PREDICTIVE FACTORS OF SELF-MANAGEMENT BEHAVIORS AMONG
PATIENTS WITH CORONARY HEART DISEASE: A STRUCTURAL EQUATION
MODELING

YANG WANG

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR DOCTOR DEGREE OF PHILOSOPHY

(INTERNATIONAL PROGRAM)

IN NURSING SCIENCE

FACULTY OF NURSING

BURAPHA UNIVERSITY

2025

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ดุษฎีนิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปรัชญาดุษฎีบัณฑิต (หลักสูตรนานาชาติ)
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YANG WANG : PREDICTIVE FACTORS OF SELF-MANAGEMENT BEHAVIORS AMONG PATIENTS WITH CORONARY HEART DISEASE: A STRUCTURAL EQUATION MODELING. ADVISORY COMMITTEE: KHEMARADEE MASINGBOON, D.S.N. CHINTANA WACHARASIN, Ph.D. 2025.

Self-management behaviors can reduce symptom aggravation, recurrent rate of cardiac events, and improve the quality of life for patients with coronary heart disease. Currently, low levels of self-management behaviors are reported among CHD patients. The purpose of this study was to develop and test a causal model of self-management behaviors among adults with coronary heart disease. A sample of 352 participants was recruited from cardiology in tertiary care hospitals in Yancheng, Jiangsu province, China. Data were collected by self-administered questionnaires including the Demographic record form, the family APGAR index, the Chew's set of brief screening questions, the self-rating depression scale, the coronary heart disease knowledge questionnaire, the self-efficacy for chronic disease 6-item scale, the social support rating scale and the coronary artery disease self-management scale. AMOS software program was used to test the model of self-management behaviors.

The results showed that the final model of self-management behaviors consisted of family functioning, health literacy, depression, knowledge, self-efficacy and social support, which explained 57% of the total variance for self-management behaviors ($R^2 = .57$). Health literacy, self-efficacy and social support had a direct effect on self-management behaviors, whereas self-efficacy and social support were mediators between family functioning, depression, knowledge, and self-management behaviors.

These findings suggest that nurses should develop nursing interventions to improve self-management behaviors by reducing depression and promoting family functioning, health literacy, knowledge, self-efficacy and social support.

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CHAPTER 1
INTRODUCTION

Statement and significance of the problem

Cardiovascular diseases remain a leading cause of death and an economic burden worldwide, accounting for 32% of all deaths according to World Health Organization (WHO, 2021). Specifically, 17.9 million people died annually from cardiovascular diseases, with 11.1 million from coronary heart disease (CHD) (WHO, 2021). Similarly, the prevalence rate of CHD in China increases gradually with age. According to China Cardiovascular Health and Disease Report 2022 (China, 2023), there are 11.39 million patients with CHD in China, among which the prevalence rate of people over 60 years old is 27.8%. In China, CHD has affected more than 10 million people and remains one of the top major causes of death (Chen et al., 2017). In 2019, the number of deaths caused by CHD in China reached 1.87 million, ranking second in the cause of death spectrum. At the same time, with the aging population and the continuing prevalence of risk factors, the prevention and control situation of CHD in China is becoming more serious, which will bring great economic burden (Commission, 2022).

CHD is sometimes referred to as coronary artery disease (CAD), which is caused by the narrowing of the large blood vessels that deliver oxygen to the heart. It results from multiple risks factors consisting of unmodifiable factors (e.g. age, gender, and genetics) and modifiable factors (e.g. physical inactivity, smoking, unhealthy diet, and harmful alcohol consumption, etc.). Overall, a patient has a higher chance of developing CHD if they possess one or more risk factors. This also depends on the degree or severity of each risk factor. Meanwhile, CHD could cause impact not only localized in the heart, but also on pulmonary function, whole-body skeletal muscle function, activity ability and psychological status (Wang, Ai, & Zhang, 2017).

Recommended therapies for CHD include revascularization by coronary artery bypass graft surgery or percutaneous coronary intervention coupled with long-term pharmaceutical therapy (Itier & Roncalli, 2018). Although these therapies are very efficacious in reducing the symptoms of angina and improving prognosis, these

patients continue to live with chronic cardiac disease with possible complications, including advanced heart failure, adverse cardiac events, and even death. Thus, these patients are still associated with high burdens of morbidity, mortality, readmission rates, and increased healthcare cost. In addition, previous studies revealed that the prevalence of anxiety and depression grew significantly, and health-related quality of life (HRQoL) was impaired among CHD patients (Le, Dorstyn, Mpofu, Prior, & Tully, 2018). Therefore, it is essential for CHD patients to take responsibility for taking care of themselves to manage their chronic conditions properly.

Self-management (SM) of chronic illness has been widely recognized as a way to support patients in living the best possible quality of life with their chronic condition (Kimble, 2018). SM is commonly defined as an 'individual's ability to manage symptoms, treatment, physical and psychosocial consequences, and lifestyle changes inherent in living with a chronic condition (Jonkma et al., 2016). SM includes the activities in which individuals engage to promote wellbeing with support from family, communities, and care providers. Self-management behaviors (SMB) refer to CHD patients through self-behavior, including long-term medication, smoking cessation, alcohol restriction, physical exercise, diet control, regular review, psychological factors management, persistent treatment to improve prognosis and prevent complications (Wang, 2023). Self-management behaviors can reduce symptom aggravation and the recurrent rate of cardiac events and improve the quality of life for patients. With the shift in predominant disease patterns from acute to chronic disease, the promotion of SMB amongst people with long-term conditions is important.

For patients living with CHD, SMB involves a range of behaviors including daily life management, disease medical management, and emotion management. These behaviors need the patients to insist on performing them for a long time, whereas many CHD patients could not keep self-management behaviors well (Li et al., 2017). For many individuals, optimum self-management behaviors are often difficult to achieve, as indicated by poor rates of adherence to treatment prescription, poor psychological wellbeing, and reduced quality of life, which are frequently reported across several chronic illnesses (Auld, Mudd, Gelow, Hiatt, & Lee, 2018; Kazemi Shishavan, Asghari Jafarabadi, Aminisani, Shahbazi, & Alizadeh, 2018). A

study of patients with CHD showed that 48.6% continued to smoke 1.35 years in median time after the cardiovascular event, almost two out of three patients were physically inactive, 38% were obese, more than 40% had hypertension and 80.5% had hypercholesterolemia (Kotseva et al., 2016). A cross-sectional study reported that 45.3% and 41.1% of patients were non-adherent to dietary recommendations and exercise, respectively, following a CABG intervention (Ali et al., 2017). In addition, the self-management behaviors of CHD patients is in the middle and low level, the patients' medication compliance is poor, the weight management is not good, and the bad habit of smoking and drinking is high in China (Chen, Yang, Yang, Pan, & XU, 2020). Hence, standardizing and urging patients to improve the level of self-management behavior is the focus of secondary and tertiary prevention of CHD and is also the core of continuous nursing work of cardiovascular nurses. Therefore, understanding factors related to SMB is important to improve the implementation of these behaviors and reduce the risk of morbidity and mortality of patients with CHD.

Based on a literature review and individual and family self-management theory (IFSMT), both context and process factors influence CHD patients taking self-management behaviors in real life. Several context variables were found related to SMB including, family functioning (Cui et al., 2023; Wang et al., 2023; Zhang, Zheng, Qiu, Zhao, & Zang, 2020), health literacy (Ajuwon & Insel, 2022; Kim et al., 2022; Papadakos et al., 2022) and depression (Ajuwon & Insel, 2022; Schmitt, Bendig, Baumeister, Hermanns, & Kulzer, 2021; Vestergaard et al., 2023). Depression is found to be common in adults with CHD, especially for elderly, and worsens CHD prognosis and increases the risk of complications (Carney & Freedland, 2017). Several process variables were found related to SMB including, knowledge (Ghozali & Urrohmah, 2023; Papappicco, Gramegna, Brio, & D'Accolti, 2023), self-efficacy (Liu et al., 2023; Zhang et al., 2023; Zhou & Li, 2020) and social support (Liu et al., 2023; Noviana & Zahra, 2022; Song, Chen, Wang, Yang, & Jiang, 2022).

