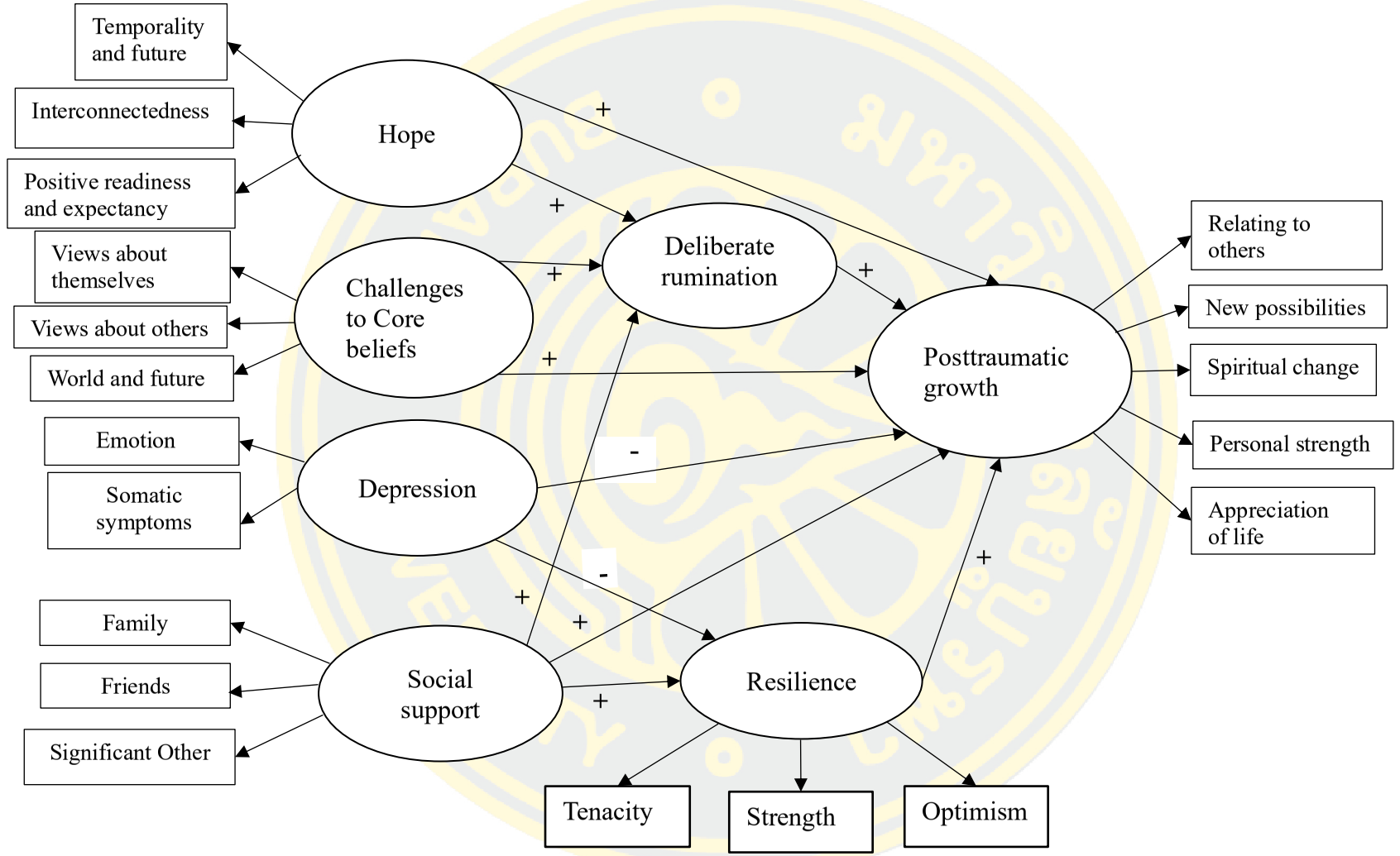

Figure 1 The hypothesized model of posttraumatic growth among acute coronary syndrome patients

Scope of the study

An empirical study of a cross-sectional structural model was conducted to investigate the influence of six predictors on the posttraumatic growth. The participants were the patients who were diagnosed with acute coronary syndrome within 6 months receiving permission to participate in this study and enrolled to study in Yancheng, Jiangsu Province from August 2022 to March 2023.

Definition of terms

Acute coronary syndrome (ACS) patient is defined as a patient who was diagnosed with ACS by the physician through the clinical presentation, electrocardiogram (ECG) findings, cardiac biomarkers, and received antiplatelet drugs, anticoagulation, percutaneous coronary intervention (PCI) and intravenous thrombolysis treatment. Acute Coronary Syndrome includes unstable angina, ST elevation myocardial infarction, non-ST elevation myocardial infarction (Torres & Moayedi, 2007). The patients who were diagnosed with ACS after treatment for 1 to 6 months were included.

Posttraumatic growth (PTG) refers to the positive psychological changes experienced by patients with ACS after treatment for 1 to 6 months. The composition of PTG includes appreciation of life, relating to others, personal strength, new possibilities, and spiritual change. PTG was measured by the Chinese version of the Posttraumatic Growth Inventory (PTGI) (Wang et al., 2011).

Hope refers to the perception of patients with ACS about their capability to derive pathways to maintain life involvement and prevent further deterioration of the disease despite physical limitations imposed by the disease. There are three components associated with hope: 1) having goal-oriented thoughts; 2) developing strategies to achieve goals; and 3) being motivated to expend effort to achieve goals (Snyder, 2002). In study, hope was measured by the Chinese version of the Herth Hope Index (HHI) (Zhao & Wang, 2000).

Challenges to Core Beliefs refers to the cognitive change that the disease shakes the original beliefs and assumptions about the world, others, and self of ACS patients and leads patients to re-examine their core beliefs. Core Beliefs include

beliefs and assumptions about the world, others, and the self. In this study, Challenges to Core Beliefs was measured by the Chinese version of the Core Beliefs Inventory (CBI) that was translated and revised by Zhou et al. (2014) based on the original version of the CBI (Cann et al., 2010).

Depression refers to the negative feelings of patients with ACS characterized by sadness, constrain, low spirits, helplessness, fatigue, changes in appetite, sleep disorders, difficulty in concentrating, self-esteem and shame. Elements of depression include somatic symptoms and emotion. In this study, depression was measured by the Patients Health Questionnaire Depression Scale (PHQ-9) (Jin et al., 2011).

Social support refers to the perception of patients with ACS in receiving help or support (ex. informational, emotional, esteem, tangible support) from family, friends, and significant other. In this study, social support was measured by the Multidimensional Scale of Perceived Social Support (MPSS) (Jiang, 2001).

Deliberate rumination refers to the positive thinking of patients with ACS in response to the difficulties caused by the acute coronary syndrome and actively solves the problems by modifying or reconstructing their views on the outside world after suffering from the disease. In this study, deliberate rumination was measured by the deliberate rumination subscale from the Chinese Event Related Rumination Inventory (ERRI) (Dong et al., 2013).

Resilience refers to the ability of ACS patients to recover from negative disease experience and adapt to the external environment after experiencing disease trauma, showing the characteristics of tenacity, strength, empathy, and optimism. Resilience was measured by the Chinese version of Connor-Davidson Resilience Scale (CD-RISC) (Yu & Zhang, 2007).

CHAPTER 2
LITERATURE REVIEW

This chapter presents related literature review about posttraumatic growth among patients with acute coronary syndrome (ACS) from five parts. The first part describes an overview of acute coronary syndrome, including definition of acute coronary syndrome, epidemiology of acute coronary syndrome, pathophysiology of acute coronary syndrome, diagnosis of acute coronary syndrome, impact of acute coronary syndrome after treatment, and impact of acute coronary syndrome after treatment. The second part presents the posttraumatic growth theory, including definition of posttraumatic growth, components of posttraumatic growth, and the theory of posttraumatic growth. The third part introduces the posttraumatic growth in patients with acute coronary syndrome, including the development of the posttraumatic growth, impact of high posttraumatic growth on ACS patients, measurement of posttraumatic growth, situation of posttraumatic growth in ACS patients in China, nursing intervention for promoting the posttraumatic growth. The fourth part presents the factors affecting posttraumatic growth in patients with acute coronary syndrome such as hope, depression, challenges to core beliefs, social support, deliberate rumination, and resilience. The last part provides a summary of all the contents of the literature review.

Overview of Acute coronary syndrome

This topic presents the introduction of acute coronary syndrome, including definition, epidemiology, pathophysiology, diagnosis, treatment, impact of acute coronary syndrome on patients.

Definition of acute coronary syndrome

The term ACS has recently appeared in medical dictionaries. The American Heart Association (AHA) defined Acute Coronary Syndrome (ACS) as a syndrome due to decreased blood flow in the coronary arteries such that part of the heart muscle is unable to function properly or dies (Amsterdam et al., 2014). While, the guidelines for rapid emergency diagnosis and treatment of acute coronary syndrome in China

Zhang et al. (2019) defined Acute coronary syndrome (ACS) as the acute ischemic syndrome of the heart caused by fresh thrombosis secondary to the rupture or erosion of unstable atherosclerotic plaque in the coronary artery.

Acute Coronary Syndrome is a name given to three types of coronary artery disease depending on the duration of symptoms, the presence of ECG changes, and blood test results (Grech & Ramsdale, 2003), including Unstable angina (UA), ST-elevation myocardial infarction (STEMI), Non-ST-elevation myocardial infarction (NSTEMI). NSTEMI and UA are called Non-ST-elevation -acute coronary syndrome (NSTE-ACS) (Torres & Moayedi, 2007). Unstable angina (UA) is defined as myocardial ischemia at rest or on minimal exertion in the absence of acute cardiomyocyte injury/necrosis (Collet et al., 2021). It is characterized by specific clinical findings of prolonged (>20 minutes) angina at rest; new onset of severe angina; angina that is increasing in frequency, longer in duration, or lower in threshold; or angina that occurs after a recent episode of myocardial infarction (Collet et al., 2021). European Society of Cardiology (ESC)/American College of Cardiology (ACC)/American Heart Association (AHA)/World Heart Federation (WHF) Uniformly reported that Myocardial infarction (MI) is defined as myocardial cell death caused by myocardial ischemia on the basis of coronary artery disease (Kristian et al., 2018). STEMI is defined by symptoms of myocardial ischemia accompanied by a persistent elevation of the ST segment on the electrocardiogram (ECG) and the subsequent release of biomarkers of myocardial necrosis (O'gara et al., 2013). NSTEMI is differentiated from STEMI by the presence of persistent ECG findings of Non-ST segment elevation (O'gara et al., 2013).

Epidemiology of acute coronary syndrome

The 2021 heart disease and Stroke Statistics update of the American Heart Association (AHA) has recently reported that the corresponding number of inpatient hospital discharges was 1,045,000 unique hospitalizations for ACS, with 615,000 cases were males, and 430,000 were females. Of the total, 1,022,000 were for myocardial infarction (MI) alone, and 23,000 were for Unstable angina (UA) alone (Virani et al., 2021). It had been estimated that approximately every 42 seconds, an American suffered from an MI in this report. More than 4.2 billion inhabitants populated the Asia-Pacific region. Acute coronary syndrome (ACS) was a leading

cause of death and disability in the Asia-Pacific region with, in-hospital mortality typically exceeding 5% (Chan et al., 2016). Huo et al. (2020) examined 12,922 Asian patients with ACS who were enrolled from 219 centers in eight Asian countries for 2 years, finding that 5.2% of patients died; non-ST-elevation myocardial infarction (NSTEMI) patients had the highest risk profile.

In China, the incidence of cardiovascular diseases has been increasing year by year from 1990 to 2019, with an increase of 99.75%. The overall prevalence of cardiovascular disease in 2019 was on the rise with age, with females being higher than males (Yang et al., 2023). The mortality rate of cardiovascular disease remained the highest in 2020, higher than that of tumors and other diseases (National Center for Cardiovascular Diseases, 2022). The number of patients with coronary heart disease was 11 million, accounting for the second largest number of cardiovascular diseases (Hu et al., 2019). The mortality rate of coronary heart disease in 2020 continued the upward trend since 2012, with a significant increase in rural areas and exceeding the urban level by 2016 (National Center for Cardiovascular Diseases, 2022). ACS patients in China in 2018 accounted for the total number of coronary heart disease was 22.73, and the ratio of the number of ST elevation myocardial infarction (STEMI) to non-ST elevation myocardial infarction (NSTEMI) patients was 1.3:1 (Hu et al., 2019). The total number of registered cases of coronary intervention therapy in mainland China in 2021 increased by 20.18% compared to 2020 (Wang & Hu, 2023). The mortality of acute coronary syndrome showed an upward trend from 2002 to 2020. Since 2012, the morbidity of acute coronary syndrome in rural areas significantly increased, and it was consistently higher than the urban level since 2013 (Hu Shengshou, 2023). Further analysis revealed that the morbidity of ACS in women was lower than that in men, but the mortality of ACS in women was significantly higher than that in men (Jiangping., 2019).

The incidence rate of acute myocardial infarction among people under 45 years of age in Tianjin in China has been increasing year by year from 1999 to 2013 (Wang et al., 2017). The data showed that people aged 55 and below accounted for 45.8% of hospitalized patients with acute myocardial infarction in Beijing from 2007 to 2012, accounting for the largest proportion (Zhang, Li, et al., 2016). Studies in the United States and New Zealand show that young and middle-aged people account for

about 7% ~30% of the ACS population (Arora et al., 2019; Matsis et al., 2017; Morillas et al., 2007). The average age of AMI patients provided by the National Cardiovascular Data Registry (NCDR) system in 2010 was 64 years old (Peterson et al., 2010). The research of China AMI registration (CAMI) shows that the average age of AMI patients in China is 62.88 years old, which was slightly lower than in western developed countries (Gao et al., 2016).

The World Health Organization (WHO) under the United Nations officially revised the age standards in 2015. According to the new age classification, the young age is 25-44, middle age is 45-59, elderly age is 60-74, senile age is 75-90 and long-livers are after 90 (Dyussenbayev, 2017). The National Bureau of Statistics of China divided the population into three stages in the latest age classification standards, including 0-14 years old as the juvenile population, 15-64 years old as the working age population, and 65 years old and above as the elderly population (Age classification range in China, 2022). It can be seen that acute coronary heart disease events occur in young, middle-aged, and elderly groups, bringing psychological and social pressure to patients' individuals and families. But the elderly ACS patients have organ failure, decreased hearing, visual acuity and cognitive decline due to their age. Meanwhile, the average age of AMI patients in China is 62.88 years old, so ACS patients aged 25 to 65 years old have the significance of being studied and were included in the study.

Pathophysiology of acute coronary syndrome

The hallmark of ACS is the sudden imbalance between myocardial oxygen consumption (MVO2) and demand, which is usually the result of coronary artery obstruction. The imbalance may also be caused by other conditions, including excessive myocardial oxygen demand in the setting of a stable flow-limiting lesion; acute coronary insufficiency due to other causes (e.g., vasospastic angina, coronary embolism, coronary arteritis); noncoronary causes of myocardial oxygen supply-demand mismatch (e.g., hypotension, severe anemia, hypertension, tachycardia, hypertrophic cardiomyopathy, severe aortic stenosis); nonischemic myocardial injury (e.g., myocarditis, cardiac contusion, cardiotoxic drugs); and multifactorial causes that are not mutually exclusive (e.g., stress cardiomyopathy, pulmonary embolism, severe heart failure (Amsterdam et al., 2014).

Diagnosis of acute coronary syndrome

The diagnosis and classification of ACS include clinical presentation, electrocardiogram (ECG) findings, and cardiac biomarkers (Thygesen et al., 2012).

Clinical Presentation

The most common symptom is centrally located chest pain, experienced as tightness around or over the chest and usually radiating to the left shoulder or angle of the jaw, crushing (Goodacre et al., 2009). This may be associated with diaphoresis, nausea, and vomiting, as well as shortness of breath. These symptoms usually are "atypical symptoms". Atypical symptoms of ACS may occur in certain patient populations such as women, the elderly, diabetics, or postoperatively (Kar-mun & Schneider, 2009). Pain and discomfort associated with ACS events may occur during exertion or rest and are usually diffuse rather than localized (Thygesen et al., 2012). Heart and Stroke Foundation of Canada reported that the chest pain of Myocardial infarction generally lasts more than 30 minutes (Tscheng, 2002). NSTE-ACS most commonly presents as pressure-type chest pain that typically occurs at rest or with minimal exertion lasting more than 10 minutes (Sabatine & Cannon, 2012).

ECG Changes

ECG abnormalities that are potentially reflective of myocardial ischemia include changes in the PR segment, the QRS complex, and the ST-segment. ECG alone is usually not enough to diagnose acute myocardial infarction. The sensitivity and specificity of an electrocardiogram are increased by serial assessments (Fesmire et al., 1998). ECG shows that new or presumably new transient ST-segment deviation (> .05 mV) or T-wave inversion (> .2 mV) with symptoms indicating a high likelihood of ACS (Braunwald, 1994). Japanese Circulation Society (JCS) 2018 guideline proposed that if the ECG shows persistent ST elevation, the patient was initially diagnosed with STEMI. The patient was initially diagnosed with NSTE-ACS if the ECG showed no persistent ST-elevation (Kimura et al., 2019). In 2019, China's guidelines for rapid emergency diagnosis and treatment of acute coronary syndrome proposed that The ECG manifestations of unstable angina pectoris are transient ST segment depression or T wave low, flat, and inverted, and ST segment elevation is rare. ST-segment elevation found on an ECG is the hallmark sign of a STEMI. ECG

showed new ST segment depression or T wave low, flat, and inverted, indicating NSTEMI (Zhang et al., 2019).

Cardiac Biomarkers

Ideally, both cardiac troponin (cTn)troponin and the MB fraction of creatine kinase (CKMB) should be obtained during evaluation for ACS due to the different concentrations of these biomarkers over time and the added diagnostic value of serial testing (strength of recommendation A) (O'gara et al., 2013). Cardiac troponins are biochemical markers of myocardial damage (Reichlin et al., 2009). An elevation in troponin concentration is defined as a value exceeding the 99th percentile of a normal reference population (ULN) (Zhang et al., 2019). It reported that elevations in troponin might be seen for up to 2 weeks after the onset of myocardial necrosis. If troponin concentrations are unavailable, then CKMB should be measured (Thygesen et al., 2012). In 2019, China's guidelines for rapid emergency diagnosis and treatment of acute coronary syndrome proposed that cTn was negative in unstable angina pectoris. cTn or CK-MB of more than 99^{th} percentile of a normal reference indicate myocardial infarction (Zhang et al., 2019).

Treatment of acute coronary syndrome

The treatment of acute coronary syndrome consists of drugs and Interventional surgery, such as antiplatelet drugs, anticoagulation, percutaneous coronary intervention and coronary artery bypass grafting, cardiac rehabilitation.

Antiplatelet drugs

Activation of blood platelets and the coagulation cascade play a key role in the initial phase and evolution of ACS. Aspirin is considered to be the cornerstone of treatment for inhibition of thromboxane A2 generation, which is normally complete with a dose ≥75 mg/d. Aspirin treatment is started with a loading dose (LD) followed by maintenance treatment. Current evidence supports a maintenance dose (MD) of 75100 mg once daily (o.d.) (Valgimigli et al., 2018). Dual Antiplatelet Therapy (DAPT) including aspirin and a potent $P2Y_{12}$ receptor inhibitor (ticagrelor or prasugrel) is the recommended standard treatment for NSTE-ACS patients. Clopidogrel, characterized by less potent and variable platelet inhibition, should only be used when prasugrel or ticagrelor are contraindicated, not available.

If the ECG does not show typical changes, the term “non-ST segment elevation ACS” is applied. The patient may still have suffered a “non-ST elevation MI” (NSTEMI). Therefore, the accepted management of unstable angina and acute coronary syndrome is empirical treatment with aspirin, a second platelet inhibitor such as clopidogrel, prasugrel or ticagrelor, and heparin (usually a low-molecular weight heparin), with intravenous nitroglycerin and opioids if the pain persists. The heparin-like drug known as fondaparinux appears to be better than enoxaparin (Bundhun et al., 2017).

Anticoagulation

Anticoagulation is recommended for all patients in addition to antiplatelet therapy during invasive management for NSTEACS. Unfractionated heparin (UFH) is the standard of care for NSTE-ACS patients due to its favorable risk benefit profile (Eikelboom et al., 2000). Enoxaparin, a LMWH with a predictable dose-effect relationship and a lower risk for heparin-induced thrombocytopenia (HIT) compared to UFH, should be considered as an anticoagulant for PCI in patients pre-treated with subcutaneous enoxaparin. A benefit of enoxaparin over UFH reduced mortality and bleeding complications were reported in a meta-analysis that included NSTE-ACS patients (Silvain et al., 2012), but dedicated large-scale trials comparing enoxaparin vs. UFH in NSTE-ACS are lacking.

Percutaneous coronary intervention (PCI) and Coronary artery bypass grafting (CABG)

Early reperfusion therapy in STEMI patients is very important, mainly including percutaneous coronary intervention (PCI) and intravenous thrombolysis. A few patients need urgent coronary artery bypass grafting (CABG) (Zhang et al., 2019). PCI is a non-surgical procedure used to treat narrowing of the coronary arteries of the heart found in coronary artery disease. The time frame for door-to-balloon Percutaneous Coronary Intervention according to American College of Cardiology (ACC) guidelines should be less than 90 minutes (Antman et al., 2004). According to the Chinese guideline for rapid emergency diagnosis and treatment of acute coronary syndrome in 2019, when patients with non-ST elevation ACS face extremely high-risk ischemic conditions (such as life-threatening arrhythmias), PCI is recommended within two hours after onset (Zhang et al., 2019). ACS patients at high risk of

ischemia are recommended for PCI within 24 hours. ACS patients with middle risk ischemia, such as diabetes and angina pectoris, are recommended to implement PCI within 72 hours. If the ECG confirms changes suggestive of myocardial infarction (ST elevations in specific leads, a new left bundle branch block or a true posterior MI pattern), primary coronary angioplasty may be performed.

Coronary artery bypass surgery is a surgical procedure to restore normal blood flow to an obstructed coronary artery. A normal coronary artery transports blood to the heart muscle itself, not through the main circulatory system. CABG is only considered in a small number of patients. For example, there is continuous or repeated ischemia after thrombolytic therapy or PCI; ACS patients are not suitable for PCI; Mechanical complications of myocardial infarction (Zhang et al., 2019).

Cardiac rehabilitation

The Chinese guidelines for cardiac rehabilitation and secondary prevention propose that ACS patients are the population with indications for cardiac rehabilitation, such as acute myocardial infarction, coronary artery bypass grafting (CABG) and percutaneous coronary intervention (PCI). Cardiac rehabilitation includes medicine, exercise, nutrition, psychology and patient education. The implementation of cardiac rehabilitation for ACS patients mainly includes three stages: rehabilitation in hospital (stage I), out of hospital early rehabilitation (stage II) and out of hospital long-term rehabilitation (stage III) (Yuan & Ding, 2019).

In stage I, depending on the condition of patients with acute myocardial infarction without chest pain and dyspnea, they can be provided with four levels of rehabilitation. For example, rehabilitation Level C includes walking beside the bed twice a day for 10 minutes each time. In stage II, it is generally carried out 1 ~ 6 months after discharge. Phase II rehabilitation includes education, daily activity guidance, psychological support. In addition, it also includes moderate intensity exercise 3-5 times a week, lasting 30-90 minutes each time for about 3 months, and 36 times of exercise rehabilitation are recommended. Phase III rehabilitation, also known as community or family rehabilitation, is designed to provide prevention and rehabilitation services for out of hospital patients one year after cardiovascular events. The key to this period is to maintain the formed healthy lifestyle and exercise habits. The exercise rehabilitation of low-risk patients does not need medical supervision.

Impact of acute coronary syndrome after treatment

Acute coronary syndrome is a sudden and acute traumatic event. The main purpose of treatment is to alleviate the urgency of the disease, reduce the risk of complications, maintain mental health, and develop healthy behaviors. However, acute coronary syndrome after treatment can affect the patients' physical, mental, and social life.

1. Physical problems

Long term severe ACS will bring health-threatening complications to patients. Thang et al (2015) found that 21% of ACS patients died or had a cardiovascular complication during hospitalization and 10% died during one year of follow-up (Thang et al., 2015). The previous study showed that a subset of 492 ACS patients (58.4%) experienced an in-hospital complication, the most common being ischemia (48.8%) and cardiac arrest (7.2%) (Grewal et al., 2010). Major complications of ACS were identified in the model for death, including cardiogenic shock/acute pulmonary edema, reinfarction, stroke, major bleeding, cardiopulmonary arrest (Piegas et al., 2013). Approximately 5%–10% of acute coronary syndrome (ACS) cases occur in people younger than 45 years of age. The results of the study revealed that 49.7% patients had complications associated with ACS while hospitalized, with the most common being heart failure (35.4%), followed by arrhythmia (20.4%) (Norsa'adah & Che-Muzaini, 2018).

Affected by the fear of death and disease, ACS patients will have physical activity limitation or low level of physical activity. Increased levels of kinesiophobia can be found in subjects hospitalized for acute cardiovascular disease (Brunetti et al., 2017). Impaired physical mobility and impaired tissue integrity are readmission predictors of Acute coronary syndrome patients. Impaired physical activity last for at least 77 days (Belitardo & Ayoub, 2015). The study of ACS patients showed that inactive physical activity occurred to the 56.7% patients (Matthias et al., 2018). ACS patients always have anxiety sensitivity, high anxiety sensitivity was significantly correlated with fear of negative consequences from exercise (Farris et al., 2018).

2. Psychological problems

Depression is a common psychological problem in ACS patients. Osler et al (2016) found that ACS patients are prone to concurrent depression (Osler et al.,

2016). The prevalence of depressive and anxiety symptoms among 510 patients with acute coronary syndrome was 66.3% and 56.5%, respectively (Zou et al., 2023). A study also showed that 66.4% of patients who experienced ACS after 5 days experienced anxiety, and 51% experienced depression, especially among women (Hadi et al., 2020). Patients with unstable angina, female and under 60 years of age reported the presence of depressive symptoms more frequently (Dessotte et al., 2013). About one-third of ACS patients after treatment for 10 months experienced mild depression and 78.8% had mild anxiety. Severe depression and anxiety particularly occurred in ACS patients with low education levels and socio-economic status (Furlong-Millones et al., 2022).

Acute coronary syndrome can bring fear and posttraumatic stress symptoms to patients. Fear of death was present in 25% of all enrolled ACS patients, and severe pain and dyspnoea were predictors of fear of death occurrence in ACS samples (Sławska & Siudak, 2018). An integrative literature review reported that acute coronary syndrome patients experienced fear, uncertainties about the future and social isolation (Alyasin et al., 2021). Steptoe et al (2011) considered that intense distress and fear of dying was experienced by 21.7% ACS patients (Steptoe et al., 2011). In addition, result of study showed that 26.7% ACS patients developed posttraumatic stress symptoms 1 month after the acute coronary syndrome event (Malinauskaite et al., 2017). Meta-analysis yielded an aggregated prevalence estimate of 16% for clinically significant symptoms of ACS-induced posttraumatic stress disorder in 16 studies (Edmondson et al., 2012). A systematic review study showed that the prevalence of posttraumatic stress disorder was 12% after an acute coronary event for 5 months (Jacquet-Smailovic et al., 2021).

3. Social life

The patients after myocardial infarction described experiences of lacking ‘maleness’ (strength, ability to provide), and the loss of happiness from lifestyle-related changes (Merritt et al., 2017). Physical impairments and comorbidities occur in the patients with acute myocardial infarction could limit the keep the healthy lifestyle (Nicolai et al., 2018). The social network range of patients with myocardial infarction decreased after experiencing complications such as stroke (Dhand et al., 2018). The higher the education level and over 50 years old of the patients with acute

coronary syndrome in primary percutaneous coronary intervention took the shorter the time to return to work (Babić et al., 2015). Results of the showed that 71.7% of patients with myocardial infarction had poor sleep quality and over 64% slept six hours or less per night (Andrechuk & Ceolim, 2015).

Posttraumatic growth is an important factor affecting the health promotion behavior of elderly patients with coronary heart disease, that is, the higher the posttraumatic growth level of elderly patients with coronary heart disease, the better the health promotion behavior (Wang et al., 2021). A systematic review found that the experience of PTG could motivate the involvement in physical activity (Chen et al., 2020). Individuals may recognize new possibilities and generate more appreciation in struggling with stressful life events, which in turn encourages them to participate in activities. Posttraumatic growth positively predicts quality of life and negatively predicts depression, Which means that the improvement of post-traumatic growth can promote patients' quality of life and reduce depression (Morrill et al., 2008).

From the above, we can conclude that posttraumatic growth is of great significance to promote the quality of life, healthy behavior and alleviate negative emotions in patients with acute coronary syndrome. Therefore, we need to pay attention to the study of PTG on acute coronary syndrome patients.

Posttraumatic growth theory

This topic presents the introduction of posttraumatic growth, including definition, components, and the revised model of posttraumatic growth.

Definition of post-traumatic growth

Before the birth of positive psychology, psychological circles agreed that mental health and psychological distress were incompatible. People who experience trauma or negative events will have psychological distress. Therefore, a large number of studies on the psychology of trauma focus on the negative aspects. However, more and more studies show the opposite results. Some trauma experienced people not only do not fall into a lasting psychopathological state, but also have a higher psychological state than before (Linley & Joseph, 2004).

In 1996, Tedeschi and Calhoun named the positive psychological change formed after trauma as posttraumatic growth (PTG). Posttraumatic growth (PTG) is a

concept describing positive psychological change experienced as a result of the struggle with traumatic or highly challenging life circumstances (Tedeschi & Calhoun, 1996). Posttraumatic growth (PTG) does not focus on changes in the immediate aftermath of the event. Instead, PTG is focused on longer-term changes that come about after more careful reflection. Post-trauma is usually an extended time period, from days to years, where people develop new ways of thinking, feeling, and behaving (Tedeschi et al., 2018). It means that PTG is not created by trauma itself, but gradually formed and experienced in the process of fighting against trauma and finally overcoming trauma.

One important characteristic of PTG is that the change is transformative. PTG involves positive changes in cognitive and emotional life that are likely to have behavioral implications. Since 1995, research has provided evidence of positive changes in all of these domains: cognitive (Calhoun et al., 2000), emotional (Park et al., 2008), and behavioral (Shakespeare-Finch & Barrington, 2012). The meaning of growth in the concept of post-traumatic growth shows that people's cognition, psychology and behavior not only recover and reconstruct to the pre-traumatic state, but also exceed the original functional level in some aspects (Tedeschi & Calhoun, 1996). In relevant literature, PTG is also expressed by benefits-finding, stress-related growth, psychological thriving, positive psychological changes, adverbial growth, and perceived benefits. However, the term of post-traumatic growth captures the essence of this phenomenon. The changes reported by people show positive and transformative development, implying that people can show real growth after trauma (Tedeschi et al., 2018).

In summary, posttraumatic growth refers to the positive psychological changes experienced by the individuals in order to improve their functional status, cognition, mental state, and behavior after struggling with the major traumatic events. The characteristic of this change is that cognition, psychology and behavior of people not only recover and reconstruct to the pre-traumatic state, but also exceed the original functional level in some aspects.

Components of posttraumatic growth

Posttraumatic growth is the result of individuals trying to re-establish some basic cognitive guides that are useful for survival after traumatic events. People who

have experienced posttraumatic growth report changes in the following five aspects: appreciation of life; relating to others; personal strength; new possibilities; and spiritual and existential change (Tedeschi et al., 2018).

Appreciation of life includes a greater appreciation for all the things that life has to offer, whether small things previously taken for granted or a greater appreciation for things that people still have in their lives. Because of what has happened, some people may see life as the gift of a second chance that should be cherished.

Relating to others reflects that one's attitudes or behaviors in relationships may be changed in positive ways. It can increase trust in friends, make individuals more sympathetic to the experience of others, shorten the distance with others, and finally promote patients to get in touch with the outside world with a new face.