To understand SMB, both context and process factors of adults with CHD may need to be considered. According to the IFSMT, SMB is conceptualized as proximal outcome in which CHD patients use knowledge, beliefs, and social facilitation to achieve SM goals. SMB is a multidimensional, complex phenomenon that can be conceptualized as affecting individuals, dyads, or families across all

developmental stages. IFSMT (Ryan & Sawin, 2009) was developed to address multiple levels of SM in chronic disease including CHD. Ryan and Sawin (2009) view SM as an activity based on the individual and/or family situation combined with factors that either assist or detract from self-management behaviors. In planning SM, the details of the CHD patient situation must first be assessed, including the condition specific factors, the physical and social environment of the patient, and the individual and family factors involved. Among them, Individual and family factors refers to characteristics of the individual and family that enhance or diminish SM, including family functioning and health literacy.

Family functioning refers to the family's day-to-day patterns that are practiced within the family context to enable favorable conditions for family members to thrive and represents the family's capacity to ensure that the basic and essential needs of its members are met. Family functioning has been widely discussed in nursing practice, education, and research. The term "family functioning" has been used frequently in the context of health research. Family functioning usually contains elements including communication abilities, problem solving, task performance and mutual support (Bennich et al., 2020). Previous literature suggests that effective family functioning results when the family members play their respective roles, successfully perform practical tasks, and maintain relationships within and beyond the family context. Luo and colleagues found that family functioning positively affected SM among youth with type 1 diabetes (Luo et al., 2019). An exploratory study (Bennich et al., 2019), including 127 patients with type 2 diabetes, also found the association between family function and SM. In the study of Huang et.al study (Huang et al., 2022) showed that family functioning plays an essential role in supporting the SM of depression, which is consistent with the results of Dachesa's study (Daches, Vine, Layendecker, George, & Kovacs, 2018).

Health literacy, defined as "the capacity to look for, process and understand health information to make informed decisions" (2004) seems an important priority to empower patients to self-manage their disease (Poureslami, Nimmon, Rootman, & Fitzgerald, 2017). In addition, health literacy can be divided into the categories of functional, interactive, and critical health literacy. Functional health literacy contributed to a better way to cope with the consequences of a chronic illness, to more

knowledge and to more confidence during consultations with professionals (Heijmans, Waverijn, Rademakers, Vaart, & Rijken, 2015). Weaknesses in health literacy pose a considerable health concern and may negatively influence SM, as well as interactions with health care professionals (HCP) and peers. Inadequate health literacy is associated with decreased patient engagement, which leads to worse SM and, ultimately, poor health outcomes. It is also associated with preventable health care resource use, including emergency department use and hospitalization (Papadakos et al., 2018). Qiu et.al (2019) found that functional, communicative, and critical health literacy were all significant predictors of different aspects of self-management behaviors among patients with hypertension (Qiu, Zhang, Zang, & Zhao, 2020a). These findings were similar to those of previous research. Both Heijmans et al. (Heijmans, Waverijn, Rademakers, Vaart, & Rijken, 2015) and Inoue et al. (Inoue, Takahashi, & Kai, 2013) demonstrated the significant correlations between functional, communicative, critical health literacy and self-management behaviors. A systematic review results suggest that using brief functional literacy scales in the clinical environment can be more practical (Kim et al., 2022). Health literacy was associated better medication adherence ($r = 0.487$, $p = .001$), and results implied that lower health literacy associated with lower self-management behaviors among African Americans which can lead to complications of T2DM (Ajuwon & Insel, 2022).

Depression is a major risk factor for morbidity and mortality of cardiovascular disease. From the literature review, depression acted as a psychological factor that had impacts on SM among CHD patients. Depression belongs to the context factor in our study based on IFSMT, which was the complex condition that CHD patients may face. A study reported that the prevalence of depression in patients with CHD ranged from 8.2 to 35.7% in men and from 10.3 to 62.5% in women in the United States (Vaccarino & Bremner, 2017). The incidence of depression in the Chinese population was reported to be in the range of 4% to 6% and as high as 14% to 17% in patients with CHD (Zhu, Li, Chen, & Liu, 2014). The prevalence of depression in elderly patients with CHD was 60.7% in Wu et al's study. Depression has an adverse impact on the treatment and prognosis of chronic disease (Lichtman et al., 2014; Nekouei, Yousefy, Doost, Manshaee, & Sadeghei, 2014). Several meta-analyses that examined the effect of depression on cardiac events (e.g.,

all-cause or cardiac-related mortality, revascularization) among CHD patients have reported that depression was associated with 1.19 to 2.71 times increased risk for cardiac events in this group of patients (Gan et al., 2014; Meijer et al., 2013). In CHD patients, depression is also associated with severity of functional impairment, lower adherence to therapy and lower participation in SM. In view of the theoretical assumptions and empirical evidence, depression showed negative effects on SM (Schulman-Green et al, 2016).

According to the IFSMT, knowledge, self-efficacy, and social support both belongs to process factors that may influence SM. Knowledge and self-efficacy categories as knowledge& beliefs in process factor. The term "factual information" that CHD patients need to know are beneficial to SM, we use this factor as knowledge in our research. Social support was the sub-items in the social facilitation. Knowledge and social support were mentioned as critical to the success of a person's ability to SM (Ryan & Sawin, 2009).

Knowledge can be described as the facts about the disease and its management those patients need to understand enabling them to perform complex SM activities. Disease knowledge may help patients to understand health problems and therapies better, which would lead to beneficial changes in health behavior and is essential in grasping self-efficacy skills. To effectively manage their disease, CHD patients should equip themselves with knowledge of how to live with the disease and how to address the simple but unpleasant symptoms. Studies have shown that improving SM of chronic disease means increasing patients' knowledge about their condition (Gray, 2004).

Self-efficacy refers to an individual's belief regarding his capability to carry out certain activities to achieve a desired outcome (Bandura, 1986). Self-efficacy was related to medication adherence, health behaviors and quality of life in patients with heart disease, self-efficacy has been shown to be a significant determinant of SM (Wu, Song, & Moser, 2015; Young, Kupzyk, & Barnason, 2017). Cross-sectional studies suggest that higher self-efficacy is also associated with better SM (Lin et al., 2017).

Social support refers to companionship, informational, esteem, and instrumental resources provided by a social network consisting of family members

and friends (Ding et.al, 2018). Social support could facilitate patients to perform SM by providing both subjective, objective support and support usage (Schulman-Green et al, 2016). Preliminary studies showed that social support has the potential to influence SM significantly, either directly or indirectly, through self-efficacy (Osborn et al, 2011). Social support from friends (Schroeder et al., 2019) and collaboration with both family and others (Abraido-Lanza et al., 2017) has been shown to positively influence SM levels in CHD patients. Lack of social support can be a deterrent to SM.

The IFSMT provides a practical framework to examine the factors relating to SM in CHD patients. As an outcome, SM in CHD patients has been shown to be inversely associated with cardiovascular disease incidence (Burton et al., 2019). In CHD patients who already adhere to SM guidelines, there are perceived benefits of CHD prevention, weight loss potential, and mental health benefits such as personal achievement, social/family connectedness, and increased quality of life as a result of SM (Zhang & Jemmott, 2019). Therefore, the study applied the IFSMT in the context of individual CHD patients.

Within the IFSMT and literature review, several context and process factors are associated with SM among CHD patients. SM are affected by various factors, such as context factors (family function, health literacy and depression), process factors (knowledge, self -efficacy, social support). SM is proximal outcome among this theory.

In conclusion, existing literature has revealed a description of the self-management behaviors and a correlation between major factors and outcomes. There is limited discussion in the literature about the simultaneous contribution of multiple factors that are influential in predicting the self-management behaviors of CHD patients. For these factors influencing the SM of CHD patients are complex and uncertain, so it is necessary to conduct further research on this problem. As self-management behaviors is a complex phenomenon, a full understanding of the multiple factors and their pathways leading to CHD patients' self-management behaviors is necessary in order to develop an effective intervention to enhance their self-management behaviors. The multiple factors influencing self-management behaviors among CHD patients should be tested simultaneously. The purpose of this study is to reveal the factors influencing the self-management behaviors of patients with CHD,

and to provide suggestions and references for improving the self-management behaviors of patients with CHD, reducing the incidence of adverse events, and improving the quality of life. Therefore, identifying the context factors (family functioning, health literacy, depression) and process factors (knowledge, self-efficacy, social support) of SMB among CHD patients and investigating into the relationships among the factors is important for health professional's practice. The findings of this research provide implications for health professionals including nurses working with CHD patients concerning their disease management. Base on this, health care practitioners can formulate more comprehensive and useful intervention to improve the SM of CHD patients. Findings from this research supply the real situation of self-management behaviors among Chinese CHD patients to policy maker. It also helped them to make an effective policy to help the CHD patients.

Research objectives

To develop and test a hypothesized model of self-management behaviors of patients with coronary heart disease in Yancheng, Jiangsu province, China.

Research Hypotheses

This study aimed to test the hypotheses as below:

1. Family functioning has a direct positive effect and indirect effect on SM behaviors through social support and self-efficacy.

2. Health literacy has a direct positive effect and indirect effect on SM behaviors through knowledge, self-efficacy and social support.

3. Depression has a direct negative effect on SM behaviors.

4. Disease knowledge has a direct positive effect on SM, has an indirect effect on SM behaviors through self-efficacy.

5. Self-efficacy has a direct positive effect on SM behaviors.

6. Social support has a direct positive effect on SM behaviors, has an indirect effect on SM behaviors through knowledge and self-efficacy.

Conceptual framework

This study was guided by the individual and family self-management theory (IFSMT) (Ryan & Sawin, 2009; 2014) and incorporated the literature review. The IFSMT concentrated on manage complex health situations in ways that reflect individual and family values and beliefs in perspective of individuals and family unit in a meaningful way (Ryan & Sawin, 2009). The IFSMT is a middle range descriptive theory that has been widely used in research involving adults with chronic and multiple conditions (Casida et al., 2018). This theory helps to explain factors that influence individual and family self-management behaviors for better outcomes and cost of health care services. The IFSMT proposes that SM is a complex dynamic phenomenon consisting of 3 dimensions: context, process, and outcomes (Ryan & Sawin, 2009).

The context dimension describes three main categories. First, the condition specific factors have subcategories that comprise the complexity of condition and treatment, trajectory and condition stability, and transitions. Second, the physical and social environment category has subcategories that involve health care access, transportation, culture, and social capital. Third, the individual and family factors have the subcategories of the developmental stage, learning ability, literacy, family structure and functioning, and capacity to self-manage.

The process dimension of IFSMT describes three main categories. The first category is knowledge and beliefs. It has the subcategories of factual information, self-efficacy, outcome expectancy and goal congruence. The second category is self-regulation skills and abilities. Its subcategories are goal setting, self-monitoring and reflective thinking, decision-making, planning and action, self-evaluation and emotional control. The third category is social facilitation. The subcategories are social influence, support (emotional, instrumental or informational), and negotiated collaboration.

The outcome dimension of IFSMT includes both proximal and distal outcomes. The proximal consequence is the actual participation in self-management behaviors related to a condition, risk, or change. The proximal outcome dimension describes two main types. These types are the individual and family self-management behaviors (such as engagement in activities or treatment regiments, use of

recommended pharmacological therapies, and symptom management) and the cost of health care services. The distal outcomes are partially dependent on the achievement of proximal outcomes. The distal outcomes dimension has three main types. These are health status (prevention, attention, stabilization, and worsening of the condition), quality of life (perceived well-being), and the cost of health (direct and indirect cost).

In this study, self-management behaviors acted as proximal outcome among adults with CHD, it can influence by context, process factors. The contextual factors include family functioning, health literacy and depression. These factors can be viewed as directly affecting proximal outcomes such as self-management behaviors, and indirectly through process factors. Factors in the contextual dimension influence individual and family engagement in the process of SM as well as directly impact outcomes.

Knowledge, self-efficacy and social support are process factors in the IFSMT. They were linked to constructs in the context dimensions and directly affect the proximal and distal outcomes. Enhancing the individual's and families' SM processes results in more positive outcomes. The third dimension of the theory relates specifically to outcomes. Outcomes are proximal or distal. While the outcomes of concern are those related to individuals and families, improvement of individual and family outcomes translate to improved outcomes for healthcare practitioners and systems.

Within the literature, several context factors are associated with SM behaviors in CHD patients. Based on IFSMT perspective, the hypothesized model of this study is showed in Figure 1.

Note: CCS = confidence in controlling symptom

CMF = confidence in maintaining function
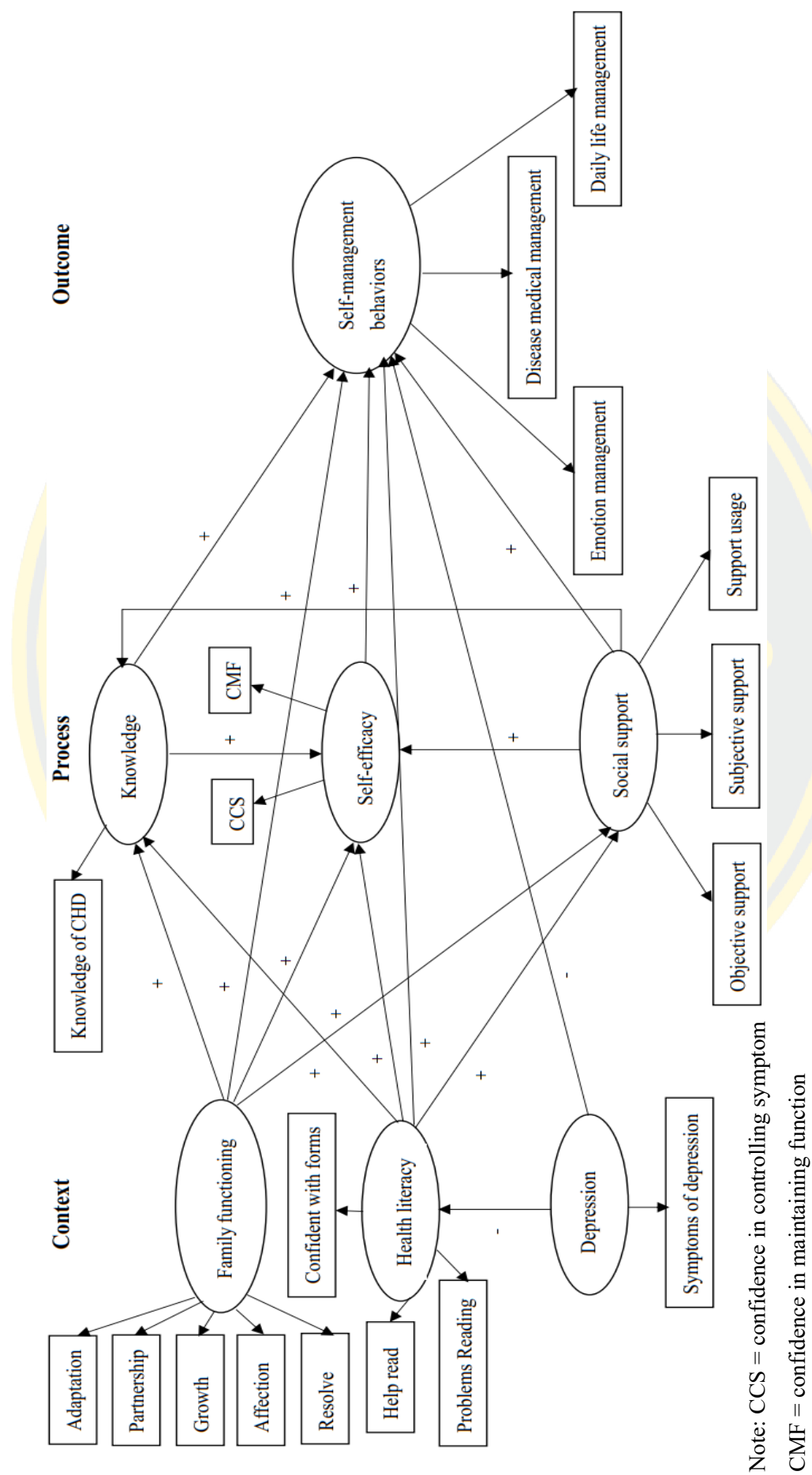
Figure 1 The Hypothesized Causal Model of Self-management Behaviors for CHD Patients

Scope of the study

An empirical of a cross-sectional structural model was conducted to investigate the influence of six predictors on SM. The participants of this study were the CHD patients who receiving permission to participate in this study in Yancheng City, Jiangsu province, China.