Personal strength refers to that an increased sense of self-reliance, a sense of strength and confidence, and a perception of self as survivor or victor rather than "victim." It can also involve the idea of having survived the traumatic event.

New possibilities refer to the change from being bored with the original content of interest to having a new interest in other things, such as forgetting some unpleasant people or things, which are usually related to their past experiences.

Spiritual and existential change means to further deepen the thinking of trauma, deepen their understanding of outlook on life, values and world outlook, and make patients more confident and have a deeper understanding of life (Tedeschi et al., 2018).

The theory of posttraumatic growth

A theoretical model was first introduced by Tedeschi and Calhoun in 1995 in order to outline the general psychological processes that lead to growth after trauma. The third version of the model can be found in (Calhoun & Tedeschi, 2014) and (Tedeschi & Calhoun, 2004), and the most recent version, prior to the one presented here, can be found in (Cann et al., 2010) and (Calhoun & Tedeschi, 2012). These models introduced the development mechanism of PTG through the following aspects: (1) The person pre-trauma; (2) Seismic traumatic event; (3) Challenge to core beliefs; (4) Intrusive rumination; (5) Coping success; (6) Deliberate rumination; (7) Social support; (8) Posttraumatic growth; (9) Enduring distress.

The most current version is Revised Model of Posttraumatic Growth (Tedeschi et al., 2018), which was developed based on earlier iterations of the PTG model (Calhoun & Tedeschi, 2012). In this study, the Revised Model of Posttraumatic Growth (Tedeschi et al., 2018) is used to explain posttraumatic growth among ACS patients. Similar to previous models, the latest version of the post-traumatic growth model examines the mechanism for how to promote the formation of PTG for people. In this model, the characteristics of pre-traumatic patients are expected to affect how patients experience traumatic events, which will challenge the patient's core beliefs and lead their personal cognition into intrusive rumination. When intrusive rumination is successful in coping strategies and emotional distress management, individual cognition will be led to deliberate rumination. Finally, individuals will gradually accept the changes of their world caused by trauma and show the posttraumatic growth (Tedeschi et al., 2018). However, there are some changes in this latest version. This model illustrates that an event may challenge some people's core beliefs, leading to intrusive rumination that in turn may lead to deliberate rumination. This model also clarifies the multiple roles of emotional distress on PTG.

As proposed in the Revised Model of Posttraumatic Growth, personality pre-trauma is likely to affect PTG in a variety of ways. Hope is a type of personality, which is defined as the perception of persons about their capability to derive pathways to desired goals, and motivate oneself via agency thinking to use those pathways (Snyder, 2002). Hope allows a response to the distress caused by traumatic events while revising goals, perspectives and behaviors, which may lead to PTG. Pre-trauma mental health status (Gil, 2005) are also likely to affect PTG. People with particularly poor mental health may hinder the development of PTG. Studies showed that Depression has a direct negative effect on PTG among patients (Garnefski et al., 2008; Leung et al., 2010). Cognitive struggle with traumatic circumstances plays a key role in PTG. This struggle is initiated by a person's core beliefs being challenged by a traumatic event. Challenge to Core belief has a direct positive effect on PTG (Wang, 2018; Zhou et al., 2014). Social support may affect PTG as a Pre-Trauma Factor or Predictor Variable. Having a strong social support network pre-trauma is likely to help people to cope effectively with the traumatic event, and thus may directly increase PTG (Tedeschi et al., 2018). Yu et al. also found that social support

was correlated with PTG in women who were struggling with infertility (Yu et al., 2014). Deliberate rumination has a crucial impact on PTG to help individuals adapt to changes in their living environment and modify the core beliefs. Empirical studies have consistently demonstrated positive associations between deliberate rumination and PTG (Cann et al., 2011; Morris. & Shakespeare-Finch, 2011).

Posttraumatic growth in patients with acute coronary syndrome

This section introduces posttraumatic growth in patients with acute coronary syndrome through the content of the development, impact, measurement, situation of posttraumatic growth in ACS, and the nursing intervention for promoting the posttraumatic growth.

The development of the posttraumatic growth

Sudden traumatic events are the trigger points for post traumatic growth. The impact on posttraumatic growth of individuals mainly depends on the severity of the event and the characteristics of different populations in different backgrounds (Helgeson et al., 2006). The ACS patients with different demographic characteristics, personality traits, pre-trauma mental health status could have positive cognitive processes in the face of sudden acute coronary artery disease. People who show serious psychological distress after trauma may be more likely to be unable to deal with emotional distress effectively or to initiate cognitive processing. The emergence and increase of posttraumatic growth are a positive cognitive process of coping with distress successfully after trauma.

The main reason is that the core beliefs of ACS patients will be challenged when they experience sudden symptoms, complications, and poor mental status. Then their emotional distress will increase with the increase of negative core beliefs and decrease of positive core beliefs. Then the cognition of ACS patients come into the intrusive rumination (negative cognition). People will enter negative thoughts and images after the appearance of intrusive rumination, which can affect their sleep and physical activity. When intrusive rumination is successful in coping by self-disclosure interventions or other methods, it will also lead to more deliberate rumination (positive cognition). Deliberate rumination occurs when an individual is trying to understand why or how the event happened and effortful, cognitive work to do, which

revise the core beliefs. At the same time, under the influence of social support, individuals will gradually accept the changes of their personal world caused by traumatic events, and finally show the growth after trauma to cope with the constant distress (Tedeschi et al., 2018).

Impact of high posttraumatic growth on ACS patients

Posttraumatic growth is shown to be associated with overall better mental health and physical health in those afflicted (Barskova & Oesterreich, 2009). High levels of posttraumatic growth have a positive impact on physical health, mental health, and social life.

1. Physical health

Affleck et al. (1987) found that those who experienced PTG seven weeks after their cardiac event had lower levels of morbidity eight years later. The study investigated 84 cardiac patients who reported PTG for 2-4 years and found that 76% of the patients' condition were improved significantly, and only 10.7% of the patients died of myocardial infarction (LAERUM et al., 1991). High degree of posttraumatic growth helped individuals with severe physical symptoms alleviate their symptom experience and enhance their sense of well-being (Hamby et al., 2022). Similarly, the increase in total posttraumatic growth score of patients after experiencing traumatic events was significantly correlated with the likelihood of performing higher level of physical activity (Brédart et al., 2016).

2. Mental health

Patients with coronary heart disease in high-level posttraumatic growth group had higher ability to reduce negative emotion regulation (Chen, 2018b). Another study on posttraumatic stress symptoms and posttraumatic growth in heart disease survivors found that posttraumatic growth alleviated the negative impact of posttraumatic stress symptoms on mental health (Bluvstein et al., 2013a). Posttraumatic growth of patients with acute myocardial infarction was significantly associated with their psychosocial adjustment (Zhou et al., 2023). High scores in the aspects of spiritual change and relating to others from posttraumatic growth was positively and significantly correlated with cognitive emotion regulation (Arjeini et al., 2020).

3. Social life

Optimism and positive affect were related to initiation and continuation of physical activity and healthy eating (Huffman et al., 2016). The study also showed that greater PTG was significantly related to more physician visits, and cardiac rehabilitation program enrolment (Leung et al., 2012b). The high posttraumatic growth experienced by Chinese patients with coronary heart disease after PCI was beneficial for enhancing self-management behavior and promoting their health (Chen., 2020). Posttraumatic growth also was an important factor in enhancing health promoting behavior in elderly patients with coronary heart disease (Wang., 2020). A research reported that patients with myocardial infarction who experienced significant changes in relating to other can significantly enhance their satisfaction with life (Ogińska-Bulik, 2014).

Measurement of post-traumatic growth

Post-traumatic growth has been assessed primarily using the Posttraumatic Growth Inventory (PTGI) (Tedeschi & Calhoun, 1996). The PTGI has been translated into Japanese, Turkish, Spanish, Chinese, Thai, Nepali, and used in thousands of research projects. When creating PTGI, a large number of items were formed based on literature review and interviews with people who lost their spouses and people with physical disabilities in adulthood. Items focused on three broad areas, including perceived changes in self, relationships with others, and philosophy of life. Based on results of exploratory factor analyses, the 21-item PTGI measure was developed. Factor analysis revealed five factors: personal strength, relating to others, new possibilities, spiritual and existential change, and appreciation of life. Items are rated on a 6-point scale, ranging from 0 (I did not experience this change as a result of my crisis) to 5 (I experienced this change to a very great degree as a result of my crisis). Reliability for the total scale and its subscales has been well established. The initial study reported excellent internal consistency ($\alpha = .90$) (Tedeschi & Calhoun, 1996). Data have also revealed a high level of test-retest reliability for the PTGI over two months (.71) with an American sample (Tedeschi & Calhoun, 1996).

The Posttraumatic Growth Inventory (PTGI) has been developed in the researchers' studies. A short form of the PTGI (PTGI-SF) was developed by Cann et al. (2010). The PTGI-SF includes ten items-two items from each of the five subscales

of the original PTGI. Empirical studies have confirmed the reliability and concurrent validity of the PTGI-SF with a sample of National Guard soldiers (Kaler et al., 2011). A 25-item expanded version of the PTGI (PTGI-X) has recently been developed. The original five factors of the PTGI are retained in the PTGI-X, as well as the relationships with constructs that predict PTG. Four items were added in the existential and spiritual domain. No changes were made to the other four subscales of the PTGI. Good internal consistency for the newly created spiritual and existential change factor has been reported (α = .91), showing improvement from the original spiritual change factor (α = .83) in an American sample (Tedeschi & Blevins, 2017).

The Posttraumatic Growth Inventory (PTGI) has also been developed and used in China. Authorized by Professor Tedeschi, Jin et al. (2011) revised PTGI into simplified Chinese version and tested its reliability and validity in patients with accidental trauma. PTGI Central Plains item No. 18 (I strengthened my belief) was deleted because the correlation with the total score was too low. The Chinese PTG Inventory is a 20-item self-report questionnaire that assesses PTG. It consists of five subscales: new possibilities (4 items), relating to others (3 items), appreciation of life (6 items), personal strength (3 items), and spiritual change (4 items). Items is rated on a 6-point Likert scale (0-5). The total score ranges from 0 to 100, with higher scores reflecting greater psychological growth. Consistency reliability of each dimension and total scale Cronbach's α was .611- .874. The posttraumatic growth inventory (PTGI) has measured PTG in ACS patients. The Cronbach's α of the PTGI was .88 in the ACS patients (Liu et al., 2019).

In conclusion, posttraumatic growth (PTG) in ACS patients refers to the positive psychological changes experienced by ACS patients in order to improve their function after struggling with the major life crisis of acute coronary syndrome. Posttraumatic growth mainly includes five aspects: appreciation of life; relating to others; personal strength; new possibilities; and spiritual and existential change. The Revised Model of Posttraumatic Growth (Tedeschi et al., 2018) was used in the study to explain posttraumatic growth among ACS patients. From the previous studies, we can conclude that the level of the posttraumatic growth in Chinese patients with acute coronary syndrome is not high. Studies have shown that posttraumatic growth can reduce the deterioration of acute coronary syndrome, relieve negative emotions, and

promote health behavior compliance among ACS patients. The Chinese version of Posttraumatic Growth Inventory (PTGI) used to measure the ACS patient's PTG. Studies also have shown that there is a certain relationship between PTG and disease time. The longer the disease was diagnosed, the lower the PTG level. Patients with ACS within six months of diagnosis reported a high proportion of PTG, and PTG was at a medium to high level. Therefore, it is necessary to further understand the PTG level and influencing factors of patients diagnosed with ACS within six months, so as to provide basis for taking intervention measures to improve PTG.

Situation of posttraumatic growth in ACS patients in China

A systematic review showed that the majority of research investigating posttraumatic growth in the context of health has predominantly focused on cancer survivors, adults with HIV/AIDS and cardiac disease (Barskova & Oesterreich, 2009), but little attention has been paid to acute coronary syndrome. A study by Karagiorgou on myocardial infarction (MI) in Britain revealed that MI Patients had moderate posttraumatic growth, the score of spiritual change was the lowest (Karagiorgou & Cullen, 2016). In Canada, 2636 patients with acute coronary syndrome undergoing invasive surgery revealed the medium PTG. Younger, female, without retirement, lower income levels related to higher PTG (Leung et al., 2012a). A systematic review in western countries concluded that MI patients experienced moderate posttraumatic growth, while acute coronary syndrome experienced low levels of PTG (Lee et al., 2022). The low to moderate posttraumatic growth was in patients with acute coronary syndrome around the world.

In China, little is known about the posttraumatic growth experienced in acute coronary syndrome, but different categories of ACS patients with different treatment experienced varying degrees of posttraumatic growth. A study found that patients with primary acute myocardial infarction experience moderate level of posttraumatic growth after treatment, with the greatest changes in appreciation of life (Zeng et al., 2018). Studies found that the post-traumatic growth of patients with coronary heart disease with PCI is at a medium level (Chen, 2018a; Pan & Chen, 2017). A study on acute myocardial infarction revealed that patients who received treatment for the first time for 3 months had moderate PTG (Zhou et al., 2023). The results in other study showed that high level of posttraumatic growth was in

myocardial infarction patients who received percutaneous coronary intervention (PCI) for more than 3 months (Wang et al., 2016). On the contrary, A study on Acute coronary syndrome with PCI revealed that the post-traumatic growth score of ACS patients 3 months after discharge belongs to low level (Luo et al., 2021). Similarly, two surveys with patients undergoing PCI reported that they had the low level of PTG (Zhang & Song, 2018b; Zhang, Zhou, et al., 2018). Under the influence of traditional Chinese medicine, patients felt that their body has been damaged and lead to energy depletion due to the minimally invasive surgery. Therefore, they think that their ability begins to weaken and their personal strength plays a smaller role (Zhang & Song, 2018a). It can be concluded patients with acute coronary syndrome undergoing PCI in China experienced low to moderate posttraumatic growth, with the majority experiencing low-level outcomes.

A survey of patients diagnosed with acute coronary syndrome within six months found that most of the study sample (71.2%) reported PTG (Bluvstein et al., 2013b). While a systematic review concluded that people who had less than 6 months since experiencing the traumatic event reported moderate-to-high PTG from and 26 articles and 5,293 subjects (Wu et al., 2019). Compared with the day before discharge, Zhao et al. (2015) found that the proportion of patients who reported PTG in the second month after diagnosis of acute myocardial infarction relatively decreased. Studies discovered negative direct relationships between PTG and time since the event (Leung et al., 2010; Zeng et al., 2018), which showed that PTG would decrease with time goes on. Compared with patients diagnosed with ACS for more than 6 months, researchers also found that the PTG of patients who were diagnosed with ACS within 6 months experienced high PTG. ACS patients need to be treated in the hospital within one month in the early stage of the disease, and they are weak affected by the disease.

In addition, patients with acute coronary syndrome exhibited different degrees of posttraumatic growth in terms of education level, gender, age, payment of medical expenses, and complication. High educated ACS patients have a higher level of post-traumatic growth. ACS patients with a college degree or above have moderate to high levels of PTG, while those with a junior high school degree or below have low to high levels of PTG (Ye et al., 2018; Zeng et al., 2018; Zhao., 2023). The PTG level

of male patients was significantly higher than that of females, and male experienced high level of posttraumatic growth (Ye et al., 2018). However, a study showed that there was no significant gender difference in the posttraumatic growth of myocardial infarction patients, both of whom were at a moderate level (Zeng et al., 2018). Besides, younger ACS patients had higher levels of posttraumatic growth (Yu. & Yang., 2021). Another study also showed such results, and patients under the age of 40 with acute myocardial infarction reported moderate levels of PTG (Zhao., 2023). Comorbidities lead to higher levels of post-traumatic growth in patients with myocardial infarction, which can make patients experienced moderate to high PTG (Fang et al., 2015; Ye et al., 2018). In terms of medical expense payment, patients who use urban resident medical insurance had the highest level of posttraumatic growth, ranging from low to high levels of posttraumatic growth (Fang et al., 2015; Ye et al., 2018; Zhao., 2023).

The nursing intervention for promoting the posttraumatic growth

The intervention to improve the posttraumatic growth of ACS patients after treatment mainly include psychological intervention, such as cognitive-behavioral therapy, mindfulness therapy, communication therapy. Cognitive-behavioral therapy can enhance posttraumatic growth by alleviating posttraumatic stress disorder, depression, and stress. Nurses and physician conducted awareness of disease education and constructed post-PCI benefit communication groups for acute myocardial infarction patients, in order to transform their avoidance coping styles and form a healthy lifestyle, and promoting posttraumatic growth (Dong., 2022a). A Meta analysis concluded the applications of cognitive-behavioral therapy, including both classic and novel cognitive-behavioral therapies. Classic cognitive-behavioral therapy adopted exposure and cognitive reconstruction strategies, utilized participation in meaningful activities and learning coping skills, corrected core beliefs, and post-traumatic growth emerged. Emotional regulation plans, adaptive disclosure, and mindfulness based stress relief training form a new intervention approach based on CBI theory (Roepke, 2015).

Mindfulness is also a factor in enhancing posttraumatic growth. Mindfulness based group psychological education was implemented within 1 to 4 weeks after treatment for myocardial infarction patients, involving exercises in body, diet,

empathy, and listening. As a result, it was found that the level of mindfulness was significantly enhanced, further affecting posttraumatic growth (Aydındoğmuş & Savaşan, 2022). Another systematic review of mindfulness interventions for coronary heart disease patients reported that mindfulness based interventions can help reduce negative stress responses in patients after PCI and significantly improve PTG (Zou et al., 2021). The review shows that mindfulness training had a short-term and effective impact on posttraumatic growth, with relating to others and appreciation of life being the most affected areas (Shiyko et al., 2017).

Communication includes relational communication, evaluative communication, and therapeutic communication. Therapeutic communication is the process of developing plans around a patient's medical condition, understanding their needs, and providing support and assistance. A study suggested that therapeutic communication systems greatly assisted PCI postoperative patients in enhancing their awareness of disease and management abilities, thereby improving their PTG levels (Yating., 2019). The results of another research three months after discharge showed that therapeutic communication systems significantly improved anxiety and depression in ACS patients after PCI, enhance self-efficacy and posttraumatic growth (Luo et al., 2021).

Factors affecting posttraumatic growth in patients with acute coronary syndrome

The Revised Model of Posttraumatic Growth explains the general psychological processes that lead to posttraumatic growth. The model emphasized that posttraumatic growth is affected by hope, challenges to core belief, deliberate rumination, resilience, social support (Tedeschi et al., 2018). Guided by the Revised Model of Posttraumatic Growth and the reviews, in this study, independent variables included hope, challenges to core belief, depression, social support, resilience, deliberate rumination, and the dependent variable is post-traumatic growth.

This topic presents the introduction of direct or indirect influence of hope, challenges to core belief, depression, social support, resilience, deliberate rumination on posttraumatic growth.

Hope

Hope is defined as the perception of person about their capability to derive pathways to desired goals and motivate oneself via agency thinking to use those pathways (Snyder, 2002). Hope as a cognitive set that is comprised of agency, goal-directed determination and pathways, and planning of ways to achieve the desired goals. In nursing, Parse's human becoming perspective defined hope as a universal lived experience of health propelled with the envisioned possibilities of everyday living; to hope is to "recognize the limitations in situations, while believing that opportunities exist" (Petrie et al., 1999). Hope in ACS patients is defined as the perception of patients with ACS about their capability to derive pathways to maintain life involvement and prevent further deterioration of the disease despite physical limitation imposed by the disease (Aase Schaufel et al., 2011; Snyder, 2002). In model, hope allows an open response to the distress caused by stressful life events while revising goals, perspectives, and behaviors, which may lead to PTG.

Hope have a significant role in predicting post-traumatic growth (Salehi & Dehshiri, 2018). It is found that the score of hope level is positively correlated with the score of posttraumatic growth in patients with acute myocardial infarction (Yating., 2019). Hope is the influencing factor of PTG in stroke patients with hemiplegia, and hope is positively correlated with PTG (Zheng et al., 2017). Multiple linear regression analysis showed that patients with head and neck nerve receiving radiotherapy who had higher level of posttraumatic growth if they had high level of hope and positive coping style (Zhang, Zhao, et al., 2016). Hope is positively correlated with post-traumatic growth in lung cancer patients (Liu., 2018). Jia (Jia, 2016) also found that hope is a positive predictor of PTG in breast cancer inpatients. Ridge regression analysis results showed that hope could explain 47.30% of the variance in PTG in patients with chronic obstructive pulmonary disease (Wang et al., 2021). The results showed that Hope was positively correlated with PTG in the Iranian elderly patients with cancer (Heidarzadeh et al., 2016). The higher levels of hope was related to higher PTG. Hierarchical regression analysis showed that hope was effective factors of PTG in stroke patients (Jeong & Kim, 2019).

Depression

Depression is a common but serious mood disorder. It causes severe symptoms that affect how you feel, think, and handle daily activities, such as sleeping, eating, or working. Depression refers to the negative feelings of sadness, constrain, low spirits, helplessness, fatigue, changes in appetite, sleep disorders, difficulty in concentrating, self-esteem and shame of patients with ACS. The Revised Model of Posttraumatic Growth (Tedeschi et al., 2018) considered that persons who show particularly poor mental health status before trauma might be difficult to initiate cognitive processing or to be effective at managing the initial emotional distress, and then may also cope with their distress using avoidance strategies, which in turn may hinder PTG development. Depression as an independent variable is a poor mental health status factor that are also likely to affect PTG.

Patients with acute coronary syndrome who show particularly depression before a traumatic event might be more likely to be too overwhelmed to even initiate cognitive processing or to be effective at managing the initial emotional distress, and then may experience intrusive rumination without the ability to convert it to a more constructive deliberate rumination. They may also cope with their distress using strategies such as avoidance, which in turn may hinder PTG development.

The depression has a direct negative effect on PTG. Garnefski et al. (2008) found that significant correlations were found between PTG and depression among the patients who had experienced a first-time acute MI. Researchers found that greater PTG was significantly related to the lower depression among coronary heart disease patients (Leung et al., 2010; Yuan. & Huang, 2017). The finding of the study showed that women with breast cancer with higher depressive symptoms presented lower levels of PTG than women without breast cancer (Romeo et al., 2017). Depression negatively correlated with PTG in the Iranian elderly patients with cancer (Heidarzadeh et al., 2016). Individuals with high levels of PTG had fewer depression and better QOL than those with low levels (Tomich & Helgeson, 2012).

Challenges to core beliefs

Core beliefs are the very essence of how we see ourselves, other people, the world, and the future. Challenges to Core Beliefs refers to the cognitive change that traumatic events shake the original core belief system of individuals and lead

individuals to re-examine their core beliefs (Calhoun & Tedeschi, 2014). The Revised Model of Posttraumatic Growth propose that the cognitive struggle caused by a person's core beliefs challenged by traumatic events plays a key role in PTG. Acute coronary syndrome is a traumatic event for patients. After experiencing ACS, the core beliefs of patients will be challenged, and their emotional distress will increase after trauma events. Then the cognition of ACS patients come into the rumination. Individuals will gradually accept the changes of their personal world caused by traumatic events, and finally show the growth after trauma to cope with the constant distress (Tedeschi et al., 2018). Core Beliefs are beliefs and assumptions about the world, others, and the self, which can guide behavior and help people understand why events occur (Tedeschi & Calhoun, 2004).

Challenges to Core belief positively correlated with posttraumatic growth (Zhou et al., 2014). Some studies have shown that there is a significant positive correlation between the challenge to core belief challenge and posttraumatic growth of childhood trauma experience (Lindstrom et al., 2013; Wang, 2018). Challenges to core beliefs was positive predictor of global PTG score among displaced survivors of terror attacks (Eze et al., 2020a). Ge et al. (2019) also found that Challenges to core belief has a significant positive predictive effect on PTG. The results provide support that challenges to core beliefs was positively associated with PTG, and significantly predicted the PTG in adult patients with acute leukemia (Danhauer, Russell, et al., 2013).

Social support

Social support refers to the social resources that persons perceive to be available or that are actually provided to them by nonprofessionals in the context of both formal support groups and informal helping relationships (Cohen et al.,2001). Social support often comes from family, friends and significant other. Social support as a predictor variable can influence PTG based on the Revised Model of Posttraumatic Growth. The model explained that having a strong social support is likely to help people to cope effectively with the traumatic event, and thus may or may not directly increase PTG. Core beliefs of ACS patients will be challenged after experiencing the acute coronary artery disease, and their emotional distress will increase after trauma events. Under the influence of social support, individuals will

gradually accept the changes of their personal world caused by traumatic events, and finally show the growth after trauma to cope with the constant distress (Tedeschi et al., 2018).

Having a strong social support network may directly increase PTG. A positive, moderate relationship between social support and PTG was found in 166 patients with myocardial infarction (Rahimi et al., 2016). Greater PTG was significantly related to the greater social support in patients with coronary heart disease (Leung et al., 2010). Another study revealed social support positively correlated with post-traumatic growth in patients after myocardial infarction. High perceived social support predicted high post-traumatic growth (Javed & Dawood, 2016). Another study also found that PTG had a significant positive correlation with social support (Hosseini Golafshani et al., 2021). The same relationship was found in Chinese patients with acute coronary syndrome. Studies showed that social support was positively correlated with PTG in Acute myocardial infarction (Zeng et al., 2018).

Deliberate rumination

Deliberate rumination refers to the positive thinking of patients with ACS in response to the difficulties caused by the acute coronary syndrome and actively solve the problems by modifying or reconstructing their views on the outside world after suffering from the disease. According to the revised Posttraumatic Growth Model, deliberate rumination promotes the emergence of posttraumatic growth. When the patient experienced a traumatic event of acute coronary syndrome, core beliefs of ACS patients will be challenged, and their emotional distress will increase after trauma events. Then the cognition of ACS patients come into the intrusive rumination (negative cognition). When intrusive rumination is successful in coping, it will also lead to more deliberate rumination (positive cognition), then individuals will gradually accept the changes of their personal world caused by traumatic events, and finally show the growth after trauma to cope with the constant distress (Tedeschi et al., 2018).

Empirical studies have consistently demonstrated positive associations between deliberate rumination and PTG (Cann et al., 2011; Chen, 2018b; Morris. & Shakespeare-Finch, 2011; Ouyang, 2020). Zhang, Li, et al. (2018) found that

deliberate rumination positively correlated with PTG in patients after PCI, which also can positively predict post-traumatic growth. Deliberate rumination was positively associated with PTG (Song, 2016a). Posttraumatic growth was positively related to deliberate ruminations in grieving individuals after the loss of a loved one; PTG was positively predicted by deliberate ruminations (Záhorcová & Prielomková, 2020). Andrades et al. (2018) observed a positive correlation between deliberate rumination and posttraumatic growth in adolescents exposed to the 2010 earthquake in Chile.

The revised model of posttraumatic growth and studies indicated that deliberate rumination mediates the relations between hope and posttraumatic growth. The study by (Cui, 2020) which investigated acute ST-elevation myocardial infarction reported that there was a positive correlation between hope and deliberate rumination. Similarly, the hope of burn patients was positively correlated with deliberate rumination (Wang et al., 2017). According to Chen et al. (2020), the hope of patients after total hip arthroplasty can positively predict deliberate rumination. Greater hope was found to correlate with more deliberate rumination in acute stroke (Dai et al., 2019; Li, Wu, et al., 2020). A qualitative study (Cui, 2020) identified hope as major factor that affect deliberate rumination. Thus, deliberate rumination not only directly affects PTG, but also includes as mediate factor between hope and posttraumatic growth.

Deliberate rumination mediates the relations between challenges to core belief and posttraumatic growth. A cross-sectional study found higher challenges to core belief to be highly correlated with more deliberate rumination. This study also reported that challenge to core belief can positively predict PTG by deliberate rumination (Zhou et al., 2014). Another study on the loss of a loved one (Záhorcová & Prielomková, 2020) found that challenges to core beliefs was significantly positively correlated with deliberate rumination. Choi et al. (2019) discovered that the higher the levels of disruption of core beliefs led to the higher level of deliberate rumination. Eze et al. (2020a) reported that challenge to core beliefs was moderately positively related to deliberate rumination among survivors of terror attacks. Deliberate rumination also mediated the association of challenges to core beliefs with PTG (Hammer et al., 2019). The study by Freedle and Kashubeck-West (2021) which investigated pregnancy loss also reported that deliberate rumination mediated the

relationship between challenges to core belief and posttraumatic growth. According to Lindstrom et al. (2013), challenges to core beliefs was significantly positively related to deliberate rumination in patients who had experienced highly stressful event in the past 2 years.

Deliberate rumination mediates the relations between social support and posttraumatic growth. As part of the SEM, Morris. and Shakespeare-Finch (2011) reported that the relationship between social support and PTG was fully mediated by deliberate rumination. Social support was found to be positively associated with deliberate rumination. The study on acute stroke (Dai et al., 2019) discovered that social support positively predicted deliberate rumination. A study which investigated acute ST-elevation myocardial infarction reported that social support was positively associated with deliberate rumination (Cui, 2020). Correlation analysis showed that deliberate rumination in colorectal cancer was positively correlated with social support. Chen, Zhao, et al. (2019) found that higher social support predicted higher deliberate rumination. Another study reported that Social support can positively predict deliberate rumination after total hip arthroplasty (Chen et al., 2020).

Resilience

The concept of resilience is currently divided into three categories, including ability definition, outcome definition and process definition. In terms of the ability definition, resilience is the ability to recover from or adjust easily to misfortune or change. Resilience is the process of adapting well in the face of adversity, trauma, threats, tragedy or significant sources of stress, which means “bouncing back” from difficult experiences (Association, 2014). In terms of the process definition, resilience is a dynamic process in which life events such as stress and adversity act simultaneously with protective factors (Richardson et al., 1990). In terms of the outcome definition, resilience is the result that individuals can well adapt to severe adversity and actively develop (Masten, 2001). According to the posttraumatic growth model (Tedeschi et al., 2018), we can see that when patients experience the traumatic event of acute coronary syndrome, their original cognition and belief will be challenged, so their emotional distress will increase. At this time, the positive psychological resources (resilience) of patients can effectively manage emotional

distress, successfully deal with traumatic events and promote the growth of individuals after trauma.

A large number of studies have shown that resilience has a direct and positive impact on PTG in patients with acute coronary artery disease. The study found that resilience was a significant predictor in improving of post traumatic growth (Yating., 2019). Studies in patients with myocardial infarction have shown that resilience had a positive correlation with PTG (Dong & Liu, 2021; Shen et al., 2021). Moreover, Crebbin (2015) also found that resilience was identified as the factor associated with PTG in patients with acute coronary syndrome (Crebbin, 2015). The finding revealed that higher personal resilience predicted a higher level of posttraumatic growth in coronary heart disease (Chan et al., 2006). The study of Yu et al. (2014) also indicated the resilience positively correlated with PTG (Yu et al., 2014).

Resilience mediates the relations between social support and posttraumatic growth. In a study where social support was placed as a predictor variable investigating PTG, results demonstrated that although there were moderate to strong correlations between social support and PTG and between resilience and PTG, resilience mediated the relationship between social support and PTG (Dong et al., 2017). Wu et al. (2021) also found that the social support positively predicted PTG, and resilience also positively predicted PTG (Wu et al., 2021). The indirect effect of resilience between perceived social support and PTG was .09. The study of Yang. and Yang. (2021) also indicated the resilience plays mediating role between social support and post-traumatic growth, and the mediating effect accounts for 60.59% of the total effect (Yang. & Yang., 2021). A study of Hajmohammadi and Shirazi (2017) found that social support was significantly and positively related to resilience. Social support could predict resilience. It indicated that resilience can be used as an intermediate variable to act on PTG and social support.

Resilience mediates the relations between depression and posttraumatic growth. A systematic review of resilience and depressive symptoms in adults with cardiac disease concluded that resilience and depressive symptoms were inversely related in 10 of 13 studies (Ketcham et al., 2020). The lower depression in patients with cardiovascular disease showed higher resilience (Toukhsati et al., 2017). The

study about acute myocardial infarction after percutaneous coronary intervention (PCI) also found that depression was significantly negatively correlated with resilience (Liu et al., 2018). Li, Kang, et al. (2019) found that depression was negatively correlated with resilience and posttraumatic growth (Li, Kang, et al., 2019). Resilience was identified as the mediate factor associated with depression and post-traumatic growth. Moreover, there was a study found that the negative association between the depression and resilience indicating that depression has the powerful influence on resilience in Stroke patients (Bai, 2019). Found that depression had a negative correlation with patients' resilience. The finding revealed that patients with lower depression had higher level of resilience (Zhang et al., 2019). Thus, these studies indicated that resilience mediates the relations between depression and posttraumatic growth.

Resilience mediates the relations between physical activity and posttraumatic growth. The A preliminary study showed that physical activity was associated with all resilience factors. Specifically, vigorous physical activity predicted self-efficacy and optimism (Carriedo et al., 2020; Ower et al., 2019) physical activity was associated with resilience in patients with psychosomatic disorders. Similarly, Yu (2016) found that physical activity as predictors of resilience among patients with advanced lung cancer (Yu, 2016). The study found that there was positive and significant relationship between resilience and physical activity (Ozkara et al., 2016). Regression analysis revealed that participation of physical activity was found to be significant predictors of resilience. The study denoted that the physical activity level was significantly correlated with the resilience (Ho et al., 2015). Resilience directly affected PTG, thus, these studies indicated that resilience mediates the relations between physical activity and posttraumatic growth.

In conclusion, hope, challenges to core belief, depression, social support and physical activity has a direct impact on PTG. In addition, deliberate rumination and resilience as mediate factors affect PTG. Most studies focus on the exploration of relationships between several factors and PTG, while rarely studied the causal relationships using the model to test the contributing factors to PTG among patients with acute coronary syndrome. Thus, this study will focus on the patients who were diagnosed with ACS and apply the structural equation modeling (SEM) to test the

relationships of hope, challenges to core belief, depression, resilience, deliberate rumination, social support and physical activity to PTG among ACS patients.

Summary

Acute coronary syndrome (ACS) was one of the top causes of mortality in China, which occur in young, middle-aged and elderly groups. ACS as a traumatic event has brought some physical, psychological and social problems to patients. At present, studies have shown that posttraumatic growth can reduce the deterioration of acute coronary syndrome, relieve negative emotions, and promote health behavior compliance among ACS patients. However, there are few studies on posttraumatic growth (PTG) in patients with ACS in both the world and China, but there are studies on patients with coronary heart disease, myocardial infarction and percutaneous coronary intervention (PCI).

Patients with acute coronary syndrome undergoing PCI in China experienced low to moderate posttraumatic growth, with the majority experiencing low-level outcomes. Highly educated, young, male, with comorbidities, and payments of urban medical insurance are characteristics that lead to moderate to high levels of posttraumatic growth. Compared with patients for more than 6 months, researchers also found that the PTG of patients with coronary heart disease, myocardial infarction and PCI within 6 months experienced higher PTG. Nurses and physicians can conduct cognitive-behavioral therapy, mindfulness therapy, and communication therapy to improve the posttraumatic growth of ACS patients after treatment. The Revised Model of posttraumatic growth is used as the conceptual framework of this study. Literature review of previous studies identified hope, depression, challenges to core beliefs, social support, deliberate rumination and resilience related to posttraumatic growth. But rarely studied the causal relationships using the Structural Equation Modeling to test the contributing factors to PTG among patients with acute coronary syndrome.

The findings of this research can contribute to nursing practice. The findings will suggest a new direction for nurses in mental health and cardiovascular department as they gain understanding of the relationships between hope, challenges to core belief, depression, social support, physical activity, deliberation, resilience,

and posttraumatic growth. Nurses in cardiovascular department can assess the psychological resource and the need level of the ACS patients to find the factors of posttraumatic growth immediately. The nurses in the mental health and cardiovascular department aware of the factors will promote the PTG and develop intervention for patients with ACS to effectively deal with the trauma. It is beneficial for promoting their rehabilitation process, enhancing their physical and mental health recovery, and improving their quality of life.

CHAPTER 3
RESEARCH METHODOLOGY

The purpose of this study was to develop and test a hypothesized model of posttraumatic growth among acute coronary syndrome. This section presents research methodology, including research design, research setting, population and sample, instruments, psychometric properties of the instruments, protection of human rights, data collection procedures, and data analysis.

Research design

A Causal Model design was used to test the direct, indirect, and mediating effects among the variables, which are always used to help us understand the complex phenomenon. A model-testing, cross-sectional design was used to test the hypothesized model of post-traumatic growth**.** Independent variables include hope, challenge to core belief, depression, social support, resilience and deliberate rumination. The dependent variable is post-traumatic growth.

Setting of the study

This research study took place in Yancheng, Jiangsu Province, a place in the eastern of China. There are about 410,000 ACS patients in Jiangsu Province (Luo et al., 2017). The mortality of acute coronary syndrome in Jiangsu Province is higher than the national average in the eastern of China (Zhou et al., 2016). Yancheng lies in Jiangsu with more than 6 million permanent resident population in 2020. A survey showed that coronary heart disease accounts for 12.6% of patients with chronic diseases in Yancheng, ranking third in chronic diseases (Qiao & Liu, 2016). Yancheng First People's Hospital is a three-level general hospital, it was used to conduct the study. The ACS out-patients who come to the follow-up visits at clinic at hospital one month to six months after discharge was included in this study. There are five cardiovascular clinics, which treat around 1,200 ACS patients every year. There are about 25-30 ACS out-patients who come to the clinic for follow-up visits every week.

The First People's Hospital of Yancheng City has two branches, which are located in the same city and very close to each other. One branch has two outpatient clinics, and another branch has three outpatient clinics. There is no difference between the five cardiovascular clinics of the Yancheng First People's Hospital, and they can provide diagnosis and treatment of disease, and follow-up services for patients with acute coronary syndrome. ACS patients should go to the cardiovascular clinic for follow-up one month, three months, six months and one year after discharge. Nurses in the cardiovascular department ward made phone calls to understand the patient's condition after discharge, and reminded them to follow up on time and know the time of their visit to the hospital for follow-up. The follow-up of patients with acute coronary syndrome after discharge includes understanding the changes in the patient's condition, adjusting their medication regimen, and health management behaviors. At the same time, ACS patients also need to complete physical examinations such as electrocardiogram (ECG), echocardiography, blood pressure measurement, and lipid measurement.

Population and sample

Population

The target population was people diagnosed with ACS outpatients (including UAP, NSTEMI, or STEMI) who had been discharged for 1 to 6 months and followed up at cardiovascular clinics in a hospital in Yancheng, Jiangsu province.

Sample of the study

The sample were people who had been diagnosed with ACS outpatients (including UAP, NSTEMI or STEMI) who had been discharged for 1 to 6 months and followed up at cardiovascular clinics in a hospital in Yancheng, Jiangsu province. The inclusion criteria were as follows:

1. Aged 25 years to 65 years
2. Have stable conditions, no disabilities
3. Be able to read and write Chinese
4. No cognitive impairment screening by Mini-Mental State Examination

The exclusion criteria were as follows:

1.Patients who have been referred for heart transplantation;

2.Patients with terminal cancer, stage 4 of congestive heart failure;

Sample size

The sample size for the study was decided based on the ratio of the number of participants to the number of model parameters. It is indicated that a desirable ratio of participants to parameters should be 20:1 (Kline, 2010). In the study, there were 18 parameters, so a sample of 360 were obtained. Guo et al. (2013) recommended an addition of 10%-20% of the desired sample size to account for missing data and participant attrition. Within this study, the sample size was increased above 10% due to anticipatory missing data due to its lengthy survey. In this study, 360 participants plus an added 10% expected attrition were recruited, totaling sample size of 396 participants.

Sample recruitment

This study used systematic sampling technique to recruit the samples. Sampling procedures were conducted as follows:

1. This study selected patients who were diagnosed with acute coronary syndrome, had been discharged for 1 to 6 months and followed up at outpatient clinics from the Yancheng First people's Hospital, located in Yancheng, Jiangsu Province.

2. Yancheng First People's hospital treats 1200 patients with acute coronary syndrome every year. A total of 396 patients were selected from Yancheng First People's hospital. It is estimated that this hospital can accommodate approximately 25 to 30 ACS patients who need to come to the hospital for follow-up every week.

3. With help of the head nurse, the researcher and a research assistant accessed follow-up information on discharged ACS patients from the on computers. ACS patients who met the inclusion criteria would be notified by phone one week in advance by the researcher and research assistant, and the specific arrival time would be explained. At the same time, researcher and a research assistant explained the purpose, their right, confidence, risks, and benefit of the study to patients over the phone. The Chinese names of ACS patients who agreed to participate in the study were recorded on the computer, forming a new list. The computer could automatically sort Chinese names and number them in turn.

4. It estimated that around 800 patients who were diagnosed with acute coronary syndrome and come to the follow-up visit at clinic during 8 months in hospital. A researcher calculated an ideal sample size to be 396. The sampling interval k thus approximately equals 800/396≈2.

5. Researcher randomly selected a starting point on the new list each week. Then they randomly selected every two patients on the new list until they got 396 participants without replacement. The researcher distributed questionnaires and instructed the patient to fill in the questionnaire.

Research instruments

In this study, there were 8 self-report questionnaires. The questionnaires included demographic questionnaire, hope, challenges to core beliefs, depression, social support, resilience, deliberate rumination, and posttraumatic growth as the following:

1.The Demographic Record Form

It contains 15 items of acute coronary syndrome patients' characteristics information (age, weight & height, gender, level of education, live condition, payment method of medical expenses, smoking condition, alcoholic drink history, physical activities) and health information (discharge time, frequency of visit, types of ACS, types of treatment, co-morbidities, BMI).

2.The Chinese version of Herth Hope Index (C-HHI)

The scale was designed by Herth (1992) for assessing people' s hope. Herth Hope Index (HHI) is an adaptation of the Herth Hope Scale (HHS). HHI includes three subscales with 12 items. Each item was scored on an ordinal scale from 1 to 4, where a score of 1 indicates "strongly disagree" and a score of 4 indicates "strongly agree". The Cronbach alpha coefficient was .97 on HHI.

In this study, hope was measured by the Chinese version of the Herth Hope Index that was translated by Zhao and Wang (Zhao & Wang, 2000). This scale has 12 items with three subscales: the subscale of temporality and future (T) includes 4 items (1, 2, 6, 11); the subscale of positive readiness and expectancy (P) includes 4 items (4, 7, 10, 12); the subscale of interconnectedness (I) includes 4 items (3, 5, 8, 9). Items were rated on a 4-point Likert scale that includes "1= very disagree, 2= disagree, 3=

agree, 4= very agree". The total score ranges from 12 to 48 (Kaye Herth PhD, 1991). According to the score standard, 12-23 points, 24-35 points and 36-48 points represent low hope, medium hope, high hope respectively (Zhao & Wang, 2000). The total Cronbach's α of the scale was .87 in patients with percutaneous coronary intervention (Su, 2015).

3.The Chinese version of the Core Beliefs Inventory (C-CBI)

The C-CBI was translated and revised by Zhou et al. (2014) based on the original version of the CBI (Cann et al., 2010). It mainly reflects the degree of challenges to core belief by measuring whether post-traumatic individuals often reexamine their basic views about themselves, others, the world and the future. The scale includes 9 items. A six-point scale ranged from ‘‘not at all’’ (0) to ‘‘a very great degree’’ (5). The internal reliability of the CBI was good (Cronbach's α = .82).

C-CBI has 9 items with three dimensions of basic views about themselves (1, 2, 3), basic views about others (4, 5, 6), basic views about the world and the future (7, 8, 9). Items is rated on a 6-point Likert scale that includes "0 = not at all, 1= to a very small degree, 2 = to a small degree, 3 = to a moderate degree, 4 = to a great degree, 5 = to a very degree". The total score ranges from 0 to 45. The higher the score of the scale means the greater the challenge of individual core beliefs by stress events. The Cronbach's α for the total score in the sample being teenagers who experienced Wenchuan earthquake was .88 (Zhou et al., 2014).

4. The Chinese version of Patients Health Questionnaire Depression Scale (PHQ-9)

This scale was compiled by Kroenke et al. (2001) and translated to Chinese by Jin et al. (2011) for measuring depression. The PHQ-9 is 9-item depression module from the full PHQ. Each of 9 items can be scored from 0 (not at all) to 3 (nearly every day). The Cronbach's α for the PHQ-9 was .95.

Chinese version of Patients Health Questionnaire Depression Scale contains 9 items. This scale has two subscales, including emotional subscale and subscale of somatic symptoms. The subscale of emotion includes 6 items (1, 2, 4, 6, 8, 9); the subscale of somatic symptoms includes 3 items (3, 5, 7). Items were rated on a 4-point scale that includes "0= not at all,1= for a few days,2= more than half of the days ,3= nearly every day". The total score ranges from 0 to 27, with higher scores reflecting

the more severe the depression. Criteria for assessing depression (Chinese norm) includes: No depression (0-4), mild depression (5-9), Moderate depression (10-14), Severe depression (More than 15). The Cronbach's α for the total scale in the ACS patients was .83 (Wang et al., 2019).

5. The Chinese version of Multidimensional Scale of Perceived Social Support (C-MSPSS)

The scale was translated and revised by Jiang (2001) based on the original version of the MSPSS (Zimet et al., 1988). The MSPSS includes 12 items. The items divided into factor groups relating the source of the support (i.e, Family, Friends, or Significant Other). Each group consisted of 4 items. A 7-point Likert scale ranged from very strongly disagree (1) to very strongly agree (7). The reliability of the total scale was .88.

The C-MSPSS can assess the overall level of social support that individuals perceive. A study based on Jiang (2001) found that three dimensions are more reasonable than two dimensions (Kaina et al., 2015). The C-MSPSS consists of 12 items with three dimensions of family support, friend support, and significant other support. Each of these groups consisted of four items. Items 3, 4, 8, 11 assess subscale of support from family. Items 6, 7, 9, 12 assess subscale of support from friends. Items 1, 2, 5, 10 assess subscale of support from significant other. Items is rated on a 7-point Likert scale that includes "1= very strongly disagree, 2= very disagree, 3= slightly disagree, 4= neutral, 5= slightly agree, 6=very agree, 7= very strongly agree". The higher the score, the higher the degree of individual social support. According to score standard, 12-36 points, 37-60 points and 61-84 points represents low social support, medium social support, high social support respectively (Jiang, 2001). The Cronbach's α for the total score in AMI patients was .92 (Zeng et al., 2018).

6. The Chinese version of Connor-Davidson Resilience Scale (CD-RISC)

Connor-Davidson resilience scale(CD-RISC) was compiled by Connor and Davidson (2003). It includes twenty-five items and is divided into five dimensions (personal competence, instincts, positive acceptance of change, control, spiritual, influences). The CD-RISC carry a 5-point range of responses, as follows: not true at all (0), rarely true (1), sometimes true (2), often true (3), and true nearly all of the time (4). The Cronbach's α for the full scale was .93.

This study used the Chinese version of the CD-RISC which was translated and revised by (Yu & Zhang, 2007) that measure resilience. C-CD-RISC contains 25 items, which is composed of three dimensions: tenacity (Items 11 to 23), strength (Items 1,5,7, 8,9, 10, 24,25), and optimism (Items 2,3,4,6). Items were rated on a 5-point Likert scale that include “0= not true at all, 1= rarely true, 2= sometimes true, 3= often true, 4 = true all the time”. The total score ranges from 0 to 100, with higher scores reflecting greater resilience. The Cronbach’s α of the Chinese version of CD-RISC was .91.

7. The Chinese version of Event Related Rumination Inventory (C-ERRI)

Event related rumination inventory was developed by Cann et al. (2011) and translated to Chinese Event Related Rumination Inventory (C-ERRI) by Dong et al. (2013). The ERRI is 20-item self-report questionnaire that assesses rumination. The scale includes intrusive rumination and deliberate rumination. 10 items were chosen for deliberate rumination subscale. Participants rated the degree to which the thoughts occurred on a 4-point scale (not at all=0 to 3 = often). The internal consistencies were strong (intrusive α = .94, deliberate α= .88).

The C-ERRI was used to measure the rumination level, which consists of 20 items and includes two subscales of intrusive rumination (10 items) and deliberate rumination (10 items). Items 11 to 20 measure deliberate rumination. For this study, the researcher only selected subscale of deliberate rumination. Items were rated on a 4-point scale that includes “0=not at all, 1= seldom, 2 = sometimes, and 3=often”. The subscale scores range from 0 to 30, with higher scores indicating the higher the frequency of deliberate rumination. The Cronbach's α of the deliberate rumination subscale in MI patients were .85 (Cui, 2020).

8.The Chinese version of Posttraumatic Growth Inventory (C-PTGI)

This Posttraumatic Growth Inventory (PTGI) was developed by Tedeschi and Calhoun (1996). The PTGI is 21-item self-report questionnaire that assesses PTG after traumatic event. Items are rated on a 6-point scale, ranging from 0 (I did not experience this change as a result of my crisis) to 5 (I experienced this change to a very great degree as a result of my crisis). The Cronbach's α of the PTGI originally reported .90.

In this study, the Chinese version of the Posttraumatic Growth Inventory was translated and revised by Wang et al.(2011) (J. Wang et al., 2011). The Chinese PTG Inventory is a 20-item self-report questionnaire that assesses PTG. An item in the original version was deleted during revision due to low correlation with the total score. It consists of five subscales: personal strength (Item 10, 12, 18), appreciation of life (Item 2, 5, 11, 13, 15, 19), spiritual change (Item1, 3, 4, 7), new possibilities (Item 9, 14, 16, 17), and relating to others (Items 6, 8, 20). Items is rated on a 6-point Likert scale that ranges from "0=not at all, 1= a very small degree, 2 = a small degree, 3= a moderate degree, 4= a great degree, 5= a very great degree". The total score ranges from 0 to 100, with higher scores reflecting greater psychological growth. The total score of post-trauma growth less than 60 represents low level, greater than 60 and less than 66 represents moderate level, while greater than 66 means high level. The Cronbach's α of the PTGI was .88 in the ACS patients (Liu et al., 2019). The Cronbach's α for new possibilities, relating to others, appreciation of life, personal strength, and spiritual change subscale were .629, .796, .641, .692, .611 respectively (Zhang et al., 2010).

Psychometric properties of the instruments

Validity

There were eight self-report research instruments for this study. They are already in Chinese and have been used previously in Chinese population. Thus, validity of these eight measures was already established.

Reliability

A pilot study was conducted to evaluate the reliability of eight instruments with 30 participants who met research inclusion criteria at Yancheng First People's hospital. The data obtained were used to calculate reliability by using Cronbach's alpha coefficient. The internal consistency for seven instruments was acceptable in present study (Cronbach's alpha higher than .70). The internal consistency reliability was presented in Table 1.

Table 1 Cronbach's alpha for each instrument used in this study

Measurement	No. of items	Cronbach's alpha	
		Pilot study	Present study
1. Chinese version of Herth Hope Index	12	.822	.901
2. Chinese version of the Core Beliefs Inventory	9	.740	.895
3. Chinese version of Patients Health Questionnaire Depression Scale	9	.733	.931
4. Chinese version of Multidimensional Scale of Perceived Social Support	12	.857	.879
5. Chinese version of Event Related Rumination Inventory	10	.803	.908
6. Chinese version of Connor-Davidson Resilience Scale	25	.887	.959
7. Chinese version of Posttraumatic Growth Inventory	20	.828	.931

Protection of human subjects

The study received approval from the Institutional Review Board [IRB] of Burapha University (G-HS030/2565) and the Committee of Rights for Human Research of Yancheng First People's hospital ([2022]- (K-046)). All of the patients who volunteered to participate were informed about the research objectives and methods. The participants were assured of data confidentiality and voluntary participation. To minimize physical risk to the participants in the study during covid-19, a nurse measured a patient's temperature and asked him to wear a mask before entering the clinic. Participants also were asked to disinfect their hands with alcohol sanitizer and keep one meter distance. To minimize mental risk to the participants, filling out the questionnaire was carried out in a quiet and private environment. If the participants had any questions and concerns about study, the researcher patiently

explained them in time. The instruments in the study also do not involve items that cause psychological harm to participants. The participants were allowed to withdraw from the study at any time without penalty or loss of benefits after informed consent had been obtained. The presentation of the findings maintained the confidentiality of individual responses. The data was kept in locked cabinets, and only the researcher has access to the data, which will be destroyed over years.

Data collection procedures

The researcher had received the letter asking permission for data collection from the Faculty of Nursing, Burapha University. Then, researcher submitted the document issued by Nursing Faculty of Burapha University to the First people's Hospital in Yancheng, located in Jiangsu Province, China. The procedures were as follows:

1. The researcher contacted the nurse directors at the selected hospital at the appropriate time for collecting data after the research permission had been granted.

2. The researcher selected a research assistant from the clinic of hospital who was registered nurse with three or more years of nursing experience for adult with coronary heart disease. Also, she works in the outpatient department of cardiovascular medicine. Then, the researcher trained the research assistant before collecting data:

2.1 The researcher explained the objective of the study, the concept of study, benefits of this study, the rule of using measurement tool, the protection of subjects, steps of data collection to the research assistant.

2.2 In the first week, the research assistant observed the researcher collecting data at the outpatient clinic. After that the researcher discussed and answered questions to make clear that the research assistants could collect data correctly and independently like the researcher.

2.3 Subsequently, the researcher supervised and tracked the process that the research assistant collected data at the outpatient clinic. The assistant was only allowed to independently collect data when no new issues arose.

3. The researcher used systematic sampling method from the name list of the hospital to recruit participants who met the inclusion criteria based on their medical records and voluntary of participation. The researcher and the research assistant were

at the cardiovascular outpatient clinic every weekday from 8:30 to 16:30 for collecting all data. The researcher collected data in the branch with three outpatient clinics, and the research assistant collected data in the branch with two outpatient clinics.

4. The researcher and a research assistant first introduced themselves to eligible patients who came to the hospital's clinic for follow-up, and explained the research purpose, procedure, risks, benefits, and methods to deal with and protect privacy for participants. The participants who voluntarily participated in the study, they were asked to sign in the informed consents. After the participants signed the informed consent form, the researcher and a research assistant applied for permission to use medical records in this study. If consent was obtained, relevant disease information could be filled out in the questionnaire.

5. To ensure the safety of participants participating in the study during covid-19, a nurse measured a patient's temperature and ask them to wear a mask before entering the clinic. Participants also were asked to disinfect their hands with alcohol sanitizer and keep one meter distance between two people. Only those with normal temperature and those without special symptoms can continue participating in the study.

6. The participants got the self-report questionnaire and instruments from researcher or a research assistant, and completed them in a private room in the clinic before meeting the physician. In the case of the samples who were unable to read due to visual problem, researcher and a research assistant could read the items to them and help them mark all their answers. When the ACS patient had any discomfort during the research, the researcher and the assistant immediately stopped the research, then notified the nurse to inform the doctor, and the outpatient nurse helped the patient alleviate the problem according to the doctor's advice. The whole questionnaires took about 20-40 minutes. No participants experienced any uncomfortable symptoms throughout the entire survey process.

7. The researcher and the research assistant could answer questions raised by participants during the data collection process at any time. If participants suddenly requested to withdraw from the study midway, their investigation could be stopped.

8. The research assistant and the researcher checked each page of the questionnaires after a participant finished. If there were blanks in instruments, an assistant or the researcher reminded the participants to complete all missing items.

9. The completed questionnaires prepared for further statistical analyses. All collected data, including the participants' medical records, were kept in locked cabinets, and only the researcher had access to the data, which will be destroyed over years.

Data analysis

1. A statistical computer program was used to analyze the demographic data by using descriptive statistics and perform data management and analysis, including frequency, percentage, variables' mean and standard deviation (SD).

2. Structural equation modeling (SEM) by using AMOS program was used to test the relationships of the study variables in the model and examine the magnitude of causal effects, both direct and indirect on posttraumatic growth. The analysis of AMOS program was tested based on statistical significance level throughout the analysis at $p < .05$.

3. The assumptions of testing for structural equation Modelling was satisfied as follow: (1) Independence: observations are a simple random sample from some population; (2) Appropriate sample size; (3) missing data; (4) outlier; (5) Multivariate normality; (6) linearity; (7) multicollinearity.

CHAPTER 4
RESULTS

This chapter mainly analyzes the results of the research data through three parts. The first part is descriptions of the participant's characteristics and the continuous study variables. The second part is results of the testing for statistical assumptions before conducting structural equation analysis of the data. The final part presents the measurement model results by using confirmatory factor analysis (CFA), and results of the hypothesized model and the modified model of posttraumatic growth of outpatients with acute coronary syndrome.

Participants' characteristics

A total of 396 outpatients with acute coronary syndrome were recruited from the five cardiovascular clinics at the outpatient departments of the hospital. The demographic characteristics are presented in Table 2. The mean age of participants was 51.75 years (SD = 10.56), ranging from 25 to 65 years. The participants with the largest number were in the 56 to 65 years age group (45.20%). Most of the samples were male (66.16%). 32.07% of participants had completed Junior high school and 25.76% completed college and above. Most of them lived with their family (81.57%). Medical insurance was the main payment method for people's medical expenses (80.05%). Almost one-fourth of the participants (23.23%) were still smoking now, and 27.02% were quitting smoking. More than half of the participants were drinking alcohol in the past (57.07%), but 31.56 % persons were quitting drinking now. Most of participants spent on exercise that less than 90 minutes per week (12.63%), while only 19.95% people spent on exercise that more than 450 minutes per week.

Table 2 Demographic characteristics of the participants (n = 396)

Demographic characteristics	n	%
Age (years) (M = 51.75, SD = 10.56; Range: 25-65)		
25-35 years old	40	10.10
36-45 years old	68	17.17
46-55 years old	109	27.53
56-65 years old	179	45.20
Gender		
Male	262	66.16
Female	134	33.84
Level of education		
Primary school and below	84	21.21
Junior high school	127	32.07
High school	83	20.96
College degree and above	102	25.76
Living condition		
Live alone	53	13.38
Live with family	323	81.57
Live with friend	20	5.05
Payment method		
Medical insurance	317	80.05
At one's own expense	79	19.95
Smoking condition		
No history of smoking	197	49.75
Smoking in the past, still smoking now	92	23.23
Smoking in the past, quitting smoking now	107	27.02

Table 2 (Continued)

Demographic characteristics	n	%
Alcoholic drink history		
No history of drinking alcohol	170	42.93
Drinking in the past, still drinking now	101	25.51
Drinking in the past, quitting drinking now	125	31.56
Physical activity (per week) (M = 312.3, SD = 250.7; Range: 0-1260)		
0-89 minutes	50	12.63
90-450 minutes	267	67.42
>450 minutes	79	19.95

Health information of the participants are presented in Table 3. The average discharge time for participants was 3.46 months (SD = 1.90), and most of the participants had a discharge from hospital between 1 to 2 months (36.11%). The majority of people came to the hospital for visit between 1 and 2 times after discharge (74.75%). There were three main types of participants diagnosed with acute coronary syndrome, including ST-elevation myocardial infarction (32.32%), non-ST elevation myocardial infarction (35.61%), unstable angina pectoris (32.07%). Most participants had one comorbidity or comorbidities, including hypertension (54.80 %), diabetes (25.00%), Hyperlipidemia (28.28%), or other (4.80%). In terms of treatment for acute coronary syndrome, more than half of the participants accepted drugs (71.94%) and percutaneous coronary intervention (60.78%), and proportion of coronary artery bypass grafting was the lowest. The mean body mass index (BMI) of participants was 24.75 (SD = 3.50). More than half of the participants (56.31%) were classified as either overweight (38.13%) or obese (18.18%).

Table 3 Health information of the participants (n = 396)

Health information	n	%
Discharged time (M = 3.46, SD = 1.90; Range:1-6)		
1-2 months	143	36.11
3-4 months	114	28.79
5-6 months	139	35.10
Frequency of visit (M = 1.96, SD = 1.19; Range:1-8)		
1-2 times	296	74.75
3-4 times	85	21.46
⩾5 times	15	3.79
Types of ACS		
ST-elevation Myocardial Infarction	128	32.32
Non-ST elevation Myocardial Infarction	141	35.61
Unstable angina pectoris	127	32.07
Comorbidities*		
None	80	20.20
Diabetes	99	25.00
Hypertension	217	54.80
Hyperlipidemia	112	28.28
Others	19	4.80
Types of treatment*		
Drugs	277	71.94
Percutaneous coronary intervention	234	60.78
Coronary artery bypass grafting	21	5.45
BMI (kg/m^2) (M = 24.75, SD = 3.50; Range:16.65-34.09)		
BMI<18.5	12	3.03
18.5 ≤ BMI <24	161	40.66
24 ≤ BMI <28	151	38.13
BMI ≥ 28	72	18.18

* More than one answer

Assumption testing for the SEM analysis

The types commonly used for testing the assumptions in the SEM analysis included missing, outlier, normality, linearity and multicollinearity. Missing data often occur when a respondent fails to answer one or more questions in a survey, which would affect the reliability and authenticity of the results of data analysis. First, missing data was checked. The results of 396 ACS outpatients showed that there were no missing data.

Outlier is an observation that is substantially different from the other observations on one or more characteristics variables (Hair et al., 2014). Next, univariate, and multivariate outliers are identified in assumption testing. Standardized scored was used to assess univariate outliers. If any cases with Z-score are more than 3.29 standard deviations or less than -3.29 standard deviations, it would been considered an outlier (Tabachnick et al., 2013). The results revealed that there were three univariate outliers in posttraumatic growth (#142,324,392) and one univariate outlier in social support (#68) as shown in table 10 (Appendix E). Consequently, 392 cases were used for testing multivariate outliers. An objective way for assessing the multivariate outliers is to use Mahalanobis distance, which used chi-square distribution that measured for each case. A distance that probability value of $\chi 2$ statistic less than .001 is regarded as a multivariate outlier (Meyers et al., 2016). The results in table 11 (Appendix E) showed that no multivariate outliers were found in the testing.

The assumption of normality was tested by calculating skewness and kurtosis statistic. Z value is used to determine whether the variables data are normally distributed. The most commonly used critical values are between -2.58 and 2.58 (.01 significance level), which showed normal distribution (Hair et al., 2014). However, for normality tests with a sample size greater than 300, West et al. (1996) and Kim (2013) proposed that absolute values of skewness and kurtosis can be used instead of considering z-values. Absolute skewness values greater than 2 or absolute kurtosis values greater than 7 can be used as reference values for determining non-normality (Kim., 2013; West et al., 1995). Thus, all variables had normal distribution. These data are shown in Table 12 (Appendix E).

The linearity assumption between variables was tested using Pearson

correlation coefficients (Schumacker & Lomax, 2010). The bivariate relationship between the seven variables in this study did not show zero correlation and prove to be linear relationships as shown in Table 13 (Appendix E). Finally, the multicollinearity assumption was tested. Multicollinearity means extent to which a variable can be explained by the other variables in the analysis. The most obvious means of identifying collinearity is an examination of the correlation matrix for the independent variables. The two most common measures for assessing multicollinearity are tolerance and the variance inflation factor (VIF).

In multicollinearity tests, when variables are highly correlated (values of .90 and above), there was a problem with the correlation matrix (Blunch, 2013). At the same time, only when tolerance value is higher than .1 and VIF is less than 10 can the variables not have multicollinearity (Hair et al., 2014). The correlation coefficients among the variables ranged from -.566 to .552, suggesting all coefficients less than .90. The tolerances value and VIF presented in table 14 (Appendix E) revealed that tolerance value ranged from .587 to .890 and VIF ranged from 1.123 to 1.702, indicating no tolerance values less than .10 and no VIF more than 10. Consequently, no multicollinearity was found among the studied variables.