Definition of terms

CHD patients refer to adults clinically diagnosed as coronary heart disease by coronary arteriography, assessed angiographically and was confirmed as CHD when ≥ 50% stenosis existed in at least one major epicardial coronary artery (Theken et al., 2012). Digital coronary angiography results indicated coronary artery stenosis in more than 50% of patients with coronary artery disease in this study.

Family functioning refers to patients with CHD who gained the adaptation, partnership, growth, affection and resolve aspects from family members when they face difficulties and make decisions. It was assessed by the Family APGAR Index which was developed by Smilkstein et al.(Smilkstein, Ashworth, & Montano, 1982) and translated into Chinese version by Lv and Gu (1995).

Health literacy refers to the functional health literacy, is defined as the basic level skills that are sufficient for CHD patients to obtain relevant health information (for example on health risk, and on how to use the health system), and to be able to apply that knowledge to a range of prescribed activities. Functional health literacy refers to basic reading and writing skills of CHD patients. It was assessed by the Chew's Set of Brief Screening Questions (Chew, Bradley, & Boyko, 2004).

Depression refers to CHD patients characterized by depressed mood or anhedonia (loss of interest or pleasure), functional impairment and additional somatic or cognitive symptoms. It was measured by the self-rating depression scale (SDS) (Qiu, Zhang, Zang, & Zhao, 2020b).

Knowledge refers to understanding of CHD patients about the information of coronary heart disease risk factors, inducing factors, clinical manifestations, examination methods, treatments, drug knowledge and secondary prevention

knowledge after discharge. It was measured by the coronary heart disease knowledge questionnaire (Xiao, 2008).

Self-efficacy refers to belief or confidence of patients with CHD in their abilities to carry out certain activities to maintain their health or prevent complications of CHD. Self-efficacy includes confidence in controlling symptom (CCS) and confidence in maintaining function (CMF). It was assessed by the Self-efficacy for Chronic Disease 6-item Scale (SECD6) (Jiang, Zhang, Yan, Liu, & Gao, 2020).

Social support refers to the perceptions that CHD patients receive help or support from spouse, child, relative, neighbor, colleagues. It was assessed by the Social Support Rating Scale (SSRS) developed by Xiao (Xiao, 1994).

Self-management behaviors refer to actions or abilities that CHD patients used to control their disease, including daily life management, disease medical management and emotional management. It was measured by Coronary artery disease Self-management Scale (CSMS) developed by Ren (2009).

CHAPTER 2

LITERATURE REVIEW

The literature reviews are presented in 4 parts to provide an understanding of the relevant context in the present study. The first part of this chapter describes CHD, including the definition, classification, pathophysiology, risk factors, signs and symptoms, treatment and impacts to patients & families of CHD. The second part focuses on the concept of SM in CHD, including definition, self-management among persons with CHD, and components of self-management behavior in patients with CHD. The third part describes theories linked to SM, Individual and Family Self-Management theory. The fourth part describes factors influencing SM in CHD, including family functioning, health literacy, depression, knowledge, self-efficacy and social support.

Situation of Coronary heart disease in China

CHD is currently one of the most serious diseases affecting public health. CHD Morbidity: Recently 10 Annual statistics show that among every ten thousand people worldwide, there are 835 male, 265 female suffer from CHD. According to the Chinese Cardiovascular Disease Report 2018, our country has at least 1100 ten thousand people suffer from CHD (El-Menyar et al., 2011). With the aging of China's population and the trend of CHD's younger age in recent years, the number of CHD patients will be larger. CHD mortality: the proportion of CHD deaths in total deaths is 1/4 that of developed countries; the figure for western countries is one-third (Cui, 2018). The annual death rate of CHD is about 1.1 million in China, among which the urban mortality rate is 94.96 out of 100 000 and the rural mortality rate is 91.27 out of 100 000 (with an increasing trend in recent years) (Chen, 2016). It is predicted that CHD may become the leading cause of death in China by 2022 (Hu et al., 2019).

Definition of coronary heart disease

CHD is defined as changes to myocardial function as a result of coronary artery disease (CAD), commonly atherosclerosis (Malecki-Ketchell 2016). CHD is characterized by narrowed arteries. This narrowing is caused by either the formation or rupture of plaque. Consequently, the heart will experience hypoperfusion to the muscle. This further manifest itself as chest pain and an EKG will show ST-segment elevation and T-wave changes. The patient will also experience diastolic and systolic dysfunction respectively (Buttaro, Trybulski, Bailey, & Sandburg-Cook, 2013). CHD is a major cause of death and disability in developed countries. Although the mortality for this condition has gradually declined over the last decades in western countries, it still causes about one-third of all deaths in people older than 35 years (Nichols, Townsend, Scarborough, & Rayner, 2014).

Classification of coronary heart disease

In recent years, in order to adapt to the updating of the diagnosis and treatment concept of CHD and facilitate the formulation of treatment strategies, two syndromes have been clinically classified, namely chronic myocardial ischemia syndrome and acute coronary syndrome.

Chronic Myocardial Ischemia Syndrome

Also known as stable coronary heart disease, its most representative disease is stable angina pectoris, including hidden coronary heart disease, stable angina pectoris and ischemic cardiomyopathy (ICM). Angina pectoris is a clinical syndrome caused by acute and temporary ischemia and hypoxia of the myocardium due to insufficient coronary artery blood supply.

Acute Coronary Syndrome

ACS is an acute manifestation of CHD. ACS describes a spectrum of acute cardiac events associated with atherosclerotic plaque rupture or erosion, which including ST-segment elevation myocardial infarction (STEMI), non-ST-segment elevation myocardial infarction (NSTEMI) and unstable angina (UA) (Libby &

Theroux, 2005). In recent years, the former was called ST-segment elevation ACS, accounting for about 1/4 (including a small number of variant angina pectoris), while the latter two combined were called non-ST-segment elevation ACS (NSTE-ACS), accounting for about 3/4. They mainly included Q-wave AMI, non-Q-wave AMI and unstable angina pectoris.

Pathophysiology of coronary heart disease

CHD is most commonly a consequence of fibro-lipid atherosclerotic plaque in the intimal lining of the main epicardial coronary arteries and significant branches. The plaque develops over many years from the deposition of relatively innocuous 'fatty streaks' in the arterial walls at a young age (atherosclerosis) (Lilly 2011). It is evident there is a complex interplay of predisposing risk factors and atherosclerosis (Libby & Theroux, 2005). Reduced coronary blood flow resulting from luminal narrowing of up to approximately 50-60% can often be accommodated (Libby & Theroux, 2005). However, once stenosis exceeds 60%, resting coronary blood flow may be maintained, but maximal blood flow will be reduced, leading to insufficient supply to meet increased myocardial demand during increased activity. Symptoms of myocardial ischaemia occur, commonly central chest pain, but subside with rest when myocardial demand falls to within the limits of supply (Malecki-Ketchell, 2016).