Descriptive statistics of the studied variables

Prior to conducting descriptive analysis of variables, data were screened for within missing, outlier, normality, linearity and multicollinearity. Four cases were identified as univariate outliers based on standardized scores. Therefore, there are 392 samples used for analysis.

The model had seven study variables, including posttraumatic growth, hope, challenges to core beliefs, depression, social support, deliberate rumination and resilience. Table 4 presented the descriptive statistics of each variable in the model.

Table 4 Descriptive statistics of study variables (n = 392)

Variable	Possible range	Actual range	M	SD	Level
Posttraumatic growth [1]	0-100	9-89	61.40	14.89	Moderate
Personal strength	0-15	1-15	9.29	2.93	
Appreciation of life	0-30	1-30	17.65	6.24	
Spiritual change	0-20	1-19	11.87	3.64	
New possibilities	0-20	1-19	12.38	3.88	
Relating to others	0-15	0-15	10.20	2.82	
Hope[2]	12-48	17-48	39.23	7.00	High
Temporality and future	4-16	5-16	12.14	2.73	
Positive readiness and expectancy	4-16	4-16	12.79	2.82	
Interconnectedness	4-16	5-16	13.31	2.63	
Challenges to core beliefs[3]	0-45	3-42	26.67	7.28	-
Views about themselves	0-15	0-15	9.06	2.95	
Views about others	0-15	0-15	8.25	2.82	
World and the future	0-15	1-15	9.37	2.99	
Depression[4]	0-27	0-26	8.06	7.30	Mild
Emotion	0-18	0-17	4.96	5.20	
Somatic symptoms	0-9	0-9	3.10	2.74	
Deliberate rumination[5]	0-30	4-30	20.59	6.68	-
Social support[6]	12-84	18-78	55.46	11.30	Medium
Family	4-28	4-27	20.07	4.48	
Friends	4-28	4-28	17.57	4.60	
Significant other	4-28	5-28	17.81	4.58	

Table 4 (Continued)

Variable	Possible range	Actual range	M	SD	Level
Resilience [7]	0-100	9-92	67.12	19.07	-
Tenacity	0-52	4-49	35.75	10.88	
Strength	0-32	3-30	20.71	6.73	
Optimism	0-16	1-16	10.67	3.88	

Note: [1] The Chinese version of Posttraumatic Growth Inventory [PTGI]; [2] The Chinese version of Herth Hope Index [HHI]; [3] The Chinese version of the Core Beliefs Inventory [CBI]; [4] The Chinese version of Patients Health Questionnaire Depression Scale [PHQ-9]; [5] The Chinese version of Event Related Rumination Inventory [C-ERRI]; [6] The Chinese version of Multidimensional Scale of Perceived Social Support [MSPSS]; [7] The Chinese version of Connor-Davidson Resilience Scale [CD- RISC]

Posttraumatic growth

The total score of posttraumatic growth ranged from 9 to 89 with a mean of 61.40 (SD = 14.89), indicating moderate level of posttraumatic growth among outpatients with acute coronary syndrome who had been discharged for 1 to 6 months compared to those reported boundary value of previous study (Wang et al., 2011). The mean score of the subscale shows that appreciation of life (M =17.65, SD = 6.24) has the greatest change in posttraumatic growth, while personal strength (M =9.29, SD = 2.93) has the smallest change. The descriptive statistics of the posttraumatic growth and its subscales are presented in Table 4.

Posttraumatic growth was measured by the Posttraumatic Growth Inventory [PTGI]. According to domestic norms (Wang et al., 2011), the total score of post-trauma growth is less than 60 represents low level, greater than 60 and less than 66 is moderate level, while greater than 66 means high level. Patients with acute coronary syndrome reported low, moderate, and high levels of posttraumatic growth at 1 to 2 months, 3 to 4 months, and 5 to 6 months after discharge, respectively. The changes

in total posttraumatic growth, related to others and appreciation of life in ACS patients showed a significant difference with the grouping of follow-up time. The changes in posttraumatic growth and relating to others were most prominent in ACS patients 5 to 6 months after discharge. Descriptive statistics of total posttraumatic growth and subscales at different discharge follow-up times were shown in Table 5.

Table 5 Descriptive statistics of total posttraumatic growth and subscales at different discharge follow-up times (n = 392)

follow-up times	**N**	**PTG [Mean (SD)]**					
		Total PTG	**PS**	**AOL**	**SC**	**NP**	**RTO**
1-2 months	143	59.12(13.03)	8.94(2.94)	17.18(5.71)	11.06(3.46)	12.00(3.78)	9.95(2.58)
3-4 months	114	60.65(16.8)	9.45(2.92)	16.64(6.93)	12.14(3.59)	12.31(4.18)	10.11(3.00)
5-6 months	139	64.32(15.29)	9.53(2.90)	18.93(5.98)	12.50(3.74)	12.83(3.72)	10.53(2.89)
P value		.011	.192	.003	.206	.187	.008

Note: NP=New Possibilities, RTO=Relating to Others, AOL=Appreciation of life, PS=Personal Strength, SC=Spiritual Change

Hope

The overall score for hope ranged from 17 to 48 with a mean score of 39.23 (SD = 7.00), which indicated that most patients still have high hope suffering from acute coronary syndrome. The mean scores of the three dimensions (temporality and future, positive readiness and expectancy, interconnectedness) also showed high values (M = 12.14, SD = 2.73; M = 12.79, SD = 2.82; M = 13.31, SD = 2.63, respectively). These results are shown in Table 4.

Challenges to core beliefs

The total mean score of challenges to core beliefs was 26.67 (SD = 7.28) and ranged from 3 to 42, which was higher than a half of the possible range. The results also showed high mean score of views about the world and the future subscale equal 9.37 (SD = 2.99) and views about themselves subscale equal 9.06 (SD = 2.95).

The results of total challenges to core beliefs and each subscale are presented in Table 4.

Depression and deliberate rumination

The total score of depression was between 0 and 26 with mean score of 8.06 (SD= 7.30), indicating mild level of depression in ACS outpatients who had been discharged for 1 to 6 months according to the Chinese norm (Jin et al., 2011). Mean of each dimension score revealed typical performance of emotion symptoms in depression assessment, with average score of 4.96 (SD= 5.20). The total score for deliberate rumination ranged from 4 to 30 with mean score of 20.59 (SD = 6.68). All Results are shown in Table 4.

Social support

The results of this study on social support showed that mean score equal to 55.46 (SD = 11.30). Therefore, these finding demonstrated that ACS outpatients who had been discharged for 1 to 6 months were medium degrees of social support. The order of sources of social support for ACS outpatients was Support from family (M = 20.07, SD = 4.48), significant other (M = 17.81, SD = 4.58), and friends (M = 17.57, SD = 4.60). These results can be seen in Table 4.

Resilience

The overall mean resilience score of 67.12 (SD = 19.07) implied that resilience level of ACS outpatients who had been discharged for 1 to 6 months was not high. The mean scores of the three subscales (tenacity, strength, optimism) were above average (M = 35.75, SD = 10.88; M = 20.71, SD = 6.73; M = 10.67, SD = 3.88, respectively). This data can be seen in Table 4.

Results of model testing

Structural equation modeling (SEM) is a set of statistical techniques that are used to examine linear causal relationships, mediating effect and moderating effect among variables. SEM is deconstructed into the measurement model and structural model; therefore, it can be regarded as union of confirmatory factor analysis and path analysis. This study used the analysis of moment structure (AMOS) program in SEM analysis to examine the degree of fitting between the hypothesized model and data.

Measurement model assessment

Measurement model assessment is the initial step before evaluating the structural model in Structural Equation Model (SEM) analysis, which mainly defines relations between the observed and unobserved variables (Byrne, 2016), clarifies the indicators of each structure and assess the construct validity (Hair et al., 2014). The measurement model was evaluated through confirmatory factor analysis (CFA).

This study used confirmatory factor analysis (CFA) to evaluate the measurement models of seven variables, including posttraumatic growth, hope, challenges to core beliefs, depression, social support, resilience, and deliberate rumination. The results of CFA analysis for each measurement model were reported in Table 6. In confirmatory factor analysis, multiple fitting indices are generally reported to help researchers understand the degree of fit of the measurement model. An acceptable rule of thumb is that all indicators had positive values of standard factor loading and greater than .30 (Kim & Mueller, 1978). The criteria for the indices of a minimum chi-square value [CMIN] should be non-significant ($p > .05$), and CMIN divided in degrees of freedom [CMIN/df] were smaller than 2.0 that considered very good, while CMIN/df were between 2.0 and 5.0 is also acceptable (Hair et al., 2014). The Goodness-of-fit index [GFI] was higher than .90 or .95 is acceptable, and the comparative fit index [CFI] should be greater than .90 for a model of this complexity and large sample size (Hair et al., 2014; Schumacker & Lomax, 2010). The root square error of approximation [RMSEA] should be less than .05, but value was between .05 to .08 also indicating close fit (Schumacker & Lomax, 2010). The results show that these variables were a good construct (Table 6, Figure 4, 5, 6, 7, 8, 9, 10 (Appendix F).

Table 6 Results of measurement models of seven variables (n = 392)

Names of Variables	Instruments	Items	Factor loading	Fit Indices						
				CMIN	*df*	p	CMIN/ *df*	GFI	CFI	RMSEA
Hope	HHI[1]	12	.56-.83	163.48	51	＜.001	3.205	.932	.949	.075
Challenges to core beliefs	CBI[2]	9	.80-.87	39.08	24	.027	1.628	.978	.992	.040
Depression	PHQ-9[3]	9	.78-.88	47.17	26	.007	1.814	.974	.992	.046
Social support	MSPSS[4]	12	.47-.90	156.422	49	＜.001	3.192	.935	.946	.075
Deliberate rumination	ERRI[5]	10	.44-.84	77.787	33	＜.001	2.357	.962	.978	.059
Resilience	CD-RISC[6]	25	.70-.86	560.775	269	＜.001	2.085	.904	.957	.053
Posttraumatic growth	PTGI[7]	20	.74-.90	295.477	160	＜.001	1.847	.928	.974	.047

Note: [1]The Chinese version of Herth Hope Index [HHI]; [2] The Chinese version of the Core Beliefs Inventory [CBI]; [3]The Chinese version of Patients Health Questionnaire Depression Scale [PHQ-9]; [4]The Chinese version of Multidimensional Scale of Perceived Social Support [MSPSS]; [5]The Chinese version of Event Related Rumination Inventory [C-ERRI]; [6] The Chinese version of Connor-Davidson Resilience Scale [CD- RISC]; [7] The Chinese version of Posttraumatic Growth Inventory [PTGI].

Results of the hypothesized model testing

After performing the CFI analysis, it was found that each measurement model was effective and reached an acceptable level of model fitting. Therefore, the next step is to assess the structural model validity by using SEM technique, which purpose is to define relations among the unobserved variables (Byrne, 2016). Generally, structural equation models can be evaluated by testing significance of parameters, parameter change and various fit indices (Schumacker & Lomax, 2010). The model-fit indices of SEM indicate to what extent the specified model fits the empirical data (Schermelleh-Engel et al., 2003). Multiple fit indices should be used to evaluate the goodness-of-fit of the model, including χ^2 statistic, χ^2 / degrees of freedom (df) ratios, one absolute fit index (GFI, RMSEA or SRMR), one incremental fit index (CFI, TLI, NFI, RNI), one goodness-of-fit index (GFI, CFI, TLI, etc.) and one badness-of-fit index (RMSEA, SRMR, etc.) (Hair et al., 2014).

Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA) and Tucker Lewis Index (TLI) are less affected by sample size and widely reported (Bollen, 1990; Hair et al., 2014; Hu. & Bentler, 1998). As an incremental fit index, the disadvantage of normed fit index (NFI) is that it could artificially inflate the estimate of model fit, thus it is used less today (Hair et al., 2014). In this study, the minimum chi-square value [CMIN], CMIN/df, GFI, CFI, TLI and RMSEA were used to test the hypothesized model. The acceptance value of CMIN should be non-significant ($p > .05$) (Hair et al., 2014; Tabachnick et al., 2013). However, the chi-square is sensitive to sample size and model complexity. The χ^2 value will increase with increasing sample size, which make it more difficult for models to get an insignificant χ^2 statistics (Meyers et al., 2016; Schermelleh-Engel et al., 2003; Schumacker & Lomax, 2010). Researchers suggest that Significant p-values could be acceptable if the sample size is large (such as $N > 250$, $12 <$ number of observed variables < 30) (Hair et al., 2010), and using Multiple model fit indices to evaluate the model (Byrne, 2016; Jöreskog & Sörbom, 1993). The ratio CMIN/df for good data-model fit was less than less than 2.0 (Hooper et al., 2008; Schumacker & Lomax, 2010), and for acceptable model fit was between 2 and 3 (Hair et al., 2014; Schermelleh-Engel et al., 2003). The GFI and TLI should be between .90 to 1.00 (Hu. & Bentler, 1998; Schumacker & Lomax, 2010). The CFI should be above .92 at the

sample size greater than 250, which was accepted for the model fit (Hair et al., 2014). The acceptable level of RMSEA should be < .05 or between .05 and .08, representing good fit or fair fit respectively (Browne & Cudeck, 1989; Byrne, 2016; Hooper et al., 2008). The results of hypothesized model testing showed that CMIN was 854.800 ($p < .001$, df = 360), CMIN/df was 2.374, GFI was .871, TLI was .895, CFI was .907, and RMSEA was .059 as presented in Table 8. These findings implied that hypothesized model did not fit the sample data well.

In this study, the hypothesized causal model of posttraumatic growth in ACS outpatients who had been discharged for 1 to 6 months proposed relationships among four exogenous latent variables (Hope, Challenges to core beliefs, Depression, Social support) and three endogenous latent variables (Resilience, Deliberate rumination, Posttraumatic growth). The parameter estimates had statistical significance ($p \leq .05$) indicating relationships between latent variables.

The results of hypothesized model showed that 7 parameter estimates had statistically significant direct paths (Figure 2, Table 7). Challenges to core beliefs had a positive direct effect on deliberate rumination ($\beta = .179$, $p = .017 < .05$). In addition, depression had a negative direct effect on posttraumatic growth ($\beta = -.421$, $p = .001 < .01$) and resilience ($\beta = -.653$, $p < .001$). Social support had a positive direct effect on resilience ($\beta = .120$, $p = .047 < .05$) and deliberate rumination ($\beta = .273$, $p < .001$). Both deliberate rumination and resilience had positive direct effects on posttraumatic growth ($\beta = .171$, $p = .005 < .01$; $\beta = .313$, $p = .001 < .01$, respectively). However, the parameter estimates from hope, challenges to core beliefs and social support on posttraumatic growth were not significant ($\beta = .008$, $p > .05$, $\beta = .129$, $p > .05$, and $\beta = -.057$, $p > .05$, respectively). Also, hope had a positive direct effect insignificantly on deliberate rumination ($\beta = .112$, $p > .05$).

The results also showed significant indirect effects between the following exogenous and endogenous variables (Table 7). Challenges to core beliefs had an indirect effect on posttraumatic growth ($\beta = .031$, $p = .009 < .01$) through deliberate rumination. Depression had an indirect effect on posttraumatic growth ($\beta = -.204$, $p = .001 < .01$) through resilience. In addition, social support had an indirect effect on posttraumatic growth ($\beta = .084$, $p < .001$) by deliberate rumination and resilience.

The total effects of variables on posttraumatic growth were reported in Table 7. The positive total effects on posttraumatic growth were challenges to core beliefs ($\beta = .160$, $p = .015 < .05$), deliberate rumination ($\beta = .171$, $p = .005 < .01$) and resilience ($\beta = .313$, $p = .001 < .01$). Depression had the strongest negative total effect on posttraumatic growth ($\beta = -.625$, $p < .001$). The path directions that had a significant impact on posttraumatic growth in outpatients with acute coronary syndrome accounted for 57 % of the total variance ($R^2 = .57$).

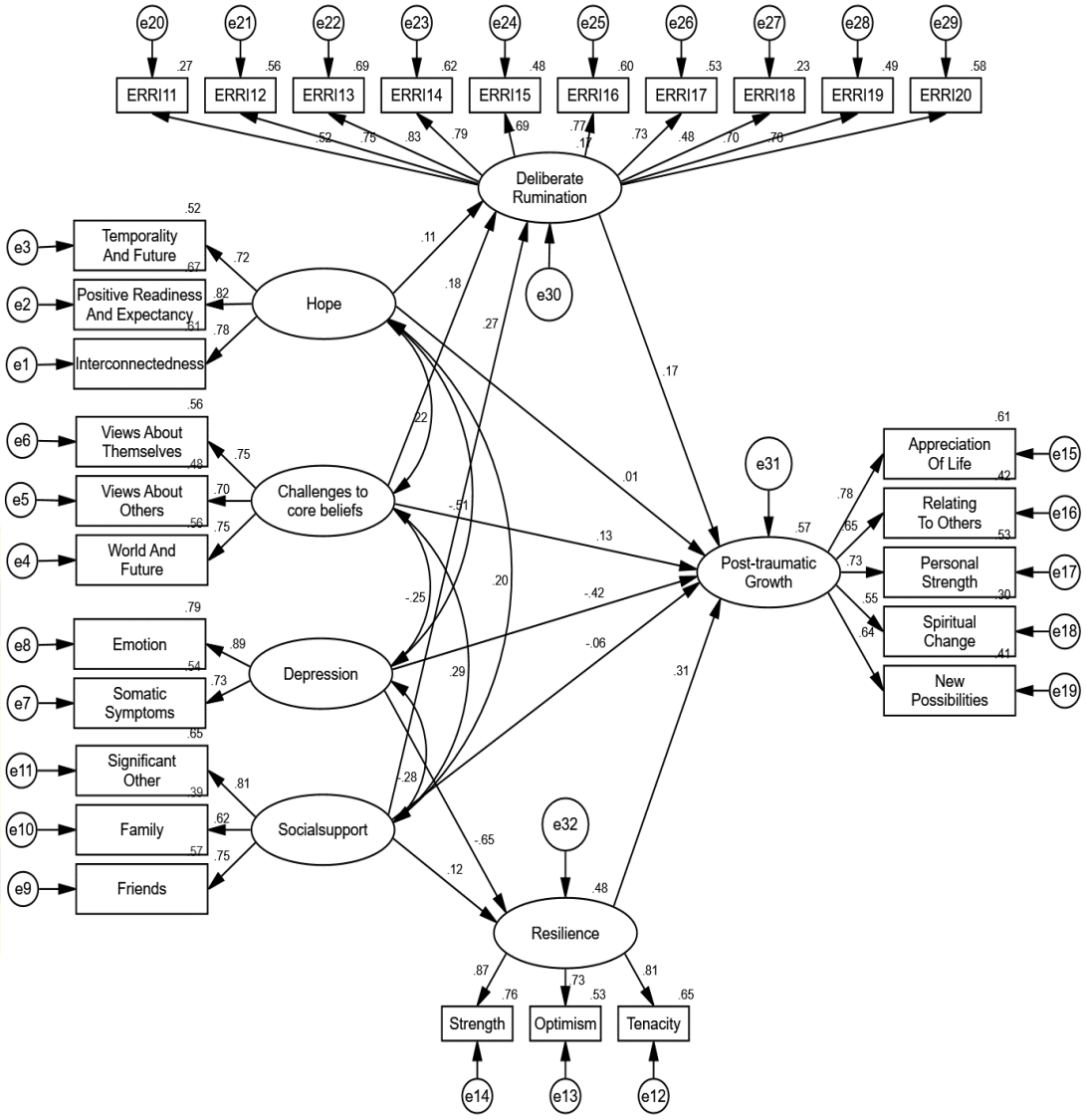

Figure 2 The hypothesized model of posttraumatic growth in ACS outpatients who had been discharged for 1 to 6 months

Table 7 Direct, indirect, and total effects of variables in the hypothesized model of posttraumatic growth (n = 392)

Causal variable	Deliberate rumination			Resilience			Posttraumatic growth		
	DE	IE	TE	DE	IE	TE	DE	IE	TE
1. Hope	.112	-	.112	-	-	-	.008	.019	.028
2. Challenges to core beliefs	.179 *	-	.179*	-	-	-	.129	.031 **	.160 *
3. Depression	-	-	-	-.653***	-	-.653 ***	-.421**	-.204**	-.625***
4. Social support	.273 ***	-	.273 ***	.120*	-	.120*	-.057	.084***	.027
5. Deliberate rumination	-	-	-	-	-	-	.171**	-	.171 **
6. Resilience	-	-	-	-	-	-	.313**	-	.313**
		$R^2 = .17$			$R^2 = .48$			$R^2 = .57$	

* = p < .05, ** = p < .01, *** = p < .001; Note DE = direct effect, IE = indirect effect, TE = total effect

Model modification

The hypothesized model did not fit the data well, Consequently, the next step was to modify the hypothesized model. The method used to modify the model in this study is to add parameters to create a better model. It is necessary to relax the constraints on the model by introducing additional covariances. Modification Index (MI) from AMOS can be used to provide information about which parameters should be added, which were used to enhance the model fit (Kang & Ahn, 2021). For parameters with modification index, only one parameter can be released at a time (Long, 1983). As a result, the modified model has reached a good fit to the data: the CMIN was equal to 674.842 ($p < .001$, $df = 354$), CMIN/df =1.906, GFI = .900, TLI = .930; CFI = .939, and RMSEA = .048 (Table 8).

In the modified model of posttraumatic growth in outpatients with acute coronary syndrome, the results showed that 7 parameter estimates had statistically significant direct paths (Figure 3, Table 9). Challenges to core beliefs had a positive direct effect on both deliberate rumination ($\beta = .142$, $p= .046 < .05$). Social support had a positive direct effect on both deliberate rumination ($\beta = .263$, $p < .001$) and resilience ($\beta = .126$, $p= .036 < .05$). Depression had a negative direct effect on both resilience ($\beta = -.648$, $p < .001$) and posttraumatic growth ($\beta = -.406$, $p= .001 < .01$). Deliberate rumination and resilience both had positive direct effect on posttraumatic growth ($\beta = .203$, $p= .001 < .01$; $\beta = .316$, $p= .001 < .01$). In addition, challenges to core beliefs in combination with social support accounted for 15% ($R^2 = .15$) of the variance in deliberate rumination. Depression in combination with social support accounted for 48% ($R^2 = .48$) of the variance in resilience. Moreover, depression in combination with deliberate rumination and resilience accounted for 57% ($R^2 = .57$) of the variance in posttraumatic growth.

Challenges to core beliefs had an indirect effect on posttraumatic growth ($\beta = .029$, $p= .024 < .05$) through deliberate rumination (Table 9). Depression had an indirect effect on posttraumatic growth ($\beta = -.205$, $p < .001$) through resilience. Social support had an indirect effect on posttraumatic growth ($\beta = .093$, $p < .001$) through deliberate rumination and resilience.

Depression had the strongest negative total effect on posttraumatic growth ($\beta = -.611$, $p < .001$) (Table 9). Furthermore, the positive total effects on posttraumatic

growth were challenges to core beliefs (β = .146, p= .038 < .05), deliberate rumination (β = .203, p= .001 < .01) and resilience (β = .316, p= .001 < .01).

Table 8 Statistics of the model fit index between the hypothesized model and the modified model (n = 392)

Model fit criterion	**Acceptable score**	**Hypothesized model**	**Modified model**
CMIN	p > .05	854.800 P < .001 (*df* =360)	674.842 p < .001 (df = 354)
CMIN/ df	< 2	2.374	1.906
GFI	.90-1.00	.871	.900
TLI	.90-1.00	.895	.930
CFI	.92-1.00	.907	.939
RMSEA	< .05	.059	.048

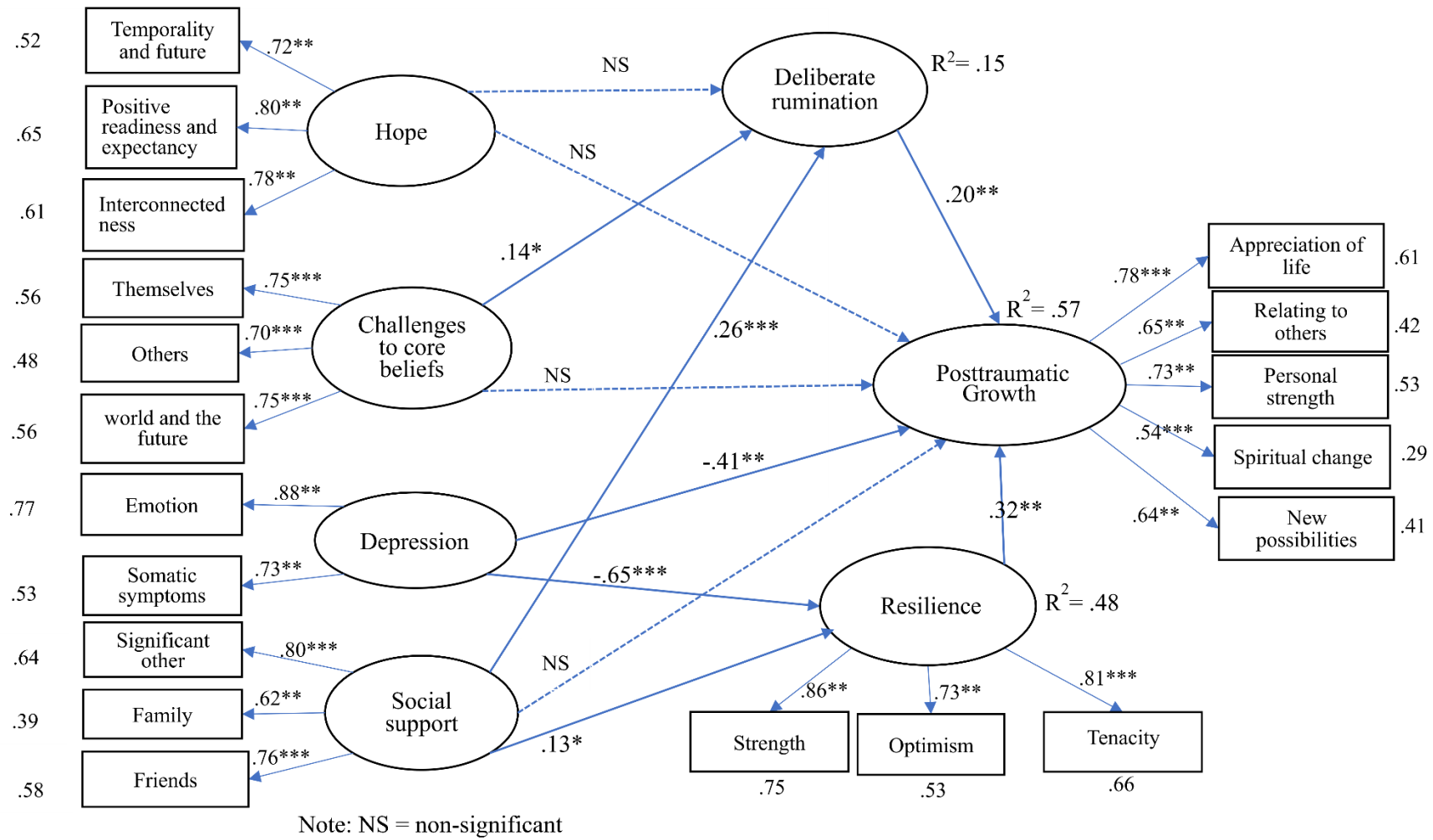

Figure 3 The modified model of posttraumatic growth in ACS patients who had been discharged for 1 to 6 months

Table 9 Direct, indirect, and total effects of variables in the modified model of posttraumatic growth (n = 392)

Causal variable	Deliberate rumination			Resilience			Posttraumatic growth		
	DE	IE	TE	DE	IE	TE	DE	IE	TE
1. Hope	.120	-	.120	-	-	-	.008	.024	.032
2. Challenges to core beliefs	.142 *	-	.142 *	-	-	-	.117	.029 *	.146 *
3. Depression	-	-	-	-.648***	-	-.648***	-.406 **	-.205***	-.611***
4. Social support	.263***	-	.263 ***	.126 *	-	.126 *	-.044	.093 ***	.049
5. Deliberate rumination	-	-	-	-	-	-	.203 **	-	.203 **
6. Resilience	-	-	-	-	-	-	.316 **	-	.316 **
		R^2= .15			R^2= .48			R^2= .57	

* = p < .05, ** = p < .01, *** = p < .001; Note DE = direct effect, IE = indirect effect, TE = total effect

Summary

In summary, this chapter presented the demographic characteristics and risk factors of study samples. Descriptive statistics of the study variables were also reported. The assumptions of outlier, normality, linearity and multicollinearity of all variables were tested in the preliminary analyses, finding that three univariate outliers in posttraumatic growth (#142,324,392), one univariate outlier in social support (#68), and no multivariate outliers. The variable data of the remaining 392 participants meet the assumptions of normality, linearity and multicollinearity.

According to the findings, the hypothesized model did not fit the empirical data well. Therefore, the model was modified until the goodness-of-fit index indicated a goodness-of-fit level. The results of final model testing showed that the CMIN was equal to 674.842 ($p < .001$, $df = 354$), CMIN/df =1.906, GFI = .900, TLI = .930; CFI = .939, and RMSEA = .048.

In the final model, hypotheses in this study were tested and 7 parameter estimates had statistically significant direct paths. Deliberate rumination and resilience had a direct positive effect on posttraumatic growth among outpatients with acute coronary syndrome, but depression had a negative direct effect on PTG. Challenges to core beliefs and social support had a direct positive effect on deliberate rumination. Social support had a direct positive effect on resilience. Depression had a negative direct effect on resilience. In addition, Challenges to core beliefs had a significantly indirect positive effect on posttraumatic growth mediated by deliberate rumination. Depression had a significantly indirect positive effect on posttraumatic growth mediated by resilience. Social support had a significantly indirect positive effect on posttraumatic growth mediated by deliberate rumination and resilience.

CHAPTER 5
CONCLUSION AND DISCUSSION

This chapter mainly consists of three aspects of content. The first part describes the summary of the study. The second part is a discussion and conclusion of the research findings. The last part suggests the limitations, implications for nursing, and recommendations.

Summary of the study

The objective of this study was to develop and test a hypothesized model of posttraumatic growth among acute coronary syndrome (ACS) by testing causal relationships between predictors (hope, challenges to core beliefs, depression, resilience, deliberate rumination, and social support) and posttraumatic growth (PTG). Systematic sampling technique was used to recruit samples of acute coronary syndrome who had been discharged for 1 to 6 months and followed up at cardiovascular clinics in a tertiary hospital, China. A total of 396 participants were recruited on the basis of the following inclusion criteria: 1) patients with ACS who aged 25 years to 65 years; 2) have stable conditions, no disabilities; 3) be able to read and write Chinese; 4) no cognitive impairment screening by Mini-Mental State Examination. The eight questionnaires were used in this study to collect data, including the Posttraumatic Growth Inventory [PTGI], Herth Hope Index [HHI], Core Beliefs Inventory [CBI], Patients Health Questionnaire Depression Scale [PHQ-9], Multidimensional Scale of Perceived Social Support [MSPSS], Event Related Rumination Inventory [ERRI], and Connor-Davidson Resilience Scale [CD- RISC]. All instruments were Chinese versions. The Cronbach's alpha for PTGI, HHI, CBI, PHQ-9, MSPSS, ERRI, and CD- RISC were .931, .901, .895, .931, .879, .908, and .959 respectively.

The majority of patients with acute coronary syndrome were male (66.16%) with mean age of 51.75 years (SD = 10.56). Furthermore, most participants had completed Junior high school (32.07%) or college degree and above (25.76%), implying that the participants in the study had strong cognitive abilities. More than

half of people prefer to live with family (81.57%) and use medical insurance to pay medical expenses (80.05%). Most participants had never smoked (49.75%) or drank alcohol (42.93%), and some had given up smoking (27.02%) or drinking (31.56%) even if they had a hobby in the past. More than half (67.42%) of ACS patients participate in physical activities for 90 to 450 minutes per week. The majority of ACS patients who had been discharged for 1 to 2 months (36.11%) or 5 to 6 months (35.10%) were followed up at outpatient clinics. Most of the participants had one comorbidity or comorbidities, including hypertension (54.80%), diabetes (25.00%), Hyperlipidemia (28.28%), or other (4.80%). In terms of treatment for acute coronary syndrome, more than half of the participants accepted drugs (71.94%) and percutaneous coronary intervention (60.78%). One-third of the total participants were diagnosed with ST-elevation myocardial infarction, non-ST elevation myocardial infarction, and unstable angina pectoris, respectively. More than half of the sample (56.31%) were either overweight or obesity.

The results of hypothesized model of post-traumatic growth in ACS patients did not fit the data well. Modification Index was used to determine which parameters should be added for modifying model. After modification, the goodness-of-fit indices of final model were CMIN = 674.84, df = 354, $p < .001$, CMIN/df = 1.91, GFI = .90, TLI= .93, CFI = .94, and RMSEA = .048, which fit the data well. The results of modified model also showed that challenges to core beliefs and social support had significantly positive direct effects on deliberate rumination ($\beta = .14$ and $\beta = .26$, respectively). Social support and depression both had direct effect on resilience ($\beta = .126$ and $\beta = -.648$, respectively). Finally, deliberate rumination, resilience and depression had direct effect on posttraumatic growth ($\beta = .13$, $\beta = .32$ and $\beta = -.41$, respectively), thereby explaining 57% of the variance of posttraumatic growth (R2=.57). It can be seen that challenges to core beliefs and social support had indirect effect on PTG through deliberate rumination. Social support and depression had an indirect effect on PTG through resilience.

Discussion of the study findings

The posttraumatic growth in ACS outpatients who had been discharged for 1 to 6 months

The findings of this study presented that the participants reported moderate posttraumatic growth (M = 61.40, SD = 14.89). Furthermore, 58.6% of patients who have been discharged for 1 to 6 months during outpatient follow-up exhibited moderate to high levels of PTG. The study of Husson (2017) also found that patients who were within 6-month follow-up at outpatient department exhibited moderate post-traumatic growth (Husson et al., 2017). Meanwhile, it is also consistent with other research findings (Dong., 2022b). However, compared to Chinese individuals who have not experienced illness, participants experience lower levels of posttraumatic growth (Zhang. et al., 2021).

Moderate posttraumatic growth may be influenced by patients' age, education level, live condition, treatment, and BMI. The age of participants in this study mainly ranged from 25 to 65 years old, with an average age of 51.75 years (SD=10.56), which was at a middle-aged level. Compared to the elderly, the results of studies indicated that younger patients more often were found in the high PTG group (Husson et al., 2017; Paredes & Pereira, 2018).The reason may be that young and middle-aged person have more potential to change their lives to cope with adverse changes caused by traumatic events (Tedeschi et al., 2018), such as work pressure, family responsibility pressure, and economic pressure. Meanwhile, young people are more willing to adopt positive coping strategies (such as active emotional coping) (Javed & Dawood, 2016; Wang et al., 2016), for example, shifting their life goals, building another career path, and more chances to meet new people. Positive coping strategies are positively correlated with posttraumatic growth (Javed & Dawood, 2016).

Approximately half of the participants had high school education or above (46.7%) in this study. Thus, those with high education level experience more posttraumatic growth than poor-educated person (Kearns et al., 2020; Zeng et al., 2018). Patients with higher education level have a higher ability to acquire knowledge about disease, and their mastery and cognition of disease knowledge will increase (Wang et al., 2016). After individual reflection and cognitive processing, a new

cognition of accepting reality and adapting to the changes brought about by diseases will emerge, thereby improving the ability to adapt to traumatic events and promoting growth (Tedeschi et al., 2018; Ting et al., 2016).

In addition, the majority of ACS outpatients after discharge lived with their families (81.6%). A qualitative study showed that patients who lived with their families thought it prompt an increase in time spent with family, more support and caring from family, thus bring about positive changes in cognition (Gökalp et al., 2022). More than half of ACS patients in this study received PCI treatment. Patients who had undergone PCI experienced more posttraumatic growth compared to those who had not undergone surgery. Because undergoing PCI surgery can bring better quality of life to patients, alleviate their concerns, and ultimately achieve more growth (Ye et al., 2018). The BMI of the normal group is another factor that can improve survivors' PTG development (Hongming et al., 2019; Liyan et al., 2020). In this study, The BMI of 40.7% ACS outpatients were at normal range. Survivors with normal BMI typically tend to adopt positive attitudes and seek effective strategies (such as healthy lifestyle) when facing traumatic events, for maintaining a healthy psychological status, which leads to higher PTG levels.

Posttraumatic growth requires a process of adaptation and adjustment, and growth could occur in a short period of time (approximately three weeks) (Su. & Chen, 2015). In this research, the PTG score of outpatient ACS patients at 5-6 months after discharge is the highest, higher than that of the 3-4 months group and the 1-2 months group after discharge. The study of Danhauer et al. (2013) also reported that the total mean score of PTG over time increased over the first 12 months following diagnosis and then stabilized after 24 months (Danhauer, Case, et al., 2013). This may be because people tend to experience more negative experiences (such as negative emotions) in the early stages after trauma (Seok et al., 2020). During this period, PTG is closely related to negative experiences, which continuously catalyze the emergence and growth to reduce the impact of negative feelings on individuals. The changes in "Relationship to others", "New possibilities", "Personal strength", and "Acceptance of life" will gradually increase over time, thereby promoting the continuous enhancement of PTG (Danhauer, Case, et al., 2013). At present, the pattern of changes in posttraumatic growth of patients with acute coronary syndrome over time

is currently inconclusive (taper off, increase, or maintain stability), which is a question worth exploring in the future study.

In terms of dimension scores, the mean score of "appreciation of life" is the highest among the five subscales of PTGI, followed by the "new possibilities" subscale. This result is consistent with other research findings (Shen et al., 2021; Yan et al., 2021). "Appreciation of life" domain reflects a greater appreciation and cherishing for everything that life has to provide, whether it is small things that were previously taken for granted or things that still exist in people's lives (Tedeschi et al., 2018). After experiencing acute and severe traumatic events, ACS patients who have survived are grateful for their second life. At the same time, they are more aware of the importance of health and understand the value of health to life (Menger et al., 2021). Therefore, ACS patients after discharge would pay more attention to positives in life with their family and friends, such as paying attention to beautiful sunsets and waterfalls, or appreciating friendly people.

"New possibilities" domain can be seen in the individual's identification of new possibilities in one's life or the possibility of embarking on new and different paths in life (Tedeschi et al., 2018). ACS patients may develop new healthy lifestyle habits and behaviors after discharge, such as a healthy diet, regular exercise, and a reasonable schedule. In addition, ACS patients could build a new career experience and choose to pursue other possibilities. For example, ACS patients tend to participate in light work instead of busy work, in order to leave more time to spend with their families (Adorno et al., 2018).

Factors influencing posttraumatic growth

In the proposed hypothesis model, there were six factors that affected posttraumatic growth among ACS outpatients who were followed up after discharge. The results in the final model showed that challenges to core beliefs, depression, social support, deliberate rumination, and resilience had direct and/or indirect effects on posttraumatic growth. Additionally, deliberate rumination and resilience also had been found to be mediators between challenges to core beliefs, depression, and social support and posttraumatic growth in the modified model.

The Revised Model of Posttraumatic Growth theory guided this study and illustrated how the antecedents of PTG reshape people's cognition and promote positive psychological change after experiencing trauma (Tedeschi et al., 2018).

In this model, characteristics of personality pre-trauma (hope) and pre-trauma mental health (depression) are expected to affect the PTG. Suffering the traumatic event caused person's core beliefs being challenged. Challenges to core beliefs often lead to initial emotional distress and rumination. When coping with emotional distress successfully, it would lead to more deliberate rumination, which interacts with PTG. Having a strong social support network pre-trauma is likely to help people to cope effectively with the traumatic event, and thus may or may not directly increase PTG. This research model could support and enrich the Revised Model of Posttraumatic Growth theory. The researcher discussed the effect of various factors as follows.

Direct effect on posttraumatic growth

Depression

Depression in ACS outpatients who followed up at clinic had a negative effect on posttraumatic growth ($\beta = -.41$, $p < .01$). Therefore, the study results support the third hypothesis that proposed in the hypothesized model. The research's findings were consistent with previous studies that has presented that depression had a significant influence on post-traumatic growth. PTG score was statistically significantly higher in the 'no longer depressed' group compared to the 'still depressed' and 'depressed now' groups (Romeo et al., 2020). PTG was favorably related to other aspects of mental health. A systematic review also found that PTG was connected with mental health, for example, higher PTG was associated with lower depressive symptom and enhanced psychological well-being in in cardiac patients (Lee et al., 2022). A negative correlation was between depression and PTG, meaning that the more severe the patient's depression, the less conducive it is to the development of PTG (Li. et al., 2019).

In the early stages after experiencing ACS events, research has found that at least 88.4% of patients reported depression and 46.3% of them had a moderate to severe depression among follow-up ACS outpatients (Leong et al., 2021). Depression is a strong predictor of worse outcomes in patients with ACS. Furthermore, more

severe depression significantly reduced quality of life and health status (Johnston et al., 2019; Kyoungrim et al., 2017; Zhunzhun. et al., 2020) such as recurrent cardiovascular events and mortality, and higher health care costs (Sporinova et al., 2019). Therefore, when an individual's physical and mental health is poor, it may hinder the emergence and development of posttraumatic growth. Another explanation may be that high depressed individuals often have a negative worldview, making it more difficult to find positive meaning in adversity. It significantly hinders the use of positive coping strategies to deal with traumatic events, and significantly hinders the emergence of PTG (Henson et al., 2022).

Resilience

The fifth hypothesis was supported by the results in that resilience in ACS outpatients who followed up at clinic had a direct positive effect on posttraumatic growth ($\beta = .32$, $p < .01$). In general, resilience is understood by people as the same concept as post-traumatic growth, but their connotations are actually different. Resilience may be defined as a trait, a process, or a result, therefore there is currently no unified definition. Tedeschi & Calhoun (2004) defines resilience as “the ability to go on with life after hardship and adversity and remain psychologically healthy despite very difficult circumstances” (Tedeschi & Calhoun, 2004). Resilience is also often considered as the personal ability to “bounce back” or recover quickly from the effects of a stressor, allowing individuals with resilience to maintain a stable trajectory of healthy functioning after serious adverse event over time (Bonanno, 2008). Unlike resilience, posttraumatic growth (PTG) is defined as the positive psychological changes experienced as a result of the struggle with traumatic or highly challenging life circumstances (Tedeschi & Calhoun, 1996). Posttraumatic growth has a quality of transformation and achieve higher levels of functioning and positive growth following traumatic experiences (Tedeschi & Calhoun, 2004; Tsai et al., 2016). Therefore, resilience differs from posttraumatic growth in that it is characterized by recover to individual initial state (pre-traumatic state), whereas PTG is characterized by the "gain" of positive psychological benefits, usually dynamic and developing after an event occurs.

Resilience can be seen as a major contributory factor in the process of PTG (Ting et al., 2018). High levels of resilience bring beneficial physical and mental

health outcomes. Discharged patients with the high resilience have a significantly lower chance of experiencing functional limitations in daily life activities, a higher likelihood of returning to work/school, and fewer reports of chronic pain (Nehra et al., 2019). Finding of the research found that resilience has a positively influence on the quality of life among CABG patients aged between 30 and 45 years who have undergone surgery for 3 months (Sanyal et al., 2018). Individuals with higher pain symptom, lower quality of life, and fewer frequencies of physical activity had significantly lower post-traumatic growth (Jieling et al., 2020; Martin et al., 2017; Min et al., 2014). Therefore, the improvement of resilience level can enhance one's understanding of the meaning of life, relating to others, and personal strengths through healthy physical and mental experiences, which promotes personal PTG.

The results of this study are consistent with previous studies that have shown that resilience significantly affects posttraumatic growth. A systematic review explained that individual resilience as well as collective resilience are key determinants of posttraumatic growth (Henson. et al., 2021). The positive correlation between resilience and PTG was stronger, mainly with changes in appreciation of life (Ogińska-Bulik & Kobylarczyk, 2017). When experiencing traumatic events, in addition to dealing with the negative consequences of stress, positive psychological factors can also influence positive changes, highly resilience may increase an individual's capacity for posttraumatic growth. (Garrido-Hernansaiz et al., 2017; Michalczyk et al., 2022).

Deliberate rumination

The sixth hypothesis was supported by the results in that deliberate rumination in ACS outpatients who followed up at clinic had a direct positive effect on posttraumatic growth ($\beta = .20$, $p < .01$). The study's results were consistent with previous research. Cognitive processing is considered to facilitate PTG, and individuals with higher scores on cognitive processing (having higher deliberate rumination) received higher scores from PTG (Durak et al., 2020). More deliberate rumination at cardiovascular rehabilitation completion predicted greater posttraumatic growth (Gerwe, 2014). Additionally, the recent study of Wang et al. (2023) showed that poor deliberate rumination and poor marital quality were associated with poorer

posttraumatic growth levels in young and middle-aged AMI patients (Yanfeng et al., 2023).

When the person experiences a traumatic event, their core beliefs are challenged, leading to initiate ruminative thoughts (Tedeschi et al., 2018). Intrusive rumination is initial and normal cognitive response to trauma, which is individual negative perception of the traumatic event. It generally exists as negative coping method after trauma, ultimately leading to negative emotions (Calhoun. & Tedeschi, 2014). When a person consciously understands the reasons or ways in which an event occurs, deliberate rumination can occur. Its essence is the positive thinking of individuals on clues related to trauma, revising the core belief structure, which is beneficial for alleviating negative reactions, discovering the meaning of the posttraumatic world and promoting the PTG (Tedeschi et al., 2018). Discharge patients with acute coronary syndrome experienced rapid relief of symptoms such as pain and chest tightness after treatment. This could help patients develop a positive understanding of treatment methods and set new life goals. Research has found that acute patients with myocardial infarction who received routine follow-up continued to take medication for 6 weeks after discharge (Rymer et al., 2018). 38% of patients achieved the recommended targets about prescriptions of treatment and lifestyle targets at 6 months post myocardial infarction (Dibao-Dina et al., 2018). It is precisely because deliberate rumination triggers positive thinking patterns and healthy behaviors in patients, which promotes their posttraumatic growth (Liyan et al., 2020).

Indirect effect on posttraumatic growth

The results of model testing found that challenges to core beliefs, depression, social support had indirect effects on posttraumatic growth.

The mediating effect of deliberate rumination

Challenges to core beliefs had an indirect effect on posttraumatic growth through deliberate rumination in ACS patients followed up in outpatient clinics ($\beta = .03$, $p < .05$), but challenges to core beliefs did not have a direct effect on PTG. Thus, the second hypothesis was only partially supported. It was consistent with results of the previous research on adolescents who have suffered from natural disasters (Zhou. et al., 2014). Cognitive struggle with traumatic circumstances plays a key role in PTG. Highly stress life events or unexpected traumatic events can challenge or disrupt

a person's core beliefs (Tedeschi et al., 2018). Acute coronary syndrome generally occurs at unexpected times and locations, which often affects core beliefs of the patients about themselves, others, the world, and the future.

Challenges to core beliefs often leads to stress and emotional distress. Some Chinese studies have shown that ACS patients may experience physical and mental problems within one year of returning to society after discharge. For example, the study of Du et al. (2018) reported that patients with myocardial infarction after 3 and 6 months of discharge who returned to society had a fear of disease recurrence and death. In addition, long-term medication use, changes in lifestyle habits (such as diet), and conflicts arising from rebuilding interpersonal relationships have brought distress to them (Du. & Chen., 2018). In the traditional Chinese beliefs, it is believed to be medicine that contains medicine. It means that as long as medication is taken for a long time, it can have side effects on the body. Therefore, many patients express concerns after taking medication for a long time. Another qualitative study also reflected those patients with acute myocardial infarction after returning to work still experienced angina, which can affect the completion of work (Liu et al., 2011). Especially for the majority of young and middle-aged male patients in China, they are the mainstay of social development and the main source of income for families. Meanwhile, physical and social limitations caused by illness can lead to loneliness and avoidance (Liu et al., 2011).

Both challenges and emotional distress interactively initiate ruminative thoughts, rather than directly leading to posttraumatic growth. The formation of positive core beliefs shapes positive perception, thinking, and behavior patterns. Intrusive rumination is a normal part of initial negative responses to trauma, for most people, these invasive thoughts would fade over time and may be replaced or accompanied by deliberate rumination (Tedeschi et al., 2018). Positive rumination can effectively control a person's alcohol and fruit intake, leading to healthy behaviors (Riley et al., 2019). In this study, active participation in outpatient follow-up was also a healthy behavior among discharged ACS patients. People believe that they can survive on their own through healthy behavior, live in harmony with diseases, and have a profound reflection on death. These are all manifestations of post-traumatic growth. The negative core belief of loneliness can also be re-evaluated in one's

relationships with others and family under the influence of deliberate rumination, willing to accept and express love from others, leading to traumatic growth (Zeligman et al., 2017). It was related to the study of the Eze et al. (2020) has proven that deliberate rumination mediated the relationship of challenges to core beliefs with new possibilities, personal strength, spiritual growth, and relating to others (Eze et al., 2020b).

Social support had an indirect effect on posttraumatic growth through deliberate rumination in ACS patients followed up in outpatient clinics ($\beta = .26$, $p < .001$), but social support did not have a direct effect on PTG. Thus, the fourth hypothesis was partially supported, which was in line with prior studies (Dong et al., 2017; Wang et al., 2022). In this study, there is a significant positive correlation between social support and posttraumatic growth ($r =. 18$, $p <. 01$), but it does not indicate that social support has a significant impact on PTG. The utilization of social support and duration of obtaining social support are the factors that determines whether it affects PTG (Tedeschi et al., 2018). An interesting study showed that patients can significantly predict PTG three months after diagnosis of the disease, but there is no significant correlation between social support and PTG eight years later (Schroevers et al., 2010). It may suggest that social support level in the early and late stages of disease diagnosis has different effects on individuals. Thus, it can be seen that social support may or may not directly affect PTG. The discharge time and disease diagnosis time of ACS patients followed up in this study were different, which led to the fact that social support may not directly affect PTG in this study. Discharged ACS patients could receive various sources of social support at home, such as family, friends, community nurses, and cardiac rehabilitation patients. Low utilization or participation of various social support resources in patients may make negative emotions and the stress problems persist (Hung et al., 2020). This may also explain why social support cannot directly affect PTG.

Social support in the model of posttraumatic growth had been relabeled as self-disclosure. Disclosure can take many forms, most commonly through talking to others about traumatic events or write experiences in journals and social media. A person who felt higher perceived social support could feel a higher ability to self-disclose and more mental well-being (Nguyen et al., 2022). It is indicated that

discharged ACS patients prefer to express their emotional, cognitive, and traumatic experiences with the support from family, friends, and community professionals, promoting positive psychological cognition and mental well-being. As the model of PTG suggests, disclosure can also affect the cognitive processing that plays a major role in PTG (Tedeschi et al., 2018). Deliberate rumination might have a cognitive effect, such as cognitive awareness and cognitive reconstruction. In previous study, deliberate rumination caused by self-disclosure could result in growth after experiencing trauma (Ryu & Suh, 2022; Xie & Wang, 2023). Higher level of self-disclosure may help a person positively think about the causes or ways of traumatic events, correcting negative core beliefs, and promoting them to take positive measures for adapting the changing of living environments. Therefore, it well explained the mediating role of deliberate rumination in the relationship between social support and PTG. In addition, higher levels of social support predicted higher levels of adaptive coping (Cao et al., 2018). Active coping strategies adopted by patients with acute myocardial infarction after PCI led to deliberate rumination and promote post-traumatic growth (Zhai, 2022).

The mediating effect of resilience

Depression had an indirect effect on posttraumatic growth through resilience in ACS patients followed up in outpatient clinics ($\beta = -.21$, $p < .001$). Thus, the third hypothesis was supported. Research on patients with breast cancer also showed that resilience showed mediator that could regulate depression and PTG (Joohee et al., 2019; Li, Hou, et al., 2020). There are several reasons to explain this relationship.

Depression as a negative emotion can inhibit the increase of resilience through entering negative cognition, thereby hindering the development of PTG. The individuals with traumatic event who experienced more severe the depression showed lower resilience (Toledano-Toledano et al., 2021; Xiaolin et al., 2015). The reason may be that individuals with higher level of depression experienced lower resilience, making it difficult for their psychological state to recover to a normal state. Therefore, patients were unable to adapt well to traumatic events and exhibited negative cognitive and emotional changes, resulting in less growth.

Another potential explanation may be that discharged ACS patients with high-level depression may reduce their resilience by adopting negative coping

strategies, thereby hindering posttraumatic growth. Most patients with acute coronary syndrome received the treatment of percutaneous coronary intervention (PCI). A survey by Erasmus Medical Center shows that up to 81.4% of patients experienced depression after PCI (Jinling et al., 2016). Furthermore, Depression is positively correlated with avoidance and surrender coping strategies, so it means that patients with high levels of depression tend to adopt avoidance and surrender coping strategies (Gao. & Fan, 2023; Han et al., 2014). Resilience also appeared to be significantly lower among those with maladaptive coping (Morris et al., 2020), which further led to lower PTG.

Social support had an indirect effect on posttraumatic growth through resilience in ACS patients followed up in outpatient clinics ($\beta = .13$, $p < .001$). Thus, the fourth hypothesis was partially supported. The meta-analysis study found that predictive effect of social support on posttraumatic growth is not significant, and the effect of resilience on posttraumatic growth was greater than that of social support (Liu et al., 2021). It was indicated that more attention should be paid to strengthening their ability to restore psychological balance, such as resilience.

A Chinese study shows that 76.2% of myocardial infarction patients experienced moderate to high social support after 30-days discharge (Li, Dharmarajan, et al., 2019). It was illustrated that that ACS patients could receive sufficient resources after discharge at home, such as family emotional support, a sense of belonging, and material support. Therefore, when facing adversity and pressure, individuals need to fully mobilize their own and surrounding resources to adjust their mental for facing challenges. Social support is sufficient resources, which were provided to ACS patients after discharge including family emotional support, sense of belonging, and material support. Resilience would be affected in various forms of resources, thereby promoting PTG. In addition, a higher social support was positively associated with positive coping styles (Chen, Alston, et al., 2019), thus predicting fewer depressive symptoms. Adaptive coping strategies in patients could promote the patients, resilience (Macía et al., 2020). Therefore, it can be seen that ACS patients can effectively mobilize resources around them to positively cope with setbacks. Individual's psychological quality and resistance to traumatic events were enhanced, leading to a higher level of resilience and ultimately obtain PTG by solving problem.

The relationship between Hope and posttraumatic growth

In this study, hope is significantly and positively correlated with posttraumatic growth ($r = .32$, $P < 0.01$) in ACS outpatients who followed up at clinics. This result was consistent with a study on posttraumatic growth in cardiovascular disease (Gulzar et al., 2023). However, hope had a positive direct effect insignificantly on posttraumatic growth, and also had an insignificantly indirect effect on the posttraumatic growth through deliberate rumination. As a result, the first hypothesis was not supported. Hope can be defined as "a belief that one knows how to reach one's goals and a belief that one has the motivation to use those pathways to reach one's goals". Hope seems to play a significant role in reaching PTG. Several studies found that hope can positively predict the posttraumatic growth (Sperandio et al., 2022; Wang et al., 2021). But the relationship between hope and post-traumatic growth is not consistent. Some research findings also suggested that hope was not the significant predictor of posttraumatic growth (Lin et al., 2022; Subandi et al., 2014). Therefore, the relationship between hope and PTG in this study may be due to the short time of diagnosis of patients or the narrow range of hospitals selected for the survey or the different tools. In the future, we should further increase the sample size and select multiple hospitals for investigation to explore the relationship between the two variables.

Conclusion

Acute coronary syndrome is a traumatic event for patients. Posttraumatic growth (PTG) is positive psychological changes after encountering traumatic events, and that can bring beneficial outcomes to ACS patients. The ACS outpatients who had been discharged for 1 to 6 months and followed up at clinics reported moderate posttraumatic growth. Especially in terms of "appreciation of life", the growth is most prominent. ACS outpatients who had been discharged for 5 to 6 months experienced more PTG than Within four months. The hypothesized model with six factors derived from the theory and literature did not fit the data well, but the model-fit indices met the criteria after modifying the model, showing the effects of seven significant paths and five factors on posttraumatic growth. The total variance explained was 57% for

posttraumatic growth. The results of this study are explained by the Revised Model of Posttraumatic Growth. The five factors that influenced PTG were challenges to core beliefs, depression, social support, deliberate rumination, and resilience. Deliberate rumination, and resilience were mediators of posttraumatic growth. Resilience and depression were more stronger factors influencing posttraumatic growth.

Implications for nursing

The results of this study expound the influencing mechanism of six variables on posttraumatic growth in ACS outpatients who followed up at clinics. These are useful for nursing practice, nursing education, and nursing administration.

Implication to nursing practice

Screening for the posttraumatic growth of outpatients with acute coronary syndrome while following up at clinics could identify those who needs further intervention to improve posttraumatic growth. This study provides a basis for physicians, nurses, and psychotherapists to provide interventions to promote PTG for ACS outpatients during follow-up at clinics in the future.

A Chinese study found that deliberate rumination functions as an essential mechanism in the relationship between mindfulness and PTG (Lianchao & Tingting, 2020). Therefore, mindfulness techniques and cognitive-behavioral therapy can be used to change patients' negative core beliefs to rebuild positive cognition and promote post-traumatic growth. Mindfulness techniques include attempting mindfulness meditation exercises to enhance the patient's self-awareness, and practicing self-reflection through writing reflective diaries or engaging in conversations with others. Meanwhile, encouraging ACS outpatients to obtain social support through multiple channels can also help them establish positive cognition.

In addition, resilience can directly promote PTG, or indirectly affect the relationship between depression and PTG, as well as social support and PTG. Nurses and psychotherapists can use emotional resilience therapy based on emotional ABC theory to identify negative emotions (such as depression) in discharged patients, correctly recognize stress, and self-regulate emotion to improve resilience. Family support intervention, resilience training, health and resilience education and

mindfulness decompression therapy can also enhance resilience for promoting PTG (Kim et al., 2019).

Implication to nursing education

Nurse educators could use the conclusions by teaching nursing students about importance of posttraumatic growth in the rehabilitation of ACS patients, and factors affecting posttraumatic growth. Nursing student could better understand the relationship between psychological factors and PTG. Furthermore, nursing teachers can guide the nursing students make psychological nursing plan for ACS patients to generate positive psychological changes in clinical internship. This will also help nursing students deepen their understanding that acute coronary syndrome is a psychosomatic disease that requires more attention to psychological care for patients.

Implication to nursing administration

It is necessary to develop guidelines for follow-up management of ACS patients after discharge. Guidelines for follow-up management of ACS patients can include frequency and content of follow-up, monitoring and treatment of complications, medication management, lifestyle management, and psychological management. This study can provide a theoretical basis for the content and methods of psychological management plans in the follow-up management of ACS patients.

Limitation of the study

There are some limitations that should be considered in our study. First, the participants in this study were all selected from a tertiary care hospital in Jiangsu Province, China, indicating that the selected research subjects were not comprehensive. This limits the impact of generalizing research findings to adult patients with acute coronary syndrome. Second, the samples had different periods of illness and treatment, which could result in a varying level of posttraumatic growth. This study used a cross-sectional design, so data was only collected at a single time point. This would not be able to vertically understand the patterns of changes in posttraumatic growth in specific populations during different follow-up times. Thirdly, this study did not analyze the characteristics of posttraumatic growth from different demographic perspectives in depth, which will be the goal of future research.

Recommendations for future research

1. Further research could recruit sample from different city and hospital in China to have a better representation of Chinese ACS outpatients who followed up at clinics. Furthermore, researchers can also investigate the posttraumatic growth patterns of acute coronary syndrome after discharge in the community, facilitating community nurses and doctors to provide psychological care for patients. The results would expand the understanding of posttraumatic growth in China.

2. Longitudinal studies could be used in future research to track the posttraumatic growth of the same population after different treatment times, in order to understand the patterns of posttraumatic growth changes in patients with acute coronary syndrome. At the same time, it is possible to increase the tracking time and refine it to tracking by days, understanding the turning points of growth and decline after trauma. The discovery of the timing of low-level post-traumatic growth will be beneficial for clarifying the accurate timing of further intervention implementation.

3. Interventions should be developed to promote and enhance posttraumatic growth in ACS outpatients who followed up at clinics. The intervention program will be based on the outcome factors of this study and other existing research designs, including depression, challenges to core beliefs, deliberate rumination, social support, and resilience. Meanwhile, this study showed that ACS patients experienced lower posttraumatic growth during 1-2 months after discharge. Therefore, the intervention time can be considered in 1-2 months after discharge.

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APPENDICES

APPENDIX A

Institutional review board

สำเนา

ที่ IRB3-060/2565

เอกสารรับรองผลการพิจารณาจริยธรรมการวิจัยในมนุษย์

มหาวิทยาลัยบูรพา

คณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยบูรพา ได้พิจารณาโครงการวิจัย

รหัสโครงการวิจัย : G-HS030/2565

โครงการวิจัยเรื่อง : DETERMINANTS OF POSTTRAUMATIC GROWTH AMONG PATIENTS WITH ACUTE CORONARY SYNDROME

หัวหน้าโครงการวิจัย : MISSTANG NAN

หน่วยงานที่สังกัด : คณะพยาบาลศาสตร์

BUU Ethics Committee for Human Research has considered the following research protocol according to the ethical principles of human research in which the researchers respect human's right and honor, do not violate right and safety, and do no harms to the research participants.

Therefore, the research protocol is approved (See attached)

1. Form of Human Research Protocol Submission Version 2 : 8 July 2022
2. Research Protocol Version 2 : 8 July 2022
3. Participant Information Sheet Version 2 : 8 July 2022
4. Informed Consent Form Version 2 : 8 July 2022
5. Research Instruments Version 2 : 8 July 2022
6. Others (if any) Version - : -

วันที่รับรอง : วันที่ 11 เดือน กรกฎาคม พ.ศ. 2565

วันที่หมดอายุ : วันที่ 11 เดือน กรกฎาคม พ.ศ. 2566

ลงนาม *Assistant. Professor Ramorn Yampratoom*

(Assistant. Professor Ramorn Yampratoom)

Chair of The Burapha University Institutional Review Board

Panel 3 (Clinic / Health Science / Science and Technology)

MHESI 8137/1112

Graduate School, Burapha University
169 Longhaad Bangsaen Rd.
Saensuk, Muang, Chonburi
Thailand, 20131

August 2nd, 2022

To President of the Yancheng First People's Hospital,

Enclosure: 1. Certificate ethics document of Burapha University
2. Research Instruments (Try out)

On behalf of the Graduate School, Burapha University, I would like to request permission for Ms. Tang Nan to collect data for testing the reliability of the research instruments.

Ms. Tang Nan, ID 62810071, a graduate student of the Doctor of Philosophy program, major in Nursing Science (International Program), Faculty of Nursing, Burapha University, Thailand, was approved her dissertation proposal entitled: "Determinants of Posttraumatic Growth Among Patients with Acute Coronary Syndrome" under supervision of Assoc. Prof. Dr. Pornpat Hengudomsub as the principle advisor. She proposes to collect data from 30 patients who had been diagnosed with acute coronary syndrome after treatment for one to six months and come to follow-up visit at Out-patient clinics in Medical Ethics Department of Yancheng First People's Hospital, Jiangsu province. The participants will be recruited from who aged 25 to 65 years old, have stable conditions and no disabilities, be able to read and write Chinese, and no cognitive impairment screening by Mini-Mental State Examination. The data collection will be carried out from August 20 to September 20, 2022. In this regard, you can contact Ms. Tang Nan via mobile phone +86-1836-1075-796 or E-mail: 782098836@qq.com

Please do not hesitate to contact me if you need further relevant queries.