Risk factors of coronary heart disease

Risk factor for CHD falls into two categories: unmodified risk factors (age, gender, genetic) and modifiable risk factors (HTN, Dyslipidemia, DM, obesity and overweight, smoking, physical inactivity). Overall, a patient has a higher chance of developing CHD if they possess one or more risk factors. This also depends on the degree or severity of each risk factor (AHA, 2019).

The main unmodified risk factors for CHD

Age

CHD prevalence increases after 35 years of age in both men and women. The lifetime risk of developing CHD in men and women after 40 years of age is 49% and 32%, respectively (Sanchis-Gomar, Perez-Quilis, Leischik, & Lucia, 2016).

Gender

There were gender differences in the incidence of CHD. Men are at increased risk compared to women. The study found that both white and non-white men in the United States have a higher incidence of CHD than women. The Framingham study found that postmenopausal women were twice as likely to have CHD as non-postmenopausal women (Brown, Gerhardt, & Kwon, 2022).

Genetic

A long-term follow-up study of 20,000 twins in Sweden showed that the relative risk of death from CHD by age was twice as high in monozygotic twins as in dizygotic twins, suggesting a strong genetic influence on CHD. For example, the effect of apolipoprotein gene polymorphism on blood lipid level in familial hyperlipidemia and the reaction process of angiotensin converting enzyme gene polymorphism on restenosis after stenting may affect the pathogenesis and treatment of CHD. Blacks, Hispanics, Latinos, and Southeast Asians are ethnic groups with an increased risk of CHD morbidity and mortality (Volgman et al., 2018).

The main modified risk factors for CHD

Hypertension

Hypertension (HTN) is a risk factor that is related to elevated blood cholesterol levels. A large number of studies have shown that hypertension is the main risk factor for CHD. It poses dangers that are well known within the health care community. Its effect on organ degeneration and morbidity and mortality is astounding (Buttaro et al., 2013). Both systolic and diastolic blood pressures increase the risk of CHD. Regardless of single factor analysis or multi-factor analysis, systolic

blood pressure and diastolic blood pressure are significantly related to the incidence of CHD, and with the increase of blood pressure, the incidence and mortality of CHD are on the rise. The risk is higher than in the general population, even if the blood pressure is at the normal high level (120-139/80-89 mm Hg).

Hypertension has come to the attention of the Centers for Disease Control, which acknowledges the risk that HTN poses for CHD and stroke (CDC, 2020). It reports that 75 million American adults (1 in 3) have been diagnosed with high blood pressure, and that HTN accounts for more than 1,100 deaths each day. An additional 1 in 3 adults are pre-hypertensive. The impact on the American economy is difficult to ignore at $131 billion dollars annually (CDC, 2020). The role of lifestyle changes in the treatment of hypertension is very important. As mentioned previously, dietary changes that include low salt intake are recommended. Developing a daily exercise routine, living tobacco-free life, while restricting the use of alcohol, and keeping an ideal weight are additional recommendations (Mayo Clinic, 2017).

Dyslipidemia

Elevated blood cholesterol, hypertriglyceridemia and the incidence of CHD are associated. TC is an important component of atherosclerosis, which has been confirmed by a large number of population studies and animal experiments. The Framingham study confirmed that the risk of CHD was relatively stable when the blood TC level was 200-220 mg/dl. Beyond this limit, the risk of CHD will increase with the increase of TC level. Lipoproteins play a major role in the transportation of cholesterol, which attaches itself to the lipoprotein. Blood TC was divided into different components, among which low-density lipoprotein (LDL) was positively correlated with the occurrence of cardiovascular disease, while high density lipoprotein (HDL) was negatively correlated with the occurrence of cardiovascular disease. "Bad" cholesterol or LDL is the culprit in CHD risk. LDL cholesterol lays the foundation of plaque in the arteries, eventually causing stiffness and stenosis.

Although cholesterol is necessary for cell growth and development, an elevated blood cholesterol level restricts the flow of blood in the artery. Secondly, elevated blood cholesterol increases the risk for the development of clot formation, which can then result in a heart attack or stroke (Mayo Clinic, 2019). Hypertriglyceridemia is an independent risk factor for CHD. Stockholm et al. found a linear relationship between CHD and triglyceride. Research founded that preparing meals low in sodium, eating fruits, vegetables, whole grains, reducing animal fat intake, and exercising for at least 30 minutes daily are other effective ways to reduce blood cholesterol levels. One key factor in reducing cholesterol level in the blood through dietary efforts is the reduction of saturated fat in food. The energy in saturated fat can be replaced with polyunsaturated fat. A review of the long-term evidence from 15 randomized controlled trials with 59,000 participants (Hooper et al., 2020) demonstrated that a reduction in dietary saturated fat was associated with a 17% reduction in cardiovascular events (RR 0.83; 95 % CI 0.72 to .96).

Diabetes mellitus

Diabetes is a high-risk factor for CHD. Diabetes is a disease that affects 422 million people globally (WHO, 2018b). An estimated 23.4 million U.S. adults have diabetes, while an estimated 7.6 million adults have diabetes but have not been diagnosed, according to data released by the American Heart Association (AHA) in 2017. The disease affects the body in many ways, affecting the eyes, blood vessels, heart, nerves, and kidneys. By 2030, the prevalence of diabetes worldwide is expected to rise to 7.7%. A large-scale survey of the Chinese population published in the New England Journal of Medicine in 2010 found that 92.4 million Chinese adults had diabetes (9.7% of the population). Ning et.al study, published in JAMA, also showed that the prevalence of diabetes in Chinese adults over 18 years old was 11.6%, higher in urban areas than in rural areas.

Diabetes, particularly diabetes mellitus or type 2 diabetes poses as a risk factor of CHD. This risk of suffering from CHD has been observed to be higher in

patients with diabetes than in non-diabetes. Diabetes has been observed to be often associated with hyperlipidemia, which is characterized by increased levels of triglycerides and decreased levels of HDL cholesterol (Malakar et al., 2019). Low levels of HDL cholesterol, high levels of very low-density lipoprotein (VLDL) cholesterol and high levels of total VLDL triglycerides have been reported as risk factors for CHD in patients with type 2 diabetes. Many studies were conducted to demonstrate the use of drugs to decrease the incidence of CHD in diabetic patients.

Epidemiological studies show that patients with diabetes are prone to CHD. The link between having diabetes and cardiac disease is well-documented. The Cardiovascular Outcome Trial Summit of the Diabetes and Cardiovascular Disease European Association for the Study of Diabetes Study Group is clear on the effective of DM on cardiovascular health. The conclusion that DM increases the risk of heart failure (HF) was strong (Schnell, et al., 2017).

Obesity and overweight

The role of obesity and overweight as a risk factor for CHD has been gradually discovered. Obesity defined generally as the accumulation of excessive fat that which poses negative consequences for health (WHO, 2018a). A general guideline for assessment of obesity and overweight is body-mass index (a weight for height index). Overweight individuals are those with a BMI between25-29, and an obese person possesses a BMI >30 (WHO, 2018a). Obesity is a disease that could impact nine organs and involve 40 conditions (Kushner, 2007). Studies discover obese patients and CHD risk demonstrate that to manage their risk of CHD, the patient will need to eat less and exercise.

Wang et al., (2014), identified a relationship between CHD and obesity through a systematic review and meta-analysis of 89 studies and 130, 0794 patients. Wang and his colleagues found a J-shaped relationship between obesity and mortality. Being overweight and obese showed a lower risk of mortality initially (0.60, (0.64 to 7.750; 0.68 (.61 to .75)), but that changed to a greater long-term mortality after five

years of follow-up (0.78 (.74 to .82); .79 (.73 to .85)). Obesity is confirmed to independently predict CAD (Fontes, et al., 2018), based on clinical, laboratory and angiographic profiles. The angioplasty for obese patients showed coronary lesions in excess, and additional diseases.