Sincerely yours,

(Assoc. Prof. Dr. Nujjaree Chaimongkol)
Dean of Graduate School, Burapha University

Carbon Copy: Mr. Deng Yijun

Graduate School Office
Tel: +66 3810 2700 ext. 701, 705, 707
E-mail: grd.buu@go.buu.ac.th
http://grd.buu.ac.th

MHESI 8137/1113

Graduate School, Burapha University
169 Longhaad Bangsaen Rd.
Saensuk, Muang, Chonburi
Thailand, 20131

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2. Research Instruments

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Please do not hesitate to contact me if you need further relevant queries.

Sincerely yours,

(Assoc. Prof. Dr. Nujjaree Chaimongkol)
Dean of Graduate School, Burapha University

Carbon Copy: Mr. Deng Yijun

Graduate School Office
Tel: +66 3810 2700 ext. 701, 705, 707
E-mail: grd.buu@go.buu.ac.th
http://grd.buu.ac.th

科研项目伦理审查批准件

伦审号【2022】-（K-046）

<table>
<tr><td>项目名称</td><td colspan="4">急性冠状动脉综合征患者创伤后成长决定因素研究</td></tr>
<tr><td>申请人</td><td colspan="2">唐楠</td><td>申请专业</td><td>心血管内科</td></tr>
<tr><td>审查人所在单位</td><td colspan="4">盐城市第一人民医院</td></tr>
<tr><td rowspan="3">审查材料</td><td>试验方案</td><td>有■ 无□</td><td rowspan="3">审查途径</td><td rowspan="3">会议审查□
快速审查■</td></tr>
<tr><td>知情同意书</td><td>有■ 无□</td></tr>
<tr><td>申报书</td><td>有□ 无■</td></tr>
<tr><td colspan="5">伦理委员会审评意见</td></tr>
<tr><td colspan="5">项目符合伦理学基本原则，同意申报。

主任委员签名：

日期：2022.08.09</td></tr>
</table>

APPENDIX B

Participant information and consent form

เอกสารชีแจงผู้เข้าร่วมโครงการวิจัย
(Participant Information Sheet)

รหัสโครงการวิจัย : .....G-HS030/ 2565..
(สำนักงานคณะกรรมการพิจารณาจริยธรรมในมนุษย์ มหาวิทยาลัยบูรพา เป็นผู้ออกรหัสโครงการวิจัย)
โครงการวิจัยเรื่อง : .....DETERMINANTS OF POSTTRAUMATIC GROWTH AMONG PATIENTS WITH ACUTE CORONARY SYNDROME.....

I am Ms. Nan Tang, a doctoral student in the faculty of nursing, Burapha University, Thailand. My study is “Determinants of posttraumatic growth among patients with acute coronary syndrome”. This study will focus on the patients who were diagnosed with Acute coronary syndrome after treatment for one to six months in Jiangsu Province. The objectives of research are to develop and test a hypothesized model of posttraumatic growth among acute coronary syndrome by testing the relationships of hope, challenges to core belief, depression, resilience, deliberate rumination, and social support to posttraumatic growth.. Now I'd like to invite you to join my research. Before you agree to participate in this study, I will introduce the details of the research to you.

This study will be a survey study. Participating in this study is voluntary. If you agree to participate in this study, you will sign the informed consent and answer the eight self-report questionnaires, including 112 items, which will take about 20-40 minutes. During the data collection procedure, the researcher will clarify any question proposed by the participants regarding the language or content. You will not get any direct benefits by participating in this study. However, the information collected from this study may be valuable in developing posttraumatic growth model which can help nurses find out the factors affecting posttraumatic growth and provide basis for Acute coronary syndrome patients to formulate effective measures to deal with trauma, so as to promote the recovery of patients' physical and mental health.
To avoid physical and psychological risk to the participants in the study during covid-19, a nurse will measure a patient's temperature and ask him to wear a mask before entering the clinic. Participants also will be asked to disinfect their hands with alcohol sanitizer and keep one meter distance between two persons. Only those with normal temperature and those without special symptoms can continue participating in the study.

You have the right to refuse to participate in the study and can withdraw from the study at any time, and no necessary to inform the researcher, and it will not affect the quality of services you receive from the cardiovascular clinic. Any information collected from this study, including

your identity, will be kept confidential. A coding number will be assigned to you and your name will not be used. Findings from the study will not disclose specific information from any individual participant. All data will be accessible only to the researcher, which will be destroyed one year after publishing the findings. You will receive a further explanation of the nature of the study upon its completion, if you wish.

The research will be conducted by Ms. Nan Tang under supervision of my major-advisor, Assistant Professor Dr. Khemaradee Masingboon. If you have any questions, please contact me at mobile number: + 18361075796 or by e-mail is 782098836@qq.com, or my advisor's e-mail khemaradee@nurse.buu.ac.th. If the researcher fails to comply with the provisions of the statement, you can contact Burapha University Institutional Review Board (BUU-IRB) by phone is 038-102-620 or email is buuethics@buu.ac.th .

Nan Tang

Chinese version

研究对象信息表

研究编号：.....

(人类伦理委员会办公室东方大学是研究项目代码的发布者)

研究项目：...急性冠状动脉综合征患者创伤后生长的决定因素.....

我是泰国东方大学护理学院的在读博士生。现在我想邀请您参加我的研究项目。在您同意参与本研究之前,我先向您详细介绍下项目的内容。本研究将调查急性冠脉综合征患者的希望、核心信念挑战、抑郁、心理弹性、反刍性沉思、社会支持与创伤后成长的关系。同时将验证和形成急性冠状动脉综合征创伤后成长的假设模型。

本次研究详细的研究过程内容如下。研究者首先将泰国东方大学护理学院准许收集数据的文件交给盐城市的第一人民医院。在获得医院的许可后，研究者将联系心内科门诊的护士长进行数据收集。本次研究收集数据的地点是在医院心内科门诊，针对的人群主要是来医院门诊进行随访且出院后 1-6 个月的急性冠脉综合征患者。研究者将招募心内科门诊的一名护士作为助理来协助自己收集数据。护士将向符合研究条件的参与者解释研究目的、方法和过程，并且让同意参与研究的参与者签署知情同意书。本研究主要采用调查问卷形式进行研究，主要包括 8 个调查问卷和 112 个条目。全部问卷的完成大约需要 20-40 分钟。在填写问卷的过程当中，如果参与者因视力问题无法阅读题目时，研究者可大声帮其读出题目并且帮其标注答案；如果参与者出现任何不适时，研究者立即停止研究，然后通知门诊护士、医生为其提供治疗与照护。

急性冠脉综合征作为一种急性创伤性事件，给患者带来了一些负面影响，比如抑郁、活动受限、恐惧、社会孤立感等。创伤后成长作为应对创伤事件的积极心理反应可以为重建急性冠脉综合征患者的健康心理状态提供研究思路。本研究结果将有助于医护人员了解急性冠脉综合征患者心理资源和心理需求，及时发现影响创伤后成长的因素。这可以帮助医护人员为急性冠脉综合征患者制定有效应对早期创伤的措施提供依据，以达到促进患者身心健康恢复和提高其生活质量的目的。

本研究的所有参与者都遵循自愿参与原则。研究参与者有权拒绝参与研究项目，并且可以随时退出研究，拒绝或退出研究的参与者的权利不会任何影响。为了保障参与者的权益，研究者将对参与者提供的所有信息进行保密，并且研究者不会以任何的方式透

露参与者的个人信息。如果研究者要向机构披露参与者的信息，他们必须获得参与者的许可。

如果您想参加本次研究或者对本次研究有任何的疑问，您可以通过电话(+183 61075796)或者电子邮箱（782098836@qq.com）联系我。或者联系我的导师（khemaradee @nurse.buu.ac.th）。如果研究者未能遵守声明中的规定，您可以向泰国东方大学人类研究伦理委员会进行投诉。请投诉者在电话（038-102-620）或电子邮件（buuethics @buu.ac.th）中详细说明违反声明的内容。

唐 楠

เอกสารแสดงความยินยอม

ของผู้เข้าร่วมโครงการวิจัย (Consent Form)

รหัสโครงการวิจัย : .....G-HS030/ 2565. . .....

(สำนักงานคณะกรรมการพิจารณาจริยธรรมในมนุษย์ มหาวิทยาลัยบูรพา เป็นผู้ออกรหัสโครงการวิจัย)

โครงการวิจัยเรื่อง ...DETERMINANTS OF POSTTRAUMATIC GROWTH AMONG PATIENTS WITH ACUTE CORONARY SYNDROME.....

Date of data collection..... Month ..... Year.....

I have been informed of the purpose of the research project, research methods and other details prior to signing the informed consent of the participants in this research project. The researcher has explained it to me on the participant information sheet, and I fully understand it. Moreover, I asked the researchers questions about the research, and the researchers gave me satisfactory answers. I am now willing to participate in this research without reservation.

In this study, I understand the following points. First, I can withdraw from the study at any time without any discrimination or retaliation, and my medical treatment and rights will not be affected in any way. Secondly, all the information I provide will be kept confidential, and my personal identity information will not be disclosed when the research results are published. If researchers disclose my information to various institutions, they must obtain my permission. Third, I can always ask the researcher for more information. I will get a signed and dated copy of the consent form.

I have read the above statement and have a good understanding of all aspects. Finally, I agree to sign the document proving my willingness to participate in this study.

Signature of approver: .....

Witness signature: ……

BUU-IRB Approved
11 Jul 2022

Chinese version:

研究参与者
同意文件(知情同意书)

研究编号 : .....
(人类伦理委员会办公室东方大学是研究项目代码的发布者)
研究项目： ...急性冠状动脉综合征患者创伤后生长的决定因素.....

收集数据日期：..... 年.....月 ..... 日

在签署本研究项目参与者的知情同意书之前，我已被研究者告知了研究目的、研究方法和其他细节。研究者在参与者信息表上也已向我解释了这一点，我完全能够理解。另外，我还向研究者咨询了有关本研究的一些疑问，均已得到满意答案。我将愿意毫无保留地参与这项研究。

在这项研究中，我得知了以下几点。首先，我可以随时退出研究，不会受任何歧视或报复，医疗和权利也不会受到任何影响。第二，我提供的所有信息都将被保密，并且研究结果公布时也不会披露我的个人身份信息。如果研究者要向各个机构披露我的信息，他们必须获得我的许可。第三，我可以随时向研究人员询问更多的信息，而且我将得到一份签字并注明日期的同意书副本。

我已阅读上述声明，并且对所有内容都有了很好的理解。我同意签署证明自己愿意参加本项研究的文件。

同意人签名：.....

证人签名：.....

APPENDIX C

Questionnaires

Part 1 Chinese version of Demographic Record Form

收集数据工具

调查编号：_____ 调查日期：____年_____月_____日

说明：我们诚邀您参加一项关于急性冠脉综合征患者创伤后成长的研究，主要是通过填写问卷调查表来参与，这个过程是免费的和匿名填写。我们向您保证，获得的所有信息仅用于本研究，您所填写的信息都会被保密。请完成基本特征资料的填写，在每个题目前的方框里“√”或者在横线上填写答案。健康资料将由研究者依据您在医院的医疗记录单进行填写。再次感谢您的配合，祝您身体健康。

第一部分 基本资料

一、基本特征资料(由参与者填写)

1. 年龄：

2. 身高：_____cm，体重_____kg

3. 性别：□男 □女 □其他

4. 学历：

□小学以下 □小学 □初中 □高中 □大专及以上

5. 您目前和谁居住在一起？

□独居 □和家人住在一起 □和朋友住在一起

6. 医疗费用的支付方式：□医疗保险 □自费

7. 吸烟情况：□从不吸烟 □过去吸烟，现在仍在吸烟

□过去吸烟，现在戒烟

8. 饮酒史：□从不喝酒 □过去喝酒，现在还在喝

□过去喝酒，现在戒酒

9. 平时你在体育活动上花费多长时间：每周_____天；每天____小时。

二、健康资料(由研究者填写)

1. 您目前是接受急性冠脉综合征治疗后的第_____个月

2. 半年内去心血管门诊进行就诊次数：_____次

3.急性冠脉综合征的类型是：

□ST 段抬高心肌梗死　　□非 ST 段抬高心肌梗死

□不稳定型心绞痛

4.您在院接受的治疗包括：

□药物　　□经皮冠状动脉介入治疗　　□心脏康复

□冠状动脉旁路移植术

7.合并症：

□无　　□高血压　　□高脂血症　　□糖尿病　　□其他

6.BMI：_____ kg/cm^2

Part 2 The Chinese version of Herth Hope Index

HERTH 希望量表(HHI)

指导语：以下希望调查表 12 条是关于目前您对生活的态度及信念等方面的调查。每个条目分为四个等级，即：（1）非常不同意（2）不同意（3）同意（4）非常同意，请您仔细阅读每个条目，并在相应的位置处划“√”。

项目	非常不同意	不同意	同意	非常同意
1. 我用积极的态度对待生活				
2. 我有短期、中期或长期的目标				
3. ……				
4. ……				
5. ……				
6. ……				
7. ……				
8. ……				
9. ……				
10. ……				
11. ……				
12. 我感到我的生活很有意义和价值				

Part 3 The Chinese version of the Core Beliefs Inventory

核心信念量表（CBI）

指导语：在上述事件中，有些事件所带来的影响非常大，以至于我们自己的内心世界都会受到撼动，甚至颠覆我们原有的信念和看法。在这些事情发生后，你是否重新审视自己的信念和看法？请您根据自己的实际感受作答，并在相应的位置处划“ √ ”。

项目	从未经历	很少经历	有时经历	较常经历	经常经历	总是经历
1.由于这一事件的发生，我认真地反思了各种事情发生在人们身上的公平程度						
2.……						
3.……						
4.……						
5.……						
6.……						
7.……						
8.……						
9.由于这一事件的发生，我认真地反思了我对于自身价值作为一个人的价值所持有的信念						

Part 4 The Chinese version of Patients Health Questionnaire Depression Scale

病人健康问卷抑郁量表（PHQ-9）

说明：在过去两个星期，有多少时候您受到以下任何问题所困扰？请您根据自己的实际感受作答，并在相应的位置处划“ √ ”。

条目	没有	好几天	一半以上的天数	几乎每天
1. 做事时提不起劲或没有兴趣				
2. 感到心情低落、沮丧或绝望				
3. ……				
4. ……				
5. ……				
6. ……				
7. ……				
8. ……				
9. 有不如死掉或用某种方式伤害自己的念头				

Part 5 The Chinese version of Multidimensional Scale of Perceived Social Support

领悟社会支持量表(MSPSS)

指导语：以下 12 个句子，每一个句子后面各有 7 个答案。请你根据自己的实际情况在每题选项前的方框内“√”。

1.在我遇到问题时有些人（领导、亲戚、同事）会出现在我的身旁

□极不同意 □很不同意 □稍不同意 □中立 □稍同意 □很同意 □极同意

2.我能够与有些人（领导、亲戚、同事）共享快乐与忧伤

□极不同意 □很不同意 □稍不同意 □中立 □稍同意 □很同意 □极同意

3.……

4.……

5.……

6.……

7.……

8.……

9.……

10.……

11.……

12.我能与朋友们讨论自己的难题

□极不同意 □很不同意 □稍不同意 □中立 □稍同意 □很同意 □极同意

Part 6 The Chinese version of Event Related Rumination Inventory ——Deliberate rumination subscale

事件相关反刍性沉思量表(ERRI)

指导语：人们经历一件特定事件（意外或灾害）后，有时会发现，即使他们没有刻意地思考，也会经常想到那件事；或他们会有意地（有目的地）思考那次事件。请在以下表述中，根据您自己经历特定事件后几周内（或最近几周）的感受在方框内打“√”。

经历这次疾病后……	从来没有	很少	有时	经常
1.我思考是否可以从那次经历中找到有意义的东西				
2.……				
3.……				
4.……				
5.……				
6.……				
7.……				
8.……				
9.……				
10.我思考过那件事，并试图弄清楚发生了什么				

Part 7 The Chinese version of Connor-Davidson Resilience Scale

心理弹性量表 (CD- RISC)

说明：本问卷旨在了解你在经历创伤事件后的心理状态恢复程度。根据你最真实的感受，请在每道题后相应的选项里“√”。所有信息都是保密的。

项目	从不	很少	有时	经常	一直 总是
1. 当发生变化时，我能够适应					
2. ……					
3. ……					
4. ……					
5. ……					
6. 当面对问题时，我试着去看事情幽默的一面					
7. ……					
8. ……					
9. ……					
10. ……					
11. ……					
12. ……					
13. ……					
14. ……					
15. ……					
16. 我不会轻易地被失败打倒					
17. ……					
18. ……					
19. ……					
20. ……					
21. ……					
22. ……					
23. ……					
24. ……					
25.我为自己的成就而感到自豪					

Part 8 The Chinese version of Posttraumatic Growth Inventory

创伤后成长量表（PTGI）

说明：下表是了解这次突发的疾病是否会给您带来一些变化，请仔细阅读每个句子，然后对应每个题目，选择一个最接近您目前状况的答案并打上“√”。

经历这次意外后我认为……	完全没有	非常少	少	有些	多	非常多
1.我改变了生命中重要事务的先后顺序						
2.我对自己的生命价值有了更多的欣赏（积极认识）						
3. ……						
4. ……						
5. ……						
6. ……						
7. ……						
8. ……						
9 ……						
10. ……						
11.我能以我的生命做更好的事情						
12. ……						
13. ……						
14. ……						
15. ……						
16. ……						
17. ……						
18. ……						
19. ……						
20.我更接受自己需要他人						

APPENDIX D

Permission instruments

The permission of Connor-Davidson Resilience Scale

安全浏览模式 优化阅读 精简信息

发件人：唐楠<tangnan0220@163.com>

收件人：jonathan.davidson<jonathan.davidson@duke.edu>

时 间：2022年03月09日 20:12 (星期三)

发送状态：**发送成功** 查看详情

翻译成中文

【升级】邮箱会员，更安全的邮箱体验，更大的存储空间，提高办公效率！

Dear Prof. Davidson,

I am Tang Nan, a doctoral candidate majoring in nursing at Burapha University in Thailand. Meanwhile, I am also a nursing teacher at Jiangsu province, China. The title of my current doctoral thesis is "Determinants of post-traumatic growth in patients with acute coronary syndrome". I have had the privilege of reading the findings about resilience from your research. I am very interested in the "Chinese version of Connor-Davidson Resilience Scale" that translated and revised by Prof. Yu Xiaonan. I will plan to use this scale in my doctoral thesis research. Prior to this, I had already contacted Professor Yu. Prof. Yu told me that I need get the permission from you about using the "Chinese version of Connor-Davidson Resilience Scale". Therefore, I would like to obtain your permission before using the scale. If I could obtain your permission, I would greatly appreciate it, and I believe it will have a positive impact on the promotion of my research. Looking forward to your reply!

Best wishes!

Tang Nan

Re: The permission of Connor-Davidson Resilience Scale

安全浏览模式 优化阅读 精简信息

发件人：Jonathan Davidson, M.D.<jonathan.davidson@duke.edu>

收件人：唐楠<tangnan0220@163.com>

时 间：2022年03月10日 09:21 (星期四)

附 件：1个 (Tang Nan 121523a.doc) 查看附件

翻译成中文

【升级】邮箱会员，更安全的邮箱体验，更大的存储空间，提高办公效率！

Dear Tang:

Thank you for your inquiry. We would be pleased to send the Chinese RISC, and enclose an agreement for you to kindly complete, sign and return, with arrangements for paying the $33 fee. The scale will then be duly sent.

Sincerely,

Jonathan Davidson

Re: The permission of Connor-Davidson Resilience Scale

安全浏览模式 优化阅读 精简信息

发件人：Jonathan Davidson, M.D.<jonathan.davidson@duke.edu>

收件人：唐楠<tangnan0220@163.com>

时 间：2022年03月12日 17:11 (星期六)

附 件：3个 (a Manual 010124 FINAL RO.docx 等) 查看附件

【升级】邮箱会员，更安全的邮箱体验，更大的存储空间，提高办公效率！

Dear Tang:

Thank you for your reply. Please find attached the Chinese R-25 and related materials.

Wishing you all the best of success,

Jonathan Davidson

The permission of Herth Hope Index (Chinese version)

安全浏览模式 优化阅读 精简信息

发件人：唐楠<tangnan0220@163.com>

收件人：zhaohp212<zhaohp212@163.com>

时 间：2022年03月14日 10:05 (星期一)

发送状态：发送成功 查看详情

【升级】邮箱会员，更安全的邮箱体验，更大的存储空间，提高办公效率！

赵教授，您好！

我是目前就读于泰国东方大学护理专业的博士生唐楠，也是江苏医药职业学院的一名护理教师。我目前博士论文的题目是“急性冠状动脉综合征患者创伤后成长的决定因素的模型研究”。我有幸阅读了您关于这方面的研究成果，如《血液透析患者的社会支持和希望》（2000年发表在《中华护理杂志》）。我对你修订的中文版的Herth 希望量表很感兴趣，计划在未来的研究中使用这个量表。因此，在使用量表前想获得您的许可，如果能获得您的允许，我将万分感谢，我也相信这将对本研究的推广起到积极的作用。期待您的回信！祝好！

Re:The permission of Herth Hope Index (Chinese version)

安全浏览模式 优化阅读 精简信息

发件人：中国医科大学护理学院赵海平<zhaohp212@163.com>

收件人：唐楠<tangnan0220@163.com>

时 间：2022年03月15日 14:06 (星期二)

邮件已被回复 查看详情

【升级】邮箱会员，更安全的邮箱体验，更大的存储空间，提高办公效率！

唐楠老师你好！

我同意授权你在研究中使用中文版"Herth希望调查表"，并祝愿你研究顺利！

赵海平
中国医科大学护理学院

The permission of Chinese version of the Core Beliefs Inventory

安全浏览模式 优化阅读 精简信息

发件人：唐楠<tangnan0220@163.com>

收件人：xwu2003<xwu2003@163.com>

时 间：2022年03月29日 20:46 (星期二)

发送状态：发送成功 查看详情

【升级】邮箱会员，更安全的邮箱体验，更大的存储空间，提高办公效率！

Dear Professor Wu,

I am Tang Nan, a doctoral candidate majoring in nursing at Burapha University in Thailand. The title of my current doctoral thesis is “Determinants of post-traumatic growth in patients with acute coronary syndrome”. I have had the privilege of reading the research findings from you. I am very interested in the “Chinese version of the Core Beliefs Inventory” formed by your translation and revise. I will plan to use this scale in my doctoral thesis research. Therefore, I would like to obtain your permission before using the scale. If I could obtain your permission, I would greatly appreciate it, and I believe it will have a positive impact on the promotion of my research. Looking forward to your reply! Best wishes!

伍教授，您好！我是目前就读于泰国东方大学护理专业的博士生唐楠。我目前博士论文的题目是“急性冠状动脉综合征患者创伤后成长的决定因素的模型研究”。我有幸阅读了您的研究成果，我对你翻译、修订的中文版的核心信念问卷很感兴趣，计划在未来的研究中使用这个量表。因此，在使用量表前想获得您的许可，如果能获得您的允许，我将万分感谢，我也相信这将对我研究的推广起到积极的作用。期待您的回信！祝好！

Re:The permission of Chinese version of the Core Beliefs Inventory

安全浏览模式 优化阅读 精简信息

发件人：xwu2003<xwu2003@163.com>

收件人：唐楠<tangnan0220@163.com>

时 间：2022年04月06日 09:40 (星期三)

【升级】邮箱会员，更安全的邮箱体验，更大的存储空间，提高办公效率！

好的，祝你研究顺利！

The permissiom of Event Related Rumination Inventory

安全浏览模式 优化阅读 精简信息

发件人：唐楠<tangnan0220@163.com>

收件人：dqc760208<dqc760208@163.com>

时 间：2022年03月31日 15:45 (星期四)

发送状态：发送成功 查看详情

Dear Dr. Dong,

I am Tang Nan, a doctoral candidate majoring in nursing at Burapha University in Thailand. The title of my current doctoral thesis is "Determinants of post-traumatic growth in patients with acute coronary syndrome". I have had the privilege of reading your research findings. I am very interested in the "simplified Chinese Version of Event Related Rumination Inventory" formed by your translation and revise. I will plan to use this scale in my doctoral thesis research. Therefore, I would like to obtain your permission before using the scale. If I could obtain your permission, I would greatly appreciate it, and I believe it will have a positive impact on the promotion of my research. Looking forward to your reply! Best wishes!

董教授，您好！我是目前就读于泰国东方大学护理专业的博士生。我目前博士论文的题目是“急性冠状动脉综合征患者创伤后成长的决定因素的模型研究”。我有幸阅读了您的研究成果。我对你翻译、修订的简体中文版事件相关反刍性沉思问卷很感兴趣，计划在未来的研究中使用这个量表。因此，在使用量表前想获得您的许可，如果能获得您的允许，我将万分感谢，我也相信这将对我的研究的推广起到积极的作用。期待您的回信！祝好！

Re:The permissiom of Event Related Rumination Inventory

安全浏览模式

发件人：dqc760208<dqc760208@163.com>

收件人：唐楠<tangnan0220@163.com>

时 间：2022年04月14日 06:27 (星期四)

好的，感谢你的关注，希望对你的研究有所帮助！

The permission of the Patients Health Questionnaire Depression Scale

安全浏览模式 优化阅读 精简信息

发件人：唐楠<tangnan0220@163.com>

收件人：jinp1129<jinp1129@126.com>

时 间：2022年04月18日 12:45 (星期一)

发送状态：发送成功 查看详情

金教授，您好！我是目前就读于泰国东方大学护理专业的博士生。我目前博士论文的题目是“急性冠状动脉综合征患者创伤后成长的决定因素的模型研究”。我有幸阅读了您的研究成果。我对你翻译、修订的PHQ-9量表很感兴趣，计划在未来的研究中使用这个量表。因此，在使用量表前想获得您的许可，如果能获得您的允许，我将万分感谢，我也相信这将对我研究的推广起到积极的作用。期待您的回信！祝好！

Tang Nan

Re:The permission of the Patients Health Questionnaire Depression Scale

安全浏览模式 优化阅读 精简信息

发件人：jinp1129<jinp1129@126.com>

收件人：唐楠<tangnan0220@163.com>

时 间：2022年04月26日 14:11 (星期二)

Dr.唐你好！

我同意你在研究中使用PHQ-9量表，祝你学业顺利！

在 2022-04-18 12:45:17，"唐楠" <tangnan0220@163.com> 写道：

- 隐藏引用文字 -

> 金教授，您好！我是目前就读于泰国东方大学护理专业的博士生。我目前博士论文的题目是“急性冠状动脉综合征患者创伤后成长的决定因素的模型研究”。我有幸阅读了您的研究成果。我对你翻译、修订的PHQ-9量表很感兴趣，计划在未来的研究中使用这个量表。因此，在使用量表前想获得您的许可，如果能获得您的允许，我将万分感谢，我也相信这将对我研究的推广起到积极的作用。期待您的回信！祝好！
>
> Tang Nan

The permission of Posttraumatic Growth Inventory（Chinese version）

安全浏览模式 精简信息

发件人：唐楠<tangnan0220@163.com>

收件人：xhliu<xhliu@smmu.edu.cn>

时 间：2022年04月17日 23:34 (星期日)

发送状态：发送成功 查看详情

【升级】邮箱会员，更安全的邮箱体验，更大的存储空间，提高办公效率！

刘教授，您好！

我是目前就读于泰国东方大学护理专业的博士生唐楠，也是江苏医药职业学院的一名护理教师。我目前博士论文的题目是“急性冠状动脉综合征患者创伤后成长的决定因素的模型研究”。我有幸阅读了您和汪教授关于这方面的研究成果，如《创伤后成长评定量表的修订及信效度分析》（2011年发表在《护理学杂志》）。我对您和汪教授修订的创伤后成长评定量表很感兴趣，计划在未来的研究中使用这个量表。因此，在使用量表前想获得您的许可，如果能获得您的允许，我将万分感谢，我也相信这将对本研究的推广起到积极的作用。期待您的回信！祝好！

The permission of Posttraumatic Growth Inventory （Chinese version）

安全浏览模式

发件人：xhliu<xhliu@smmu.edu.cn>

收件人：唐楠<tangnan0220@163.com>

时 间：2022年04月21日 07:03 (星期四)

【升级】邮箱会员，更安全的邮箱体验，更大的存储空间，提高办公效率！

唐老师你好！

你可以使用本量表于你的研究中，望你将研究推广应用，祝顺利！

刘

2022.04.21

APPENDIX E

Evaluation of assumptions

Table 10 Test of outliers by Z-score in the study variables (n = 396)

ID	ZHOPE	ZCCB	ZDEP	ZSS	ZDR	ZRESI	ZPTG
1	-1.89085	-.82905	1.76522	-1.78403	-1.12376	-1.66009	-1.50312
2	-1.03151	-2.09713	-.96963	-.29598	1.26315	.94201	.07391
3	-1.03151	-.57544	.39780	-.38351	.81560	-1.08763	-.36766
4	-1.17473	-.95586	.12431	-1.08377	1.26315	.10934	-.11533
5	.11429	1.19987	-.28592	-1.34637	1.11397	.42159	-.30458
6	-.74506	-1.58990	.94477	-.20844	1.11397	.00526	-.11533
7	-1.03151	-1.46309	-.28592	-1.34637	.81560	.05730	.89397
8	-1.60440	-1.58990	-.01243	-2.39676	.96479	-.87946	.20008
9	-.17216	-.95586	-.01243	-2.39676	1.11397	-.09883	.45240
10	-.60183	-1.71671	-.55940	-1.95909	.81560	.42159	.83089
11	.40074	-2.35074	-.83289	-.38351	-2.01886	-2.07642	.64165
12	-.88828	-.44863	.67128	-.20844	.81560	.05730	.26316
13	-.45861	-1.08267	-.83289	.14169	-.67622	.94201	-.55690
14	.25751	-2.35074	-1.10637	1.45468	1.41233	1.20222	1.58787
15	-1.03151	-1.33628	-.55940	-2.57182	-2.01886	-.30700	-.43074
16	-.74506	-1.58990	-.83289	.22922	.51724	.52568	.01083
17	-.45861	.05860	-.69614	.22922	1.26315	-.41108	-.30458
18	-.88828	-1.84351	2.31219	-2.92195	-2.01886	-2.64889	-1.69237
19	-2.03408	-.44863	.53454	-3.00949	-.52703	-.04679	-.43074
20	.11429	-.32182	2.03870	-1.78403	-1.12376	-.82742	-1.44004
21	-.31538	-.32182	-.69614	.22922	.66642	.36955	.76781
22	-1.46118	-1.20948	2.03870	.05416	.81560	.05730	-.55690
23	-2.17730	-.19501	.94477	.40429	.96479	-.20291	-.24149
24	-.45861	-.70224	-.01243	-.99624	.06969	-1.60805	.07391
25	-.60183	-1.71671	1.35499	-2.39676	-1.86967	-2.49276	-1.56621
26	-.88828	-2.85797	1.08151	-.99624	-1.57131	-1.08763	-1.12463
27	-.60183	-2.35074	.12431	1.10455	.81560	-.61925	-.05225
28	-.60183	-.57544	.39780	.31675	-1.57131	-1.08763	-1.12463
29	-.60183	-2.60436	.39780	-.03338	1.26315	-.04679	.26316
30	-1.46118	-1.20948	1.90196	-3.27208	-1.42213	-2.70093	-1.81853
31	-1.03151	.56583	1.35499	-.20844	1.26315	.16138	-.30458
32	-.17216	-.06821	1.90196	.05416	-.52703	-1.39988	.64165
33	-.45861	-.32182	.26105	.75442	.81560	-.04679	1.27246
34	-2.32053	.56583	.94477	-.38351	1.26315	-.20291	-.49382
35	-1.46118	.18541	-.96963	-1.17130	.51724	.42159	.51548
36	-2.17730	-.57544	-1.10637	-.20844	1.26315	.78589	-.87231
37	-1.46118	-.32182	1.76522	.22922	-2.31722	.21342	-1.31388

Table 10 (Continued)

ID	ZHOPE	ZCCB	ZDEP	ZSS	ZDR	ZRESI	ZPTG
38	.40074	-.70224	2.31219	-2.13416	-2.46640	-1.39988	-1.44004
39	-.60183	-1.20948	-.55940	-2.04663	.96479	-.20291	.57857
40	-.88828	-.19501	-.96963	1.01701	.96479	.83793	.01083
41	-2.32053	1.07306	-.83289	.14169	1.11397	.68180	1.20938
42	-.31538	-.19501	.12431	-.29598	.66642	-.72333	-.61998
43	-.31538	.05860	-.42266	.57935	1.11397	1.04610	.76781
44	-.31538	-.44863	2.17545	-.64611	-.82540	-2.23255	-.49382
45	-.88828	.56583	-.28592	.57935	.96479	.47364	.45240
46	-1.31795	.81945	.80802	-1.17130	.81560	-1.39988	-.11533
47	-.45861	.43902	1.49173	.40429	.36806	.31751	-.43074
48	-1.46118	-1.33628	.94477	-1.69650	-.97458	-1.60805	1.08322
49	-.17216	.56583	-.14917	.75442	1.26315	.88997	.38932
50	-.45861	.56583	-.69614	-1.78403	1.11397	.94201	.26316
51	-.45861	1.58029	-1.10637	1.71727	1.41233	1.20222	1.58787
52	-.60183	.69264	-.01243	.75442	.81560	.00526	.20008
53	-.02893	-1.97032	1.35499	1.54221	-.67622	.88997	.45240
54	-.60183	-.32182	-.83289	.40429	-.52703	-1.50396	-.74615
55	-1.31795	.31222	.26105	-.12091	1.26315	-.20291	.26316
56	-1.46118	-2.22394	-.69614	.31675	-1.72049	.78589	.51548
57	-1.03151	-1.58990	-.96963	-.47104	1.26315	.62976	-.61998
58	-.31538	-.06821	-.28592	-1.78403	.81560	.26547	-.05225
59	.54396	-.95586	-.96963	.66688	.96479	.73385	.64165
60	-.31538	.81945	2.03870	.92948	-1.72049	.68180	-2.07086
61	-.31538	-.57544	-.28592	.84195	.66642	.26547	-.80923
62	-1.31795	-.32182	-.96963	1.10455	1.26315	-1.97234	-.93539
63	-.45861	-.44863	-.83289	.31675	1.26315	.21342	-.55690
64	-1.31795	-.70224	.26105	1.36714	-.52703	-1.19171	-.17841
65	-.02893	.43902	-.01243	.05416	1.26315	-.04679	.32624
66	-.31538	-.06821	-.69614	.05416	.21888	.31751	-.87231
67	-.74506	.56583	-1.10637	-.03338	.81560	.42159	.70473
68	-1.03151	2.08752	2.31219	**-3.44715**	-2.46640	-3.01318	-3.20632
69	-1.03151	-.44863	-.96963	.57935	.81560	.73385	-.24149
70	-.31538	1.58029	.12431	.40429	.66642	-.20291	.76781
71	.40074	1.19987	.80802	.14169	.96479	-.30700	.70473
72	-1.17473	-.70224	-.28592	.92948	.36806	.05730	.51548
73	-.88828	-.70224	2.44893	-1.34637	-1.86967	.62976	-1.31388
74	-.17216	-.95586	-.96963	-.47104	-.22867	.68180	-.99847

Table 10 (Continued)

ID	ZHOPE	ZCCB	ZDEP	ZSS	ZDR	ZRESI	ZPTG
75	-.60183	-1.71671	-.55940	1.27961	-.52703	1.09814	1.46171
76	-.31538	1.07306	-.83289	.84195	1.26315	.52568	.32624
77	.25751	.18541	-.14917	.22922	.96479	.73385	1.14630
78	-1.31795	-1.08267	-.69614	-1.25883	-.52703	.68180	-.36766
79	-.74506	-1.58990	1.90196	-3.18455	-2.16804	-2.64889	-1.75545
80	-1.74763	-1.46309	-.01243	-1.69650	1.26315	-.25495	-.43074
81	-.45861	-2.22394	-.83289	-1.43390	-1.27295	.88997	.45240
82	-.31538	.05860	.26105	-.29598	1.11397	-.04679	.51548
83	.54396	-.19501	-.83289	.40429	1.11397	-.35904	-.80923
84	-.60183	1.32668	-.42266	-.20844	.66642	.52568	.83089
85	-.88828	.56583	-.83289	-.82117	-2.16804	1.20222	-.99847
86	-.02893	-.19501	-.42266	-.64611	.66642	-.61925	.32624
87	-.88828	.81945	-.28592	.75442	.81560	.47364	.95705
88	-.45861	.05860	-.55940	-.20844	1.11397	.10934	.20008
89	-.60183	.18541	-.96963	-.55857	-.52703	.26547	.57857
90	-.60183	-.95586	-.55940	.84195	1.11397	1.04610	-.61998
91	-.31538	-1.97032	1.90196	-2.04663	-2.16804	-2.28459	-1.75545
92	-.60183	1.58029	-1.10637	1.89234	1.41233	1.15018	1.77711
93	-.74506	1.70710	-.96963	1.01701	.81560	.36955	1.14630
94	.40074	.43902	-.28592	1.71727	1.11397	.62976	.76781
95	.11429	.56583	-.83289	.40429	1.11397	.62976	-.55690
96	-.17216	.69264	-.42266	.22922	-.37785	.62976	.32624
97	-1.17473	.18541	-.55940	.31675	.51724	.05730	.45240
98	-2.46375	-1.46309	-.55940	1.19208	-.82540	.99406	1.33554
99	-.74506	.81945	-.55940	-.64611	.51724	.26547	.83089
100	.68719	-.70224	-.42266	-1.25883	1.26315	1.04610	1.46171
101	-.45861	-2.09713	1.21825	-.99624	-2.46640	-2.38868	-.99847
102	1.26009	-1.20948	-.28592	-.12091	.96479	.36955	-.49382
103	-.02893	-.44863	-.28592	.05416	.51724	.62976	-.68306
104	1.40331	1.96071	-.83289	.84195	-1.86967	.10934	-1.18772
105	.83041	2.08752	-.14917	-.82117	.66642	.47364	.95705
106	1.26009	1.07306	-.28592	1.71727	.81560	.73385	1.08322
107	-.45861	1.07306	.39780	-1.08377	-.82540	-.25495	-.49382
108	1.11686	-1.33628	-.28592	.66688	1.26315	.36955	.13700
109	1.26009	-1.46309	-1.10637	1.10455	-1.86967	1.04610	1.27246
110	-.17216	-1.33628	2.03870	-1.60896	-2.01886	-1.03558	-1.37696
111	.97364	.81945	-.69614	.49182	.66642	.26547	-.24149
112	.54396	1.45348	-1.10637	.22922	1.41233	.99406	1.65095

Table 10 (Continued)

ID	ZHOPE	ZCCB	ZDEP	ZSS	ZDR	ZRESI	ZPTG
113	.40074	1.07306	-.14917	1.62974	.96479	.88997	-.17841
114	1.11686	-.44863	2.03870	1.54221	1.11397	1.04610	-.80923
115	1.40331	.81945	-1.10637	-.29598	.66642	1.20222	1.20938
116	1.26009	-1.08267	-.14917	-1.25883	1.26315	-.93150	-.93539
117	.25751	-.19501	2.03870	-1.69650	-2.46640	-1.39988	-1.31388
118	.54396	.56583	-.55940	-1.17130	1.26315	.83793	.01083
119	.40074	1.07306	-.96963	.66688	.81560	.73385	1.27246
120	-.02893	.43902	-.01243	1.01701	1.11397	.21342	.57857
121	.40074	.81945	-.69614	.31675	.36806	.68180	1.02014
122	1.11686	.56583	-1.10637	1.10455	.06969	-1.08763	-.68306
123	-2.46375	1.45348	2.03870	-.55857	-2.01886	.42159	-2.19702
124	1.11686	-.70224	-.83289	.49182	1.26315	.73385	-.61998
125	1.40331	-.32182	1.21825	.92948	-.52703	-2.38868	-.24149
126	.97364	-.06821	-.28592	-.47104	.51724	.52568	-.24149
127	.68719	-1.20948	2.31219	.49182	-1.86967	.10934	-1.56621
128	.40074	-1.20948	-.96963	.40429	-.97458	1.30631	1.27246
129	1.26009	.94625	-.83289	-.12091	.96479	.31751	-.36766
130	.83041	1.07306	-.28592	.66688	1.26315	1.04610	1.46171
131	-.17216	.05860	-.55940	.22922	1.26315	.83793	1.46171
132	-1.74763	.69264	-.83289	.40429	.81560	.52568	1.27246
133	.25751	.43902	-.83289	-.20844	.36806	.62976	-.11533
134	.68719	1.19987	-.42266	.40429	1.11397	.16138	1.08322
135	-.02893	-2.35074	.26105	-.12091	-1.57131	.42159	.70473
136	.25751	.18541	-.28592	.92948	-.67622	.52568	.45240
137	-.74506	.31222	-.28592	.31675	.66642	.62976	.38932
138	-.17216	.69264	-.42266	-1.25883	-.07949	.47364	.45240
139	-2.60698	-2.22394	1.62848	-.29598	-1.57131	-2.44072	-.49382
140	-2.03408	1.70710	2.44893	1.01701	-2.16804	.62976	-2.63859
141	-1.60440	1.96071	2.17545	-.64611	-2.31722	-3.01318	-2.82783
142	.25751	-.44863	-.28592	.31675	-.52703	-.56721	**-3.64789**
143	1.26009	.18541	1.76522	-.64611	.96479	-1.03558	.01083
144	1.26009	-.32182	1.62848	.84195	-2.16804	.26547	-1.25080
145	-.02893	.56583	.67128	-.73364	.81560	-.15087	1.14630
146	.40074	.81945	-.28592	1.36714	.66642	-.46312	.32624
147	.11429	-.57544	-.01243	.05416	.36806	-.56721	-.74615
148	-.45861	.94625	-.01243	.66688	.96479	.62976	1.39862
149	-.02893	.69264	-.83289	.22922	-.22867	.57772	.89397
150	.54396	.94625	-.28592	.05416	.51724	.00526	.76781

Table 10 (Continued)

ID	ZHOPE	ZCCB	ZDEP	ZSS	ZDR	ZRESI	ZPTG
151	-1.17473	-.95586	.80802	-1.69650	.21888	-.93150	-.99847
152	.83041	-.19501	-.01243	-.47104	.81560	.62976	.07391
153	.83041	.69264	1.21825	-.03338	.51724	-.98354	-.11533
154	.68719	-.19501	.39780	1.10455	1.11397	-.30700	-.49382
155	-.45861	-1.20948	2.03870	-.03338	-1.86967	.88997	-1.31388
156	.97364	-.57544	-.69614	1.19208	1.26315	.52568	-.87231
157	1.26009	1.32668	-.14917	.31675	.81560	.99406	1.02014
158	1.11686	.81945	-.96963	.05416	.81560	.10934	.64165
159	1.26009	-.44863	-.96963	1.36714	1.26315	.88997	-.55690
160	-2.03408	-.95586	-.96963	.84195	-1.12376	-2.33664	.01083
161	-.02893	.18541	-.28592	-.99624	.36806	.57772	1.33554
162	-.02893	.56583	1.21825	-.82117	.51724	-1.29579	-.17841
163	1.40331	.18541	-.55940	-.03338	1.26315	1.30631	.07391
164	.97364	.94625	-.69614	.92948	.96479	.57772	.45240
165	-.02893	.81945	.26105	.57935	.51724	-.25495	.57857
166	.11429	.94625	-.83289	.75442	.81560	.83793	.76781
167	.68719	-1.08267	-.28592	-.12091	-1.42213	.00526	-1.06155
168	.54396	.05860	-.69614	-.38351	-.82540	-.61925	-.36766
169	-1.31795	-.44863	.12431	-.64611	-2.01886	-.67129	-1.18772
170	.97364	.18541	-.96963	.22922	.96479	.62976	-.87231
171	.97364	-.82905	1.90196	-.73364	1.26315	.16138	-.43074
172	.83041	.69264	-.42266	.75442	.21888	.57772	.95705
173	.11429	.05860	-.14917	-.20844	1.26315	.31751	.38932
174	.54396	-.19501	.12431	-.12091	.96479	.36955	-.49382
175	.83041	.94625	-.55940	-.20844	.81560	.42159	.45240
176	-.74506	.81945	-.42266	-.20844	1.11397	.62976	.45240
177	.83041	1.32668	-.42266	.49182	.81560	-.35904	1.20938
178	.68719	.94625	-.83289	-.03338	.36806	.99406	.07391
179	.25751	-1.58990	1.90196	1.27961	-1.57131	-2.49276	-2.00778
180	.68719	-1.46309	-.83289	.57935	.81560	-.67129	-.30458
181	.40074	-1.71671	-.42266	.22922	.36806	-.20291	-.05225
182	.83041	-.95586	-.42266	.57935	1.26315	.68180	-.36766
183	.11429	-1.71671	-.14917	1.36714	.96479	.52568	.57857
184	.68719	1.19987	.53454	.92948	-.67622	-.30700	.38932
185	1.11686	-.70224	-.42266	.05416	.66642	.31751	-.36766
186	.97364	-.44863	-.28592	-1.08377	-.22867	-.72333	-.36766
187	-1.60440	-.19501	.80802	.14169	-.82540	.52568	-.05225
188	-1.17473	-.82905	.39780	-.47104	1.26315	-.56721	-.30458

Table 10 (Continued)

ID	ZHOPE	ZCCB	ZDEP	ZSS	ZDR	ZRESI	ZPTG
189	.11429	.31222	-.01243	-.38351	.51724	.26547	.70473
190	1.11686	.56583	-.28592	.05416	.81560	.36955	.01083
191	.25751	1.19987	-.83289	-.47104	.51724	.31751	.70473
192	.97364	.05860	-.83289	-.29598	1.11397	.62976	.64165
193	-.02893	-1.08267	-.28592	-1.08377	1.26315	.31751	-.43074
194	.25751	-.70224	.12431	-.82117	.96479	-.35904	-.99847
195	-.88828	-1.20948	.80802	-.29598	-1.12376	.26547	.76781
196	.83041	-.70224	-.83289	1.80481	.81560	.36955	-.11533
197	.40074	-.06821	1.35499	-.90870	.81560	-.20291	.20008
198	.97364	1.19987	-.96963	1.45468	.81560	1.15018	1.39862
199	.83041	.81945	.26105	.66688	1.26315	.26547	-.17841
200	1.11686	.81945	-1.10637	.66688	1.41233	1.15018	1.65095
201	.68719	.81945	-.55940	1.36714	1.41233	1.09814	1.52479
202	.54396	.94625	2.03870	-.99624	.51724	1.09814	.95705
203	.83041	.31222	-.83289	-.99624	1.26315	.73385	.01083
204	.68719	-1.58990	-.55940	-2.83442	-2.16804	-.56721	-1.06155
205	-.17216	-1.33628	-.28592	.66688	1.11397	.00526	.51548
206	.40074	.81945	-.55940	1.01701	1.26315	-.77537	.13700
207	1.11686	-.44863	.39780	-.64611	-.67622	-.56721	.32624
208	.97364	-.32182	-.96963	-.29598	1.11397	.68180	.57857
209	1.26009	.43902	-.28592	-.90870	.51724	-.30700	.64165
210	.25751	.31222	-.96963	1.97987	.51724	.62976	.70473
211	1.11686	1.07306	-.83289	.49182	1.11397	.88997	.95705
212	.54396	.31222	.53454	-.29598	-1.12376	-1.86826	-.17841
213	-1.31795	.18541	1.90196	-1.25883	-1.27295	-.87946	-.43074
214	1.26009	-.32182	-.01243	.84195	.66642	.83793	.76781
215	1.11686	-1.46309	-1.10637	1.10455	1.26315	1.09814	1.52479
216	.68719	-1.20948	-.55940	.14169	-.22867	.83793	.13700
217	-1.89085	-2.09713	2.31219	-.99624	-1.57131	-2.44072	-1.18772
218	-.02893	.18541	-.01243	-.90870	.36806	-.98354	.26316
219	-.17216	1.58029	-.69614	.92948	.81560	.10934	.95705
220	1.26009	1.45348	-.69614	.92948	.36806	-.35904	1.20938
221	.83041	.81945	-.83289	.92948	-.22867	.73385	.64165
222	.54396	.18541	.39780	.57935	-.52703	-.09883	.26316
223	-.17216	.18541	.12431	.75442	-.22867	.94201	-.74615
224	.11429	-1.20948	-.14917	-.12091	-.67622	-.82742	-.05225
225	-.74506	.18541	-.83289	.14169	.66642	.57772	.57857
226	.25751	.56583	.67128	.31675	-1.27295	-2.23255	-1.18772

Table 10 (Continued)

ID	ZHOPE	ZCCB	ZDEP	ZSS	ZDR	ZRESI	ZPTG
227	-1.60440	-2.22394	2.03870	-.90870	-.52703	.26547	.38932
228	1.11686	.94625	-.42266	-1.25883	-.67622	.62976	1.14630
229	.40074	.43902	-.55940	-.47104	-.52703	-.04679	.13700
230	1.11686	.31222	-.28592	1.36714	1.41233	.73385	.38932
231	-.17216	.56583	-.69614	.84195	-.67622	.21342	-.55690
232	.83041	.18541	-.69614	-.99624	-.22867	.31751	.07391
233	.11429	-.44863	-.28592	-.82117	-.52703	.36955	.26316
234	-1.31795	-.57544	1.76522	-.90870	-.97458	-2.85706	-.80923
235	.68719	1.32668	-.01243	.22922	-.22867	.57772	1.27246
236	.25751	-.06821	-.55940	-.38351	.06969	.99406	.32624
237	1.26009	-1.20948	-.83289	-.12091	.06969	.57772	-.99847
238	-.74506	-1.58990	1.90196	-1.60896	-2.01886	.52568	.64165
239	.54396	-.06821	.39780	-1.69650	-.67622	-.35904	-.49382
240	.68719	.05860	-.83289	-.47104	-.97458	.52568	-.24149
241	.83041	.18541	.26105	-.03338	-.07949	-.41108	-.74615
242	-.45861	.43902	-.69614	1.10455	-.07949	-.20291	.64165
243	-1.60440	1.07306	-.55940	-1.60896	-.82540	-1.13967	.32624
244	-1.74763	.31222	1.21825	1.10455	-.07949	-1.71213	-.68306
245	1.26009	.56583	-1.10637	.49182	-.07949	.62976	.70473
246	-.02893	.43902	-.55940	-1.17130	-.37785	.47364	.07391
247	1.26009	.05860	-.14917	.05416	-1.72049	.68180	-.55690
248	.54396	-.44863	1.62848	1.54221	.96479	-2.38868	-.68306
249	-.17216	.18541	.39780	-1.69650	-1.12376	-.72333	-.87231
250	.40074	.69264	-.14917	-.20844	-.52703	-1.13967	.20008
251	-1.60440	.18541	2.17545	-.55857	-1.86967	-2.85706	-2.63859
252	-.88828	.31222	1.62848	.49182	.06969	-.25495	.13700
253	-1.03151	.94625	1.76522	.66688	-.07949	.52568	.76781
254	.83041	-1.46309	-.83289	.22922	.36806	.26547	1.33554
255	.83041	1.32668	-.42266	.05416	-.82540	.68180	.64165
256	.11429	.43902	-.14917	-.38351	-.52703	-.15087	.64165
257	1.11686	1.45348	-.96963	-1.25883	-.22867	.83793	1.39862
258	1.40331	-.57544	-1.10637	1.27961	.66642	.10934	-.24149
259	.40074	.69264	-.14917	1.10455	.66642	-.20291	.13700
260	-1.89085	-1.71671	2.03870	-.03338	-1.86967	-2.18051	-.80923
261	1.11686	1.32668	-.83289	1.19208	.36806	.99406	1.02014
262	1.11686	1.07306	-.69614	.31675	-.67622	1.09814	.76781
263	.54396	.69264	-.83289	.05416	-.52703	.62976	.95705
264	-2.03408	.18541	1.76522	-1.17130	-.97458	-3.01318	-1.25080

Table 10 (Continued)

ID	ZHOPE	ZCCB	ZDEP	ZSS	ZDR	ZRESI	ZPTG
265	.54396	-.19501	-.96963	.84195	.21888	-1.03558	-.99847
266	.25751	.94625	-.14917	.14169	-.37785	.83793	.95705
267	1.11686	.94625	-.28592	-.29598	.21888	-.15087	.95705
268	1.11686	-.32182	-.83289	-.03338	-.82540	.88997	.07391
269	1.11686	-.70224	.39780	-.29598	.36806	-1.24375	-1.18772
270	-.02893	-.06821	-.83289	-.90870	.51724	-.09883	-.49382
271	1.11686	-.70224	-1.10637	.57935	-.07949	1.09814	-1.18772
272	-1.60440	-.95586	-1.10637	1.10455	.81560	.47364	-.74615
273	1.11686	-.19501	-.96963	-.38351	-1.27295	1.04610	.45240
274	-.45861	-.70224	.26105	-.64611	-.97458	-.93150	-.43074
275	.68719	-.19501	-.01243	.22922	-.22867	-.04679	-.17841
276	-.31538	-.95586	.26105	-1.52143	-.37785	-.56721	.13700
277	.97364	.81945	-.55940	-.99624	-.22867	1.20222	.83089
278	-.45861	-.82905	2.03870	-2.57182	-1.86967	-.82742	-1.44004
279	.40074	1.58029	-.01243	.75442	.06969	.73385	1.27246
280	1.11686	-.19501	.12431	-.03338	-.67622	-1.08763	-.61998
281	.97364	.56583	-.28592	-.99624	-.22867	.42159	-.68306
282	-1.46118	-.06821	1.90196	.05416	-2.31722	-2.12847	-2.00778
283	1.11686	.05860	-.69614	1.62974	-.07949	1.15018	-.74615
284	.97364	-.19501	-.69614	.66688	-.07949	.78589	.07391
285	1.40331	-.95586	-.55940	-.12091	.81560	.21342	-.05225
286	1.11686	-.95586	.26105	-1.52143	-.52703	.16138	.26316
287	.97364	1.58029	-1.10637	-.20844	.21888	.88997	1.46171
288	.83041	-.70224	-.28592	.05416	-.67622	.42159	-.36766
289	-1.46118	.18541	2.17545	.75442	-1.27295	-2.96114	-1.56621
290	-2.46375	.69264	2.31219	1.27961	-1.27295	.05730	-2.13394
291	-3.03665	.56583	2.17545	-1.17130	-1.12376	.68180	-2.00778
292	.25751	-.44863	-.69614	1.27961	-.37785	.78589	1.39862
293	.68719	-.70224	-.83289	1.71727	-.22867	1.30631	-.61998
294	.40074	.56583	-.83289	-1.08377	-.37785	.88997	.07391
295	-1.46118	.31222	-.55940	-1.17130	-.67622	.31751	.26316
296	.97364	1.19987	-.69614	.40429	-.97458	.88997	1.39862
297	-.31538	-.32182	-.42266	-1.25883	-1.72049	-.20291	.51548
298	1.11686	.94625	-.96963	-1.08377	-.52703	.88997	-.43074
299	-1.60440	-1.08267	-.28592	1.45468	-1.12376	-.25495	-.93539
300	1.40331	-1.08267	2.44893	1.10455	-.22867	.99406	-1.31388
301	.83041	.81945	-.83289	.84195	.51724	.68180	1.33554
302	-2.17730	1.45348	2.31219	.49182	-.37785	-2.64889	-2.19702

Table 10 (Continued)

ID	ZHOPE	ZCCB	ZDEP	ZSS	ZDR	ZRESI	ZPTG
303	.97364	.05860	-.83289	.40429	-.52703	.36955	-.99847
304	.40074	.56583	-.14917	.92948	.81560	.16138	1.39862
305	.54396	.69264	2.17545	.84195	.66642	-1.29579	-1.44004
306	.68719	.69264	-.14917	1.01701	-.52703	.73385	1.39862
307	1.11686	1.58029	-.01243	-.90870	.36806	.47364	-.05225
308	.68719	1.45348	-.55940	.05416	-.37785	.68180	1.33554
309	-.31538	1.07306	.12431	1.01701	.66642	.21342	.89397
310	-.88828	1.70710	2.31219	-.99624	-.37785	-1.55600	.38932
311	.25751	-.06821	-.28592	-.47104	-1.12376	-.46312	-.17841
312	.40074	.05860	-.83289	.57935	.36806	.21342	-.24149
313	.40074	1.19987	-1.10637	.92948	.21888	1.04610	1.46171
314	.83041	.18541	-.55940	.92948	1.11397	1.15018	.26316
315	1.11686	-.82905	-1.10637	-.73364	.06969	1.09814	1.52479
316	.97364	-.44863	-.28592	-.47104	.51724	1.04610	1.46171
317	.11429	.05860	-.14917	1.54221	-.37785	-.87946	-.99847
318	-.02893	.56583	-.83289	.92948	.21888	.68180	.57857
319	.40074	.94625	-.55940	.84195	-.52703	.47364	.45240
320	-1.74763	.94625	.53454	.57935	-.22867	.68180	.57857
321	-.02893	.43902	.39780	-.47104	.81560	.26547	1.20938
322	1.11686	-1.97032	.53454	.40429	-.07949	.88997	.57857
323	-1.89085	-1.46309	.94477	-.03338	-.37785	-2.23255	-.49382
324	-.45861	-.19501	-.14917	.40429	-.07949	-.35904	**-3.58481**
325	.97364	.18541	-.83289	1.36714	-.22867	.52568	-.05225
326	1.26009	.31222	.39780	.84195	.51724	.52568	.38932
327	.25751	1.19987	-.69614	.40429	.51724	.10934	-.24149
328	-.60183	-1.46309	-.69614	.22922	.36806	.62976	1.20938
329	.25751	.31222	-.96963	.14169	-1.12376	.68180	-.61998
330	-2.60698	.31222	.67128	-.73364	-.97458	.05730	-.55690
331	.97364	1.19987	-.83289	-.82117	-.07949	-1.34784	-.05225
332	-1.60440	-.95586	-.55940	.49182	.96479	-1.39988	-.99847
333	.54396	.18541	-.14917	.14169	.06969	.31751	.83089
334	.40074	.69264	-1.10637	-.20844	.36806	1.04610	1.52479
335	.83041	.43902	-.14917	1.45468	-1.12376	.05730	.26316
336	.83041	-.44863	-.28592	1.10455	-.07949	-.61925	-1.06155
337	.97364	.56583	-.42266	.84195	.66642	.78589	.64165
338	-1.17473	1.83391	2.44893	.49182	-.82540	-2.85706	-2.82783
339	-2.60698	.43902	2.44893	.40429	-.97458	.36955	-2.19702
340	-.17216	1.07306	-.28592	.05416	-.82540	-.09883	-1.18772

Table 10 (Continued)

ID	ZHOPE	ZCCB	ZDEP	ZSS	ZDR	ZRESI	ZPTG
341	.54396	.94625	-.28592	1.01701	.81560	.47364	1.27246
342	1.40331	.18541	-1.10637	-.99624	-.52703	.88997	.51548
343	.40074	.43902	-.28592	-.47104	-.67622	-1.45192	.20008
344	.97364	.81945	-.83289	.57935	.66642	.42159	-.36766
345	.40074	1.32668	-.55940	.92948	.06969	.83793	.45240
346	.11429	.81945	-.14917	.84195	-.82540	-.35904	.57857
347	-1.60440	.94625	.94477	.57935	.06969	1.09814	.51548
348	.25751	-.06821	-.69614	-.47104	.36806	.68180	.83089
349	-.31538	1.19987	-.01243	.40429	.21888	.36955	1.39862
350	-.60183	-.44863	.67128	-.03338	-.07949	-1.08763	-.49382
351	-.88828	-.70224	1.76522	.40429	-.37785	-1.86826	-1.56621
352	.97364	1.19987	-.96963	1.36714	.06969	-.67129	.38932
353	-2.75020	-2.09713	-.96963	.84195	.51724	1.25427	1.27246
354	.97364	-.44863	-.69614	.40429	.36806	-.67129	-.68306
355	.54396	.43902	-.96963	.14169	.21888	.62976	-.05225
356	-.17216	-.32182	-.83289	-.20844	.36806	.31751	-.11533
357	1.40331	-1.08267	-.83289	1.45468	-.82540	.21342	-.05225
358	.25751	.18541	1.90196	1.10455	-.37785	-.04679	-1.31388
359	1.11686	-.32182	-.69614	-1.25883	-1.57131	.21342	.70473
360	-.02893	.43902	.26105	-1.08377	-.67622	-.41108	.26316
361	.25751	1.70710	-1.10637	.92948	1.11397	1.15018	1.58787
362	-.02893	1.32668	1.90196	.84195	.66642	-2.75297	-1.75545
363	.83041	1.32668	-.55940	1.01701	-.52703	1.09814	1.52479
364	1.26009	.81945	-.96963	-.90870	.06969	.52568	.83089
365	1.11686	1.32668	-.83289	.05416	-.37785	.88997	.83089
366	-2.60698	1.70710	2.17545	.92948	-.52703	-3.01318	-3.26941
367	.83041	-.44863	-.96963	.92948	.96479	.16138	.51548
368	-.02893	-.82905	-.42266	-.73364	-.07949	.26547	.07391
369	1.26009	1.07306	-.42266	-.47104	.36806	.78589	.64165
370	-2.89342	.81945	2.31219	1.54221	-.82540	-2.64889	-2.13394
371	1.11686	-.95586	-.14917	-1.52143	-.22867	-.41108	.26316
372	.11429	-.32182	-.01243	.84195	-.67622	-.04679	1.20938
373	-.17216	-1.46309	.12431	1.10455	.36806	.42159	1.02014
374	.97364	-1.20948	-.69614	.14169	-.37785	-.25495	.51548
375	.40074	.56583	-.83289	.40429	-1.12376	.36955	.64165
376	.97364	.18541	-.83289	-1.25883	-1.86967	.52568	.64165
377	1.11686	.05860	-.01243	-1.08377	-.52703	-.35904	.26316
378	-.02893	-.06821	.39780	-1.17130	-1.12376	-.82742	.01083

Table 10 (Continued)

ID	ZHOPE	ZCCB	ZDEP	ZSS	ZDR	ZRESI	ZPTG
379	.83041	1.45348	-1.10637	1.27961	.06969	1.15018	1.58787
380	.97364	.81945	-.55940	1.71727	-.22867	.73385	.32624
381	.83041	1.07306	-.42266	-1.08377	-.52703	.78589	.83089
382	.54396	-.44863	-.42266	-1.17130	-1.12376	.42159	-.43074
383	.11429	.94625	-.14917	1.36714	-.22867	-1.13967	.45240
384	.25751	.56583	-.28592	.84195	.51724	.99406	.76781
385	1.11686	.18541	-.83289	.40429	.36806	.36955	-.11533
386	.54396	-.82905	-.42266	.22922	.66642	.16138	-.24149
387	.68719	-1.33628	2.31219	.14169	-1.86967	.94201	-1.31388
388	1.26009	1.32668	-.96963	.14169	-1.27295	.99406	.64165
389	-.74506	-.44863	-.69614	-.73364	-.97458	.62976	-.99847
390	.25751	.31222	1.21825	-.82117	.06969	.05730	.45240
391	-.60183	-.19501	-.83289	.49182	1.26315	.78589	-.49382
392	-.60183	-.19501	-.01243	.14169	-.07949	-.61925	**-3.64789**
393	.54396	.56583	.53454	-.20844	-.07949	.47364	.45240
394	.40074	.18541	-.01243	.84195	-.52703	.10934	.51548
395	.54396	.31222	-.01243	.57935	.06969	-.46312	.45240
396	.54396	1.58029	-.42266	.40429	.51724	.78589	1.14630