Smoking

It is generally accepted that smoking is one of the important risk factors of CHD. Smoking rates have fallen in developed countries, but global tobacco use is on the rise. Tobacco smoking is related to multiple health complications which threaten health and wellness. Its contribution to CHD morbidity and mortality in particular is overwhelming. Worldwide, smoking (including secondhand smoke) kills an estimated 6.3 million people (Dżugan, Błażej, & Tomczyk, 2019). Factors contributing to the harmful effects of tobacco smoking and its relationship to CAD are multi-faceted (van den Brand et al., 2017).

Smokers of tobacco also tend to consume a high fat diet without sufficient amounts of fruits, vegetables, and other foods that have a high fiber content. They tend to drink very little water and often opt to skip eating breakfast and choose to eat dinner closer to bedtime (Dżugan, Błażej, & Tomczyk, 2019). In addition, the risk of myocardial infarction in smokers is 1.5-2.0 times higher than that in non-smokers.

Physical inactivity

A sixth modifiable risk factor, physical inactivity, promises to offset a myriad of diseases including CHD when managed, with its high mortality and morbidity (Mekić et al., 2019). Exercise is being seen as a solution for cardiac wellness and fitness by reducing blood lipid levels. Thirty minutes of physical activity per day can reduce CHD mortality by 40% to 60% (World Congress on Insulin Resistance, Diabetes, and cardiovascular disease, 2019). Benefits of physical activity were observed in waist circumference, triglyceride levels, blood pressure, and fasting glucose. Aerobic exercise provided the biggest reduction in CHD risk (World Congress on Insulin Resistance, Diabetes, and cardiovascular disease, 2019).

The literature favors physical activity for the decrease in lipid profiles for CHD patients, with increase in HDL levels and a decrease in LDL blood levels (Rajić et al., 2019). Almost always, the recommendation for physical exercise is coupled with a recommendation for a heart healthy diet. However, exercise has shown a 24 % favorable decrease in all-cause mortality (HR- 0.76, 95 % Cl, 0.65-0.88) (Mok, Khaw, Luben, Wareham, & Brage, 2019). Beyond the individual and the physical benefits, the impact of physical activity extends to psychological benefits, the community, the environment, and the workplace (Johnston & Macridis, 2019).

Signs and symptoms of coronary heart disease

Clinical manifestations of stable angina pectoris

With parochial chest pain as the main performance, the department is located in the middle or upper segment of the sternum body can affect the anterior area, often radiating to the left shoulder, left arm and even ring finger or little finger; the nature is oppressive discomfort or tightness, tightness, burning sensation; Often due to physical labor or emotional induction, satiety, cold, defecation, smoking, cardiac tachycardia, shock can also be induced; the pain lasts about 3-5 minutes and relieves within a few minutes of rest or sublingual nitroglycerin.

Clinical manifestations of unstable angina pectoris

The location and nature of chest pain are similar to stable pectoris, but it has one of the following characteristics: 1) In one month, the frequency of pain attack increases, the degree of aggravation, the time limit is prolonged, the induced factors change, and the alleviating effect of nitric acid vinegar drugs is weakened; 2) New angina within a month; 3) At rest, the attack of pectoris or mild activity can be induced.

Clinical manifestations of acute myocardial infarction

Pain is the first symptom, more in the early morning or quiet, severe, lasting for a long time, up to several hours or longer, rest and nitroglycerin cannot be relieved. Systemic symptoms include fever, tachycardia, leukocyte hyperplasia and

rapid erythrocyte sedimentation rate. Gastrointestinal symptoms include frequent nausea, vomiting, and epigastric pain. Arrhythmias occur in 75%-95% of patients, most of which occur within 24 hours after onset, and ventricular arrhythmias occur more often. It often combined with low blood Pressure and shock, heart failure.

Treatment of coronary heart disease

Diet and Lifestyle Management of CHD Risk Factors

Diet and lifestyle management should always be considered necessary for the therapeutic treatment of CHD. Unhealthy diet and lifestyle act as basic CHD risk factors which not only initiate CHD process but also worsen the prognosis of CHD, as supported by various evidences (Jia, Liu, & Yuan, 2020). No matter how effective drugs and revascularization techniques might be, an experienced cardiologist shall never ignore the importance of diet and lifestyle management.

Diet Management of CHD Risk Factors

Diet management is one of the fundamental factors to CHD risk control. According to AHA dietary guidelines, population goals are summarized as: forming overall healthy eating pattern, maintaining appropriate body weight, and achieving desirable cholesterol profile and blood pressure levels (Krauss, Pinto, Liu, Johnson-Levonas, & Dansky, 2015).

As a general principle, the AHA guidelines supports the consumption of a variety of foods from all food categories with special emphasis on fruits and vegetables, including fat-free and low-fat dairy products; cereal and grain products; legumes and nuts; and fish, poultry, and lean meats (Krauss et al., 2015).

Lifestyle Management

Lifestyle modification programs were associated with reduced all-cause mortality (summary OR 1.34, 95% CI 1.10–1.64), cardiac mortality (summary OR 1.48, 95% CI 1.17–1.88), and cardiac readmission and non-fatal reinfarction (summary OR 1.35, 95% CI 1.17–1.55) (Janssen et al. 2012). Analysis from a large RCT (the Organization to Assess Strategies in Acute Ischemic Syndromes (OASIS) 5

trials) revealed that patients who change their behavior (quit smoking, modify diet, and exercise) after ACS were at lower repeat CV events in 6 months. The benefits from each behavior modification are additive as the highest risk of a repeat CV event belonged to those who change none of them (OR, 3.77; 95% CI, 2.40–5.91; p < 0.0001) (Chow et al. 2010).

What should be emphasized is that changing the habits never too easy to achieve and even sustain for a lifetime. Support and guidance from physicians and other external factors, comprehensive, continuing, and individualized, is deemed to be of great importance.

Weight Control

Obesity has a predisposition to the development and progression of atherosclerosis and CHD. As BMI increases, patients are more likely to have hypertension, diabetes, hyperlipidemia, and sleep dyspnea, which are labeled as CHD risk factors as well. With regard to the outcome of weight loss, several studies found a trend of better prognosis (revealed by serum biochemical parameters) or noted reduction in CV events and mortality (Jia et al., 2020). Thus, it is encouraged to lose weight in overweight and obese CHD patients with administration of dietary and physical strategies.

Guidelines for Treatment of ACS

Acute coronary syndrome (ACS), according to the definition, consists of three cardiac conditions: ST elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), and unstable angina (UA). The combination of NSTEMI and UA is non-ST elevation acute coronary syndrome (NSTE-ACS). Contrary to stable coronary artery disease, ACS is an urgent and sometimes a fatal condition that requires immediate medical treatment (Jia et al., 2020).

Guidelines on Treatment of STEMI

AHA/ACC guidelines elaborated on recommendations as whether or not to initiate PCI in different STEMI situations (American College of Emergency 2013) while ESC guidelines provided more details on procedural aspects of primary PCI (Task Force Members Steg et al. 2012).

PCI in elderly STEMI patients

However, there is little mention of PCI in elderly STEMI in the guidelines, as very few studies show the clinical outcomes of PCI in elderly STEMI patients (≥75 years old). Peiyuan et al. (2016) reported in CAMI registry research, which involved 3082 elderly patients, that rates of death were 7.7, 15.0, and 19.9%, respectively, with primary PCI, fibrinolysis, and no reperfusion (P < 0.001). The study came to a conclusion that early reperfusion, especially primary PCI, was safe and effective with absolute reduction of mortality compared with no reperfusion (Jia et al., 2020).

Antiplatelet and antithrombin therapies

In terms of adjunctive antithrombotic therapy to support reperfusion with primary PCI, both AHA and ESC guidelines made detailed recommendations on types and doses of each medication.

It is suggested in the AHA guidelines that it may be reasonable to administer intracoronary abciximab to patients with STEMI undergoing primary PCI (IIb, B). In terms of anticoagulants, the ESC guidelines recommended enoxaparin over unfractionated heparin (UFH) and a GPIIb/IIIa blocker. Since the publication of the ESC and AHA guidelines on STEMI, there are a number of new antiplatelet and anticoagulant agents approved for clinical use. Cangrelor is a potent, rapid-acting, reversible intravenous platelet inhibitor that was tested for PCI (Steg et al. 2013). Sarpogrelate, a specific 5HT2-receptor antagonist, is another novel antiplatelet agent which blocks serotonin-induced platelet aggregation. Yet usage of sarpogrelate in STEMI is rarely reported.

Guidelines on Treatment of NSTE-ACS

Multivessel PCI

It is recommended in the AHA guidelines that a strategy of multivessel PCI, in contrast to culprit lesion-only PCI, may be reasonable in patients undergoing coronary revascularization as part of the treatment for NSTE-ACS (IIb, B). It is still unclear whether multivessel PCI is beneficial to NSTE-ACS patients with multi-vessel lesions. It is concluded that multivessel PCI reduced repeat revascularization without significant benefits in terms of mortality or myocardial infarction at the long-term follow-up in patients with NSTE-ACS and multivessel coronary disease (Jia et al., 2020).

Antiplatelet and anticoagulant therapies

Antiplatelet and anticoagulant therapies are of great importance in NSTE-ACS patients undergoing PCI, as they prepare patients for interventional procedures, reduce ischemic complications, and improve long-term prognosis (Jia et al., 2020).

Both guidelines made clear and strong recommendations on statins usage for NSTE-ACS patients. Besides its lipid-lowering effects, statins have been discovered to have anti-inflammation and antithrombotic properties as well, which is a possible cause for its multiple beneficial effects. It is recommended in ESC guidelines to start high intensity statin therapy as early as possible, unless contraindicated, and maintain it long term (I, A) (Jia et al., 2020).

Vasospastic angina

In terms of vasospastic angina, the ESC guidelines recommended that calcium channel blockers and nitrates should be considered, and beta-blockers must be avoided (IIa, B) (Roffifi et al. 2016).

PCI versus CABG

Furthermore, the argument between coronary artery bypass graft (CABG) surgery and percutaneous coronary intervention never stopped. In the setting of NSTE-ACS, PCI's main advantages are faster revascularization of culprit lesion,

lower risk of stroke, and deleterious effect of cardiopulmonary bypass on the ischemic myocardium, while CABG more frequently offer complete revascularization in advanced multivessel CAD (Roffifi et al. 2016). In the setting of STEMI, although CABG is comparatively rare, CABG may be indicated in patients with anatomy unsuitable for PCI but who have a patent infarct-related artery, as patency of this artery provides time for transferring to the surgical team. Detailed evidence are provided in both AHA and ESC guidelines. Medical practitioners should be adept at choosing different methods of revascularization according to various settings. Cooperation and consultation between interventional cardiologist and cardiac surgical teams should be well established in order to provide the most in-time, high-quality treatment possible to ACS patients.

Last but not the least, it's always important to remember that management of both STEMI and NSTE-ACS is an integrated body of multiple teams works. we chose to only focus on the most effective and core parts of ACS treatment, percutaneous coronary intervention, and protective medications. A complete management of ACS involves timely and accurate diagnosis, making strategic decisions based on risk assessment, pharmacological treatment, or revascularization, early and late hospital care, post-hospital discharge care, and so on.

Impacts of CHD to patients & families

The medical cost of CHD is huge. The total hospitalization cost and average hospitalization cost of acute myocardial infarction in China are 19.085 billion yuan and 26056.9 yuan respectively, with an annual growth rate of 29.15% and 7.12% respectively (Hu et al., 2019). Acute myocardial infarction costs at least 70% of urban residents' disposable income, 2.5 times of rural residents' per capita net income, and coronary artery bypass surgery costs 2.2 times of urban residents' disposable income and 7.4 times of rural residents' per capita net income (Gao, 2017). Myocardial infarction and coronary heart disease were two of the 10 most expensive diseases treated in US hospitals in 2013. Between 2013 and 2030, medical costs for CHD are

expected to increase by about 100%. By 2035, the total cost of cardiovascular disease in the United States is projected to reach $1.1 trillion, with direct medical costs projected to reach $748.7 billion and indirect costs projected to reach $368 billion (Benjamin et al., 2018). It imposes a heavy economic burden on individuals, families, and society.

In brief, CHD is a typical chronic disease, requires long-term self-management of patients. Besides, it is impractical and inefficient to completely rely on medical institutions and medical personnel for the care and management of chronic diseases. Therefore, self-involvement and self-management in life, disease-related and emotional aspects of CHD patients are very important to delay the reduction of cardiac function, control the further development of CHD and improve the quality of life of CHD patients, and self-management is the most important factor affecting CHD health-related behaviors.

Self-management of coronary heart disease

Self-management can reduce symptom aggravation and the recurrent rate of cardiac events and improve the quality of life for patients. As a secondary prevention mode, it has been gradually popularized in chronic diseases at home and abroad and has significant effects in changing patients' bad living habits, improving treatment compliance, enhancing disease management ability, improving disease prognosis. Self-management of patients with CHD in China found that self-management can directly predict the quality of life and prognosis of patients with CHD and is a strong predictor of disease prognosis and management.

Definition of self-management

Self-management usually refers to the patient's ability to manage self-disease and their own status. Thomas Greer et al. first elaborated this concept in the 1970s, and its purpose is to make patients actively participate in the treatment of the disease and carry out positive self-behavior restraint and self-behavior supervision in

the process of disease progression. Later, Barlow et al. (2003) further systematized it as an ability to manage changes in symptoms, make patients comply with treatment, and adapt to and adjust to the disease state from both physiological and psychological levels (Liu, 2016). In short, self-management refers to a patient's "individual commitment to some preventive or therapeutic health care activities with the assistance of a health care provider."

Self-management is what individuals do for themselves to maintain their health and wellbeing, to preserve their physical function and to prevent further illness (Conn, 2011; Department of Health, 2005). Dickson, Tkacs and Riegel (2007; page 424) define it as: "an active process intended to maintain health through treatment adherence, symptom monitoring, recognition and treatment and an evaluative process whereby learning occurs in response to prior self-management".

Self-management among persons with CHD

Self-management is an evaluation of patients' ability to manage their own diseases and their own state. CHD as a behavioral disease, self-management plays an important role in prognosis by changing unhealthy lifestyle such as smoking, unreasonable diet and insufficient physical activity. However, existing studies have shown that the self-management of CHD patients in China is not optimistic, the risk factors are not well controlled, and the quality of life is poor. In patients with CHD, nearly half of the subgroup under 70 years old has not been effectively controlled blood pressure, more than half of the patients have poor blood lipid control, diabetes, smoking, and obesity do not change their unhealthy lifestyle. The study of Wang et al.(2017) pointed out that patients' self-management after coronary artery interventional therapy was at a medium and low level, and the scoring rate of emotional management and medical management of diseases was low, which were closely related to the long-term quality of life of patients (Wang, Yang, Yang, Song, & Jiang, 2017). The above findings indicate that the self-management level of CHD patients in China is generally at a medium or low level.

Compared with foreign current studies show that: overall, the level of patients with CHD is poor, risk factors control is not ideal. The higher the level of self-management, the more patients can avoid bad health behaviors, reduce the recurrence and hospitalization times, delay the occurrence of complications, improve the quality of life, reduces the family economic burden (Tamim &Victor, 2006). Components of self-management behavior in patients with CHD.

Based on the research results of evidence-based medicine for the secondary prevention of CHD, Ren et.al (Ren et.al, 2009) took the self-management of chronic diseases and health behaviors proposed by Lorig (Lorig & Holman, 2003) as guidance and combined with the unique characteristics of CHD management, divided the self-management behavior of CHD into 7 aspects: General life management, bad habit management, disease knowledge management, symptom management, first aid management, treatment compliance management, emotional cognition management. Among them, disease knowledge management, symptom management and emergency management are the specific self-management of patients with CHD.

General life management

The incidence of heart disease is closely related to lifestyle, and physical activity and diet are strong predictors of lifetime incidence of common heart disease (Menotti, Puddu, Maiani, & Catasta, 2015). Therefore, a good balance between work, activity and rest, and the formation of good and regular living habits, is a very important part of the self-management of patients with CHD. In daily life, patients with CHD should also pay attention to rest, especially on-the-job patients with CHD, pay attention to work and rest, and develop good living habits.

Bad habit management

Bad habits, such as smoking, alcohol abuse, high salt, high fat diet are the risk factors of CHD. Therefore, the management of bad habits is very important for the prevention and treatment of CHD. Studies (Kozakova et al., 2017) have shown that there is a significant association between cardiovascular events and smoking status.

Although heavy drinking is a risk factor for CHD, studies have shown that light, regular alcohol consumption, especially red wine, can increase HDL cholesterol levels and have a protective effect on cardiovascular events (Gepner et al., 2015). Therefore, for patients with CHD, they should strictly quit smoking, limit alcohol drinking, if there is the habit of drinking should be drunk in the capacity and number of times prescribed by professionals. In terms of diet management, they must do a good job of low-fat, low-salt diet. Low salt requires salt intake of less than 6 g/d, and low fat requires reducing the intake of saturated fatty acids, trans-fatty acids, and cholesterol.

Disease knowledge management

The Knowledge-attitude-practice (KAP) model is one of the models to change human health related behavior. It divides the change of human behavior into three processes, namely acquiring knowledge, generating belief and forming behavior. Knowledge is the basis of behavior change and forming, while belief and attitude are the driving force of behavior change and forming. CHD patients can seek the help of professionals to obtain disease-related knowledge, such as understanding the precautions and side effects of their own medication, how to control and manage their own diseases.

Symptom management

The main clinical symptom of CHD is angina pectoris, record the nature of pain during the attack, location, duration is especially important for patients, it can make a correct diagnosis for doctors and take appropriate measures to provide basis for treatment, at the same time, the characteristics of the patient's pain attack by recording also can change to better understand their condition. Avoid angina by summarizing the trigger after each attack. In addition, patients should master the correct and effective monitoring of pulse rate, heart rate, blood pressure method, through objective indicators can reflect the body changes, and then better manage their own diseases.

First aid management

For patients with CHD, it is very important to be able to take effective first aid measures when the disease attacks. It is very necessary to learn from professionals to understand first-aid knowledge and master first-aid skills. Medical personnel should not only teach patients to identify the symptoms of acute attacks, but also encourage patients' families to participate in the management of the disease and learn first-aid knowledge. In addition to mastering certain first-aid knowledge, patients should also carry first-aid drugs to save themselves in the first time.

Treatment compliance management

CHD is a chronic disease that occurs repeatedly and requires long-term and lengthy treatment. Therefore, it involves the patient's compliance with the treatment plan, and the compliance can affect the outcome of the disease. So, treatment compliance management plays an important role in the self-management of disease. Ren Hongyan (Ren, 2009) explained the treatment compliance of patients with CHD from two aspects of medication compliance and review compliance.

Emotional cognition management

CHD not only causes physical discomfort, but also often brings psychological pressure to patients due to lifelong treatment, resulting in anxiety, depression, anger and other negative emotions. Therefore, learning to recognize these negative emotions and master the control of these emotions plays an important role in the rehabilitation and treatment of diseases. Since emotion plays an important role in regulating the prognosis of disease, emotion management is an important part of self-management. In order to better manage the negative emotions caused by these diseases, patients can properly participate in some social welfare activities and local clubs, or talk to family members or friends, find ways to vent their negative emotions and learn to adjust themselves.

Impacts of self-management among CHD patients

SM can significantly reduce the financial burden of treatment on the healthcare system. Effective self-management is an important factor in promoting positive health outcomes and disease prevention. On the other hand, ineffective self-management results in poor health outcomes. SM, as a secondary prevention mode, has been gradually popularized in chronic diseases at home and abroad, and has significant effects in correcting patients' bad living habits, improving treatment compliance, enhancing disease management ability, improving disease prognosis and improving quality of life (Liu, 2016).

Advantages of effective SM: According to Lofig et al., based on the traditional health care model, its effects are mainly reflected in the following three aspects: promoting patients to change their unhealthy behaviors, improving their health status and reducing the utilization rate of health care resources (Xue, 2016). In terms of SM of CHD, Mei Jing et al found that early rehabilitation exercise is effective in preventing restenosis after percutaneous coronary stent implantation in acute myocardial infarction, which is helpful to reduce the probability of cardiovascular events. The mortality of patients with myocardial infarction who participate in cardiac rehabilitation exercise can be reduced by 19.29%. Foreign experts Okwuosa T M et al. a 13-year follow-up study on fibrinogen also suggested that quitting smoking can improve lipid metabolism and atherosclerosis, and that quitting smoking for 1 year is beneficial to the prevention of coronary heart disease events, and the mortality and re-hospitalization rate of acute myocardial infarction are reduced by 50% (Rodríguez et al., 2012). Poor self-management leads to prolonged hospitalization and increased hospitalization rates.

SM can reduce restenosis and hospitalization rates after stenting

Various clinical trials have proved: The incidence of CHD and coronary artery restenosis rate will decrease after effective treatment and control of risk factors of CHD, such as hypertension, high cholesterol, diabetes, physical inactivity and

overweight. Edwards R reported that quitting smoking for 1 year was beneficial to the prevention of CHD events, the mortality rate of acute myocardial infarction and the rate of re-hospitalization were reduced by 50%, and the risk of heart disease after 15 years was the same as that of the never smoking group. Domestic Hu Da I et al. (Wang & Hu, 2003) reported: There is clear evidence that hyperlipidemia is associated with CHD events, and a clear diet and medication to reduce cholesterol can reduce CHD events after 5 years of continuous treatment.

SM reduces mortality after stenting

Su yazhen et al. (Mei et al., 2009) reported that early rehabilitation exercise was effective in preventing restenosis after percutaneous coronary stent implantation in acute myocardial infarction, and was helpful to reduce the probability of cardiovascular events, and the mortality of patients with myocardial infarction who participated in cardiac rehabilitation exercise could be reduced by 19.29%.

SM improves social skills

Men Xiuzhen (Men, 2015) reported that patients' quality of life score and social function screening score were statistically significant through continuous care after discharge and intervention of self-management after stenting.

In conclusion, self-management is an important content of secondary prevention of CHD and plays an important role in the treatment and control of CHD. Above all, patients with CHD need to have good ability of self-management, and in general self-management among patients with CHD at medium or low levels. Therefore, it is meaningful to explore the influencing factors of self-management in patients with CHD. How to achieve self-management for patients with CHD, which factors should identify first, so as to provide a basis for the development of effective, feasible and evidence-based self-management intervention programs in the future.

The Individual and Family Self-Management Theory

According to the Individual and Family Self-Management Theory (IFSMT) (Ryan & Sawin, 2009), self-management can be explained as a complex and dynamic phenomenon consisting of contextual, process, and outcome dimensions. It is important to identify the pertinent contextual and process-related factors in the lives of adults with CHD to promote their readiness and competence for self-management behaviors (Ryan & Sawin, 2014). The individual and family self-management theory, congruent with the current state of self-management science, conceptualizes self-management as "a process in which individual and families use knowledge and beliefs, self-regulation skills and abilities and social facilitation to achieve health-related outcomes. SM takes place in the context of risk and protective factors." Outcomes in the IFSMT are either proximal (self-management behaviors) or distal (health status, quality of life, and health costs) (Ryan & Sawin, 2009; Ryan & Sawin, 2014). The IFSMT was developed to address multiple levels of self-management in chronic disease. Ryan and Sawin (2009) view self-management as an activity based on the individual and/or family situation combined with factors that either assist or detract from the self-management behavior. (Figure 2)

The context consists of risk