Note ID = number of sample
ZHOPE = Z score of Hope
ZCCB = Z score of Challenges to Core Beliefs
ZDEP = Z score of Depression
ZSS = Z score of Social Support
ZDR = Z score of Deliberate Rumination
ZRESI = Z score of Resilience
ZPTG = Z score of Posttraumatic Growth

Table 11 Test of multivariate outlier by using mahalanobis distanced (n = 392)

ID	MAH_1	pMAH_1	ID	MAH_1	pMAH_1
1	7.38555	.7133	40	4.59064	.4027
2	5.12696	.4724	41	11.39316	.9230
3	3.62562	.2728	42	1.83206	.0655
4	5.85851	.5608	43	2.59162	.1419
5	4.55078	.3974	44	7.22325	.6993
6	5.06478	.4645	45	2.55869	.1382
7	5.43893	.5111	46	7.32847	.7085
8	14.55583	.9760	47	5.11204	.4705
9	9.90051	.8711	48	6.30731	.6103
10	7.34721	.7101	49	2.66298	.1502
11	20.81540	.9980	50	8.08516	.7681
12	2.76941	.1628	51	6.83020	.6632
13	3.98031	.3207	52	1.85015	.0670
14	4.54367	.3965	53	15.78536	.9850
15	15.65524	.9843	54	8.04122	.7649
16	2.18996	.0986	55	4.26259	.3588
17	3.93846	.3150	56	16.16552	.9871
18	14.45939	.9751	57	5.11096	.4703
19	13.46757	.9638	58	5.48132	.5163
20	7.67000	.7367	59	1.91206	.0724
21	1.53344	.0428	60	13.61610	.9658
22	12.19290	.9422	61	2.32744	.1127
23	7.56296	.7281	62	16.41448	.9883
24	5.22854	.4851	63	3.44302	.2485
25	11.98432	.9377	64	7.38781	.7135
26	11.27820	.9199	65	2.07151	.0870
27	12.77033	.9532	66	.98634	.0139
28	4.45863	.3851	67	3.33190	.2338
29	13.99254	.9703	68	4.58422	.4019
30	15.16902	.9810	69	3.15176	.2104
31	7.34554	.7099	70	4.29201	.3628
32	4.70062	.4173	71	4.23487	.3551
33	2.26782	.1065	72	14.88242	.9788
34	9.55295	.8552	73	3.56369	.2645
35	7.01690	.6807	74	10.23917	.8851
36	11.44161	.9244	75	3.00312	.1915
37	11.31706	.9209	76	1.47643	.0390
38	12.57734	.9497	77	7.44043	.7180
39	8.15429	.7730	78	15.61921	.9840

Table 11 (Continued)

ID	MAH_1	pMAH_1	ID	MAH_1	pMAH_1
79	12.06572	.9395	118	1.82379	.0648
80	12.26691	.9437	119	2.11598	.0913
81	2.30115	.1100	120	.95779	.0128
82	3.43653	.2476	121	8.28624	.7821
83	3.26644	.2253	122	19.97144	.9972
84	14.14915	.9720	123	4.49390	.3898
85	2.52307	.1341	124	14.31320	.9737
86	2.77270	.1632	125	1.95924	.0766
87	2.19540	.0991	126	14.96727	.9795
88	3.50672	.2569	127	7.22524	.6995
89	5.66829	.5386	128	2.99601	.1907
90	12.13733	.9410	129	3.18297	.2144
91	7.68866	.7382	130	2.25685	.1054
92	5.88180	.5634	131	6.71916	.6524
93	3.62164	.2723	132	1.00170	.0145
94	1.49958	.0405	133	2.39794	.1203
95	1.61516	.0485	134	10.18291	.8828
96	2.85760	.1735	135	2.33215	.1132
97	17.51746	.9924	136	1.75962	.0596
98	2.95993	.1861	137	3.26356	.2249
99	7.19954	.6972	138	14.39221	.9745
100	9.45103	.8502	139	25.09437	.9997
101	6.26858	.6062	140	20.23280	.9975
102	1.25814	.0261	141	12.49973	.9483
103	14.28279	.9734	142	13.68223	.9666
104	7.11755	.6899	143	3.09058	.2026
105	4.59929	.4039	144	3.36442	.2381
106	3.77475	.2929	145	1.61980	.0489
107	2.99514	.1905	146	2.43649	.1245
108	15.20260	.9813	147	1.78355	.0615
109	8.51647	.7973	148	1.18513	.0224
110	1.58991	.0467	149	5.62298	.5333
111	3.68614	.2809	150	2.89691	.1783
112	3.82719	.3000	151	5.71743	.5444
113	20.51886	.9978	152	4.78803	.4287
114	3.45881	.2506	153	14.16317	.9721
115	11.36110	.9222	154	4.78705	.4286
116	10.05994	.8778	155	3.91778	.3122
117	5.01679	.4583	156	2.61505	.1446

Table 11 (Continued)

ID	MAH_1	pMAH_1	ID	MAH_1	pMAH_1
157	5.30352	.4945	196	3.50613	.2568
158	22.54200	.9990	197	3.55524	.2634
159	2.00566	.0808	198	3.00793	.1921
160	5.08914	.4676	199	3.51307	.2578
161	4.48356	.3885	200	16.48372	.9886
162	2.13042	.0927	201	4.42749	.3810
163	1.26538	.0265	202	14.54778	.9759
164	1.75523	.0592	203	2.07842	.0877
165	4.83587	.4350	204	5.00763	.4572
166	3.37706	.2398	205	3.34889	.2360
167	6.65546	.6461	206	3.22892	.2204
168	1.83017	.0654	207	3.97718	.3202
169	16.25529	.9876	208	4.57039	.4000
170	1.25306	.0258	209	2.52683	.1345
171	2.22535	.1021	210	6.04754	.5821
172	2.33950	.1140	211	5.53046	.5222
173	1.93221	.0742	212	3.48579	.2541
174	3.21528	.2186	213	4.09740	.3365
175	3.33448	.2342	214	1.31419	.0291
176	1.84053	.0662	215	8.59069	.8021
177	13.68036	.9666	216	2.74798	.1603
178	3.83925	.3016	217	3.67283	.2791
179	.70837	.0057	218	4.97004	.4523
180	4.65649	.4114	219	2.56193	.1385
181	3.03363	.1954	220	1.45728	.0377
182	4.14262	.3426	221	2.33517	.1136
183	3.14387	.2094	222	3.64816	.2758
184	4.00679	.3242	223	2.29612	.1094
185	5.39813	.5061	224	8.56677	.8006
186	5.82143	.5565	225	14.23786	.9729
187	.73025	.0062	226	5.49859	.5184
188	1.94478	.0753	227	1.59113	.0468
189	2.62629	.1459	228	4.41444	.3792
190	2.61054	.1441	229	3.19529	.2160
191	6.18957	.5977	230	2.50960	.1326
192	3.97988	.3206	231	1.63610	.0501
193	4.51280	.3924	232	8.56758	.8006
194	6.25269	.6045	233	2.62567	.1459
195	6.69772	.6503	234	1.53584	.0429

Table 11 (Continued)

ID	MAH_1	pMAH_1	ID	MAH_1	pMAH_1
235	4.82986	.4342	274	3.83787	.3014
236	13.47937	.9640	275	4.67191	.4135
237	3.85140	.3032	276	10.47144	.8938
238	3.23231	.2208	277	3.32818	.2333
239	1.37413	.0326	278	4.18074	.3478
240	3.24753	.2228	279	2.82745	.1698
241	11.94856	.9369	280	9.28775	.8420
242	7.61809	.7326	281	4.75785	.4248
243	2.55148	.1373	282	2.07907	.0877
244	2.88808	.1772	283	2.98962	.1899
245	6.47158	.6275	284	5.10513	.4696
246	17.57207	.9926	285	4.20792	.3514
247	3.90746	.3108	286	2.51814	.1336
248	3.42470	.2460	287	12.54123	.9491
249	10.44571	.8929	288	16.71591	.9896
250	4.36874	.3731	289	20.20238	.9975
251	8.46642	.7941	290	3.91700	.3121
252	5.29832	.4938	291	6.91861	.6716
253	4.24768	.3568	292	3.76870	.2921
254	.82825	.0087	293	6.47512	.6279
255	7.07511	.6860	294	5.17489	.4784
256	5.95412	.5717	295	5.67064	.5389
257	2.00174	.0805	296	5.57076	.5271
258	10.65687	.9004	297	10.93029	.9094
259	3.40844	.2439	298	23.38587	.9993
260	4.29924	.3637	299	1.55966	.0446
261	2.20355	.0999	300	15.08003	.9804
262	11.20095	.9176	301	2.33685	.1137
263	6.11845	.5899	302	1.40978	.0347
264	2.09769	.0895	303	11.54686	.9271
265	2.47984	.1293	304	2.88043	.1763
266	3.75996	.2909	305	5.70254	.5427
267	6.25424	.6047	306	3.40608	.2436
268	2.58815	.1415	307	2.27996	.1078
269	4.06691	.3324	308	11.22293	.9183
270	9.49875	.8526	309	2.39165	.1196
271	5.86400	.5614	310	1.11038	.0189
272	2.14844	.0944	311	3.05548	.1981
273	.92071	.0116	312	2.69786	.1543

Table 11 (Continued)

ID	MAH_1	pMAH_1	ID	MAH_1	pMAH_1
313	4.76866	.4262	352	1.05822	.0167
314	3.37690	.2397	353	1.45177	.0374
315	5.12086	.4716	354	9.16648	.8356
316	1.76132	.0597	355	7.77769	.7452
317	2.67879	.1521	356	6.83097	.6632
318	6.89249	.6691	357	1.87454	.0691
319	2.10558	.0903	358	4.21063	.3518
320	10.97494	.9108	359	16.09015	.9867
321	9.51750	.8535	360	4.76442	.4256
322	3.50236	.2563	361	3.96159	.3181
323	3.81117	.2978	362	3.93494	.3145
324	1.80545	.0633	363	20.52062	.9978
325	5.24412	.4871	364	3.63782	.2744
326	4.24261	.3561	365	1.94671	.0755
327	9.43591	.8495	366	3.29047	.2284
328	9.06248	.8299	367	19.40144	.9965
329	10.78090	.9046	368	4.68637	.4154
330	.33923	.0017	369	2.82672	.1697
331	2.07326	.0872	370	3.59252	.2684
332	5.62377	.5334	371	2.64044	.1476
333	4.22918	.3543	372	4.08015	.3342
334	1.71013	.0557	373	8.73605	.8110
335	16.42191	.9883	374	3.30868	.2308
336	16.32345	.9879	375	2.47895	.1292
337	2.92310	.1816	376	4.54517	.3967
338	1.76955	.0604	377	4.53434	.3952
339	5.09920	.4688	378	4.78781	.4287
340	5.04271	.4617	379	3.91276	.3115
341	1.61378	.0484	380	5.80597	.5547
342	2.70173	.1548	381	1.55996	.0446
343	3.12382	.2068	382	1.56361	.0448
344	8.80707	.8153	383	2.49759	.1313
345	1.22446	.0243	384	19.06605	.9959
346	1.77861	.0611	385	7.81308	.7479
347	1.74258	.0582	386	4.64248	.4096
348	6.08440	.5862	387	3.91593	.3119
349	6.88393	.6683	388	3.39668	.2423
350	21.82876	.9987	389	1.91973	.0731
351	4.13017	.3409	390	1.53191	.0427
391	1.24360	.0253	392	2.72325	.1573

Table 12 Test for normality of the variables (n=392)

Variables	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
Posttraumatic Growth	-.567	.123	.140	.246
Hope	-.760	.123	-.103	.246
Depression	-.396	.123	-.462	.246
Challenges to core beliefs	-.577	.123	.147	.246
Social support	-.596	.123	.177	.246
Deliberate rumination	-.585	.123	-.584	.246
Resilience	-1.291	.123	.104	.246

Table 13 Correlation matrix of the study variables (n = 392)

	Posttraumatic growth	Hope	Challenge to core beliefs	Depression	Social support	Deliberate rumination	Resilience
Posttraumatic growth[1]	1						
Hope[2]	.320**	1					
Challenge to core beliefs[3]	.272**	.179**	1				
Depression[4]	-.566**	-.405**	-.168**	1			
Social support[5]	.180**	.166**	.236**	-.216**	1		
Deliberate rumination[6]	.419**	.177**	.258**	-.418**	.295**	1	
Resilience[7]	.552**	.350**	.181**	-.560**	.253**	.356**	1

**P < .01

Note: [1] The Chinese version of Posttraumatic Growth Inventory [PTGI]; [2] The Chinese version of Herth Hope Index [HHI]; [3] The Chinese version of the Core Beliefs Inventory [CBI]; [4] The Chinese version of Patients Health Questionnaire Depression Scale [PHQ-9]; [5] The Chinese version of Multidimensional Scale of Perceived Social Support [MSPSS]; [6] The Chinese version of Event Related Rumination Inventory [C-ERRI]; [7] The Chinese version of Connor-Davidson Resilience Scale [CD- RISC]

Table 14 Testing for multicollinearity of the predictor variables (n = 392)

Variable	Collinearity Statistics	
	Tolerance	VIF
Hope	.801	1.248
Challenges to core beliefs	.890	1.123
Depression	.587	1.702
Social support	.862	1.160
Deliberate rumination	.746	1.340
Resilience	.640	1.562

APPENDIX F

The measurement model assessment

The measurement model assessment

The measurement model had evaluated by using confirmatory factor analysis [CFA]. Seven constructs including posttraumatic growth, hope, challenges to core beliefs, depression, deliberate rumination, social support, and resilience evaluated for their measurement model by using CFA.

1. The measurement model of posttraumatic growth

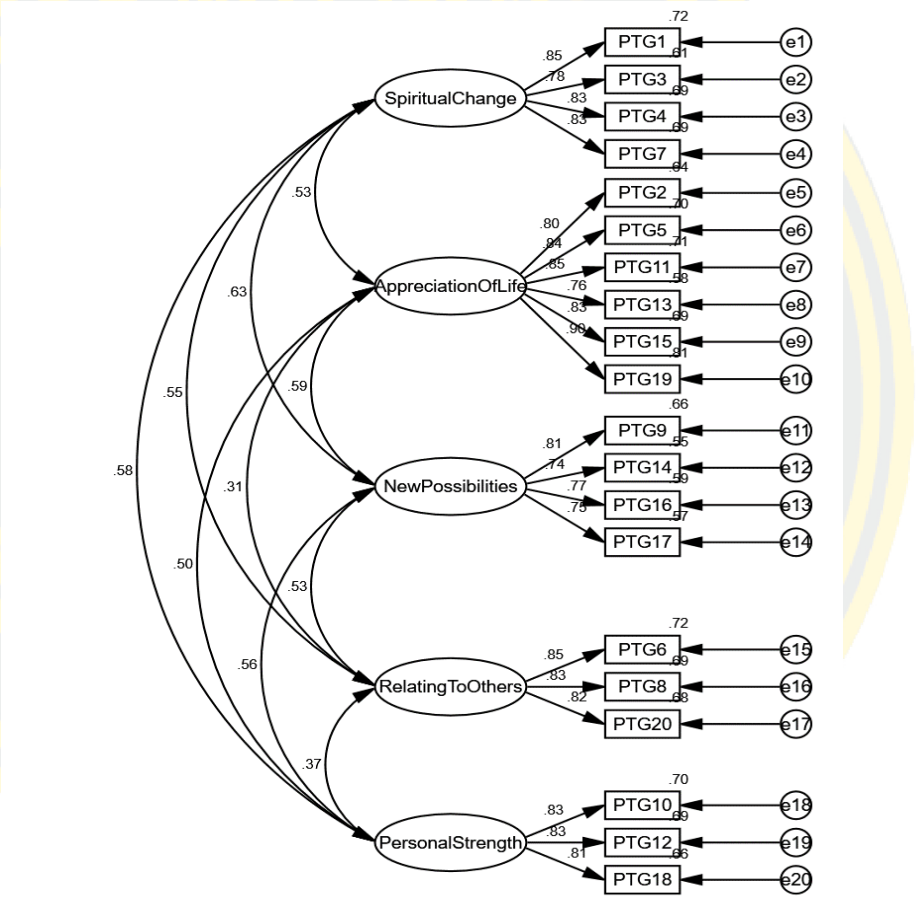

Figure 4 Standardize factor loading for the measurement model of posttraumatic growth

The measurement model for posttraumatic growth consists of five dimensions: new possibilities, relating to others, appreciation of life, personal strength and spiritual change, as well as 20 observable indicators. The loading estimate in this measurement model has statistical significance (p<. 001), with a standard loading range of .74 to .90 and absolute values greater than .3 (See Figure 4). In addition, the CMIN/df was 1.847 (less than the standard value of 2.0), the GFI index result

was .928 (greater than the acceptable value of .9), the CFI index result was .974 (greater than the acceptable value of .9), and the RMSEA index result was .047 (less than the acceptable value of .05) (See Table 6). Therefore, the model of post traumatic growth has appropriate construct validity.

2. The measurement model of hope

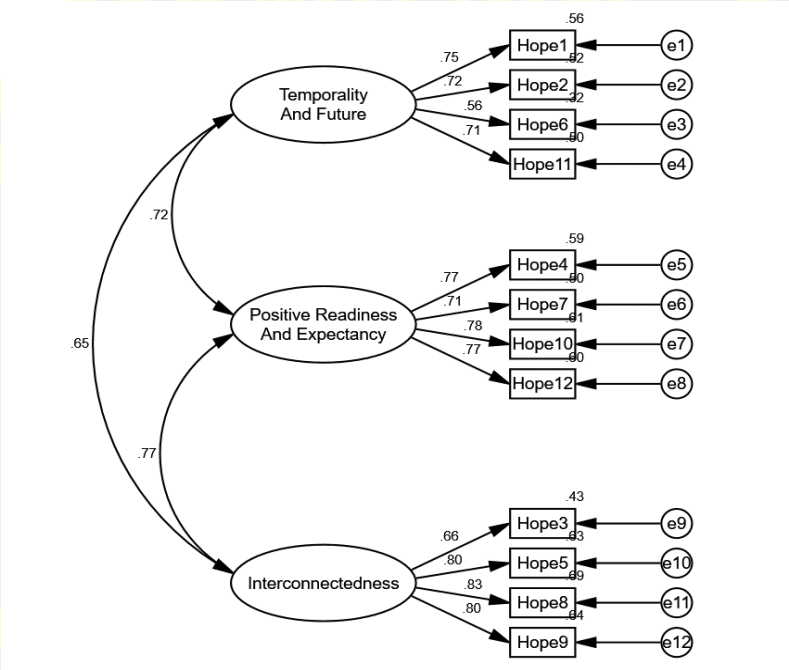

Figure 5 Standardize factor loading for the measurement model of hope

The measurement model for hope consists of three dimensions: temporality and future, positive readiness and expectancy, and interconnectedness, as well as 12 observable indicators. The loading estimate in this measurement model has statistical significance ($p <. 001$), with a standard loading range of .56 to .83 and absolute values greater than .3 (See Figure 5). In addition, the CMIN/df was 3.205 (within the acceptable range of 2 to 5), the GFI index result was .932 (greater than the acceptable value of .9), the CFI index result was .949 (greater than the acceptable value of .9), and the RMSEA index result was .075 (between .05 to .08 also indicating close fit) (See Table 6). Therefore, the model of hope has appropriate construct validity.

3. The measurement model of challenges to core beliefs

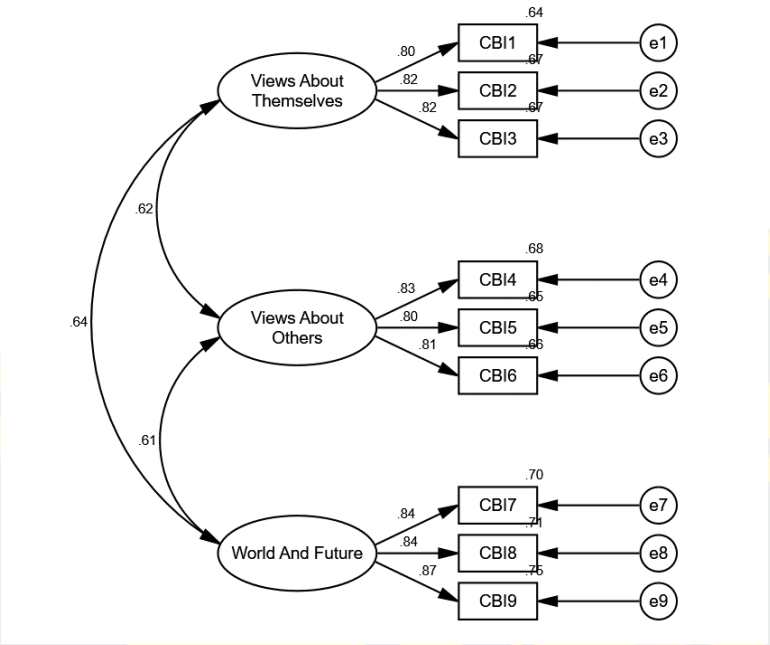

Figure 6 Standardize factor loading for the measurement model of challenges to core beliefs

The measurement model for challenges to core beliefs consists of three dimensions: views about themselves, views about others, and views about the world and the future, as well as 9 observable indicators. The loading estimate in this measurement model has statistical significance ($p < .001$), with a standard loading range of .80 to .87 and absolute values greater than .3 (See Figure 6). In addition, the CMIN/df was 1.628 (less than the standard value of 2.0), the GFI index result was .978 (greater than the acceptable value of .9), the CFI index result was .992 (greater than the acceptable value of .9), and the RMSEA index result was .040 (less than the acceptable value of .05) (See Table 6). Therefore, the model of challenges to core beliefs has appropriate construct validity.

4. The measurement model of depression

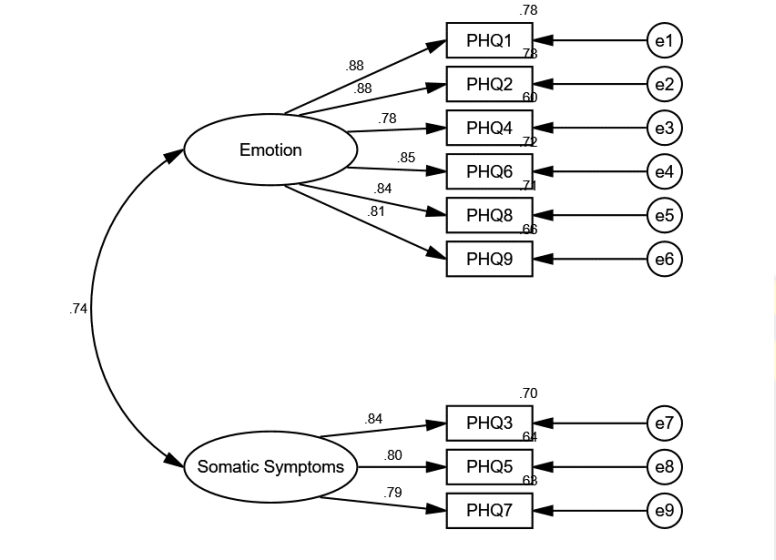

Figure 7 Standardize factor loading for the measurement model of depression

The measurement model for depression consists of two dimensions: emotion symptoms and somatic symptoms, as well as 9 observable indicators. The loading estimate in this measurement model has statistical significance (p<. 001), with a standard loading range of .78 to .88 and absolute values greater than .3 (See Figure 7). In addition, the CMIN/df was 1.814 (less than the standard value of 2.0), the GFI index result was .974 (greater than the acceptable value of .9), the CFI index result was .992 (greater than the acceptable value of .9), and the RMSEA index result was .046 (less than the acceptable value of .05) (See Table 6). Therefore, the model of depression has appropriate construct validity.

5. The measurement model of social support

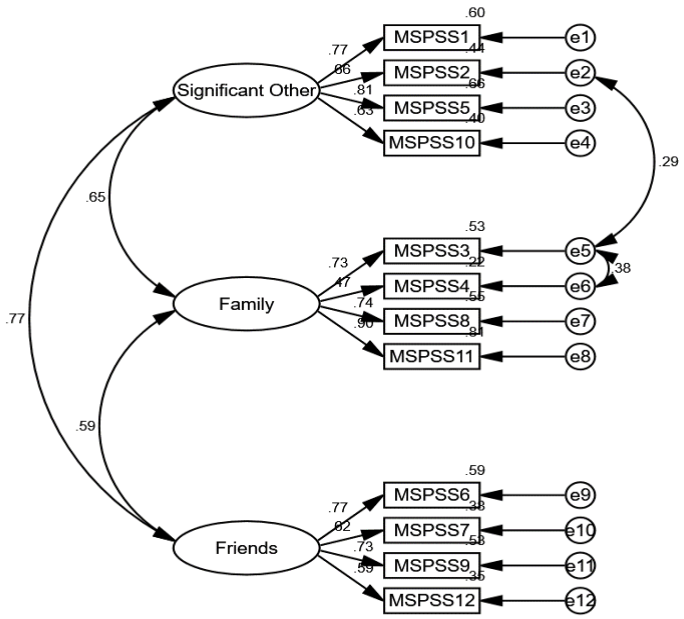

Figure 8 Standardize factor loading for the measurement model of social support

The measurement model for social support consists of three dimensions: support from family, support from friends, and support from significant other, as well as 12 observable indicators. The loading estimate in this measurement model has statistical significance (p<. 001), with a standard loading range of .47 to .90 and absolute values greater than .3 (See Figure 8). In addition, the CMIN/df was 3.192 (within the acceptable range of 2.0 to 5.0), the GFI index result was .935 (greater than the acceptable value of .9), the CFI index result was .946 (greater than the acceptable value of .9), and the RMSEA index result was .075 (between .05 to .08 also indicating close fit) (See Table 6). Therefore, the model of social support has appropriate construct validity.

6. The measurement model of deliberate rumination

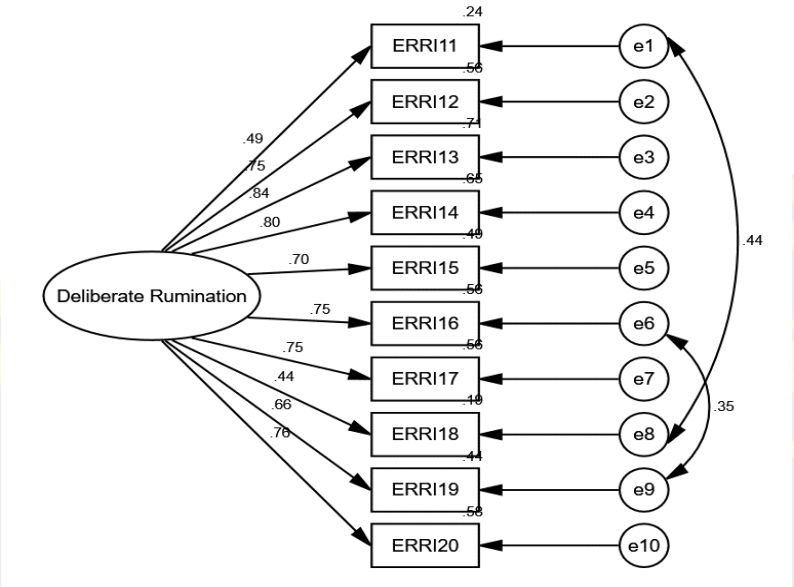

Figure 9 Standardize factor loading for measurement model of deliberate rumination

The measurement model for deliberate rumination consists of 10 observable indicators. The loading estimate in this measurement model has statistical significance (p<. 001), with a standard loading range of .44 to .84 and absolute values greater than .3 (See Figure 9). In addition, the CMIN/df was 2.357 (within the acceptable range of 2.0 to 5.0), the GFI index result was .962 (greater than the acceptable value of .9), the CFI index result was .978 (greater than the acceptable value of .9), and the RMSEA index result was .059 (between .05 to .08 also indicating close fit) (See Table 6). Therefore, the model of deliberate rumination has appropriate construct validity.

7. The measurement model of resilience

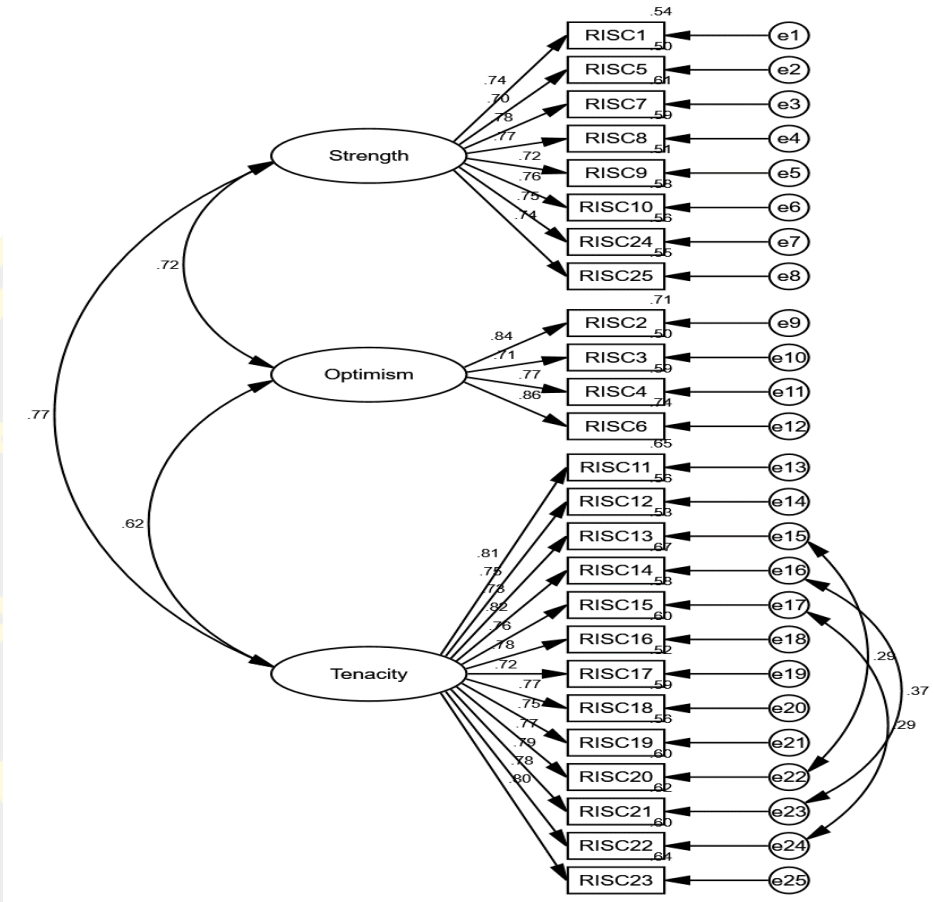

Figure 10 Standardize factor loading for the measurement model of resilience

The measurement model for resilience consists of three dimensions: tenacity, strength, and optimism, as well as 25 observable indicators. The loading estimate in this measurement model has statistical significance ($p < .001$), with a standard loading range of .70 to .86 and absolute values greater than .30 (See Figure 10). In addition, the CMIN/df was 2.085 (within the acceptable range of 2.0 to 5.0), the GFI index result was .904 (greater than the acceptable value of .9), the CFI index result was .957 (greater than the acceptable value of .9), and the RMSEA index result was .053 (between .05 to .08 also indicating close fit) (See Table 6). Therefore, the model of resilience has appropriate construct validity.

BIOGRAPHY

NAME	TANG NAN	
DATE OF BIRTH	20 February 1992	
PLACE OF BIRTH	Yancheng city,Jiangsu Province,China	
PRESENT ADDRESS	No. 283, Jiefang South Road, Yancheng City, Jiangsu Province,China	
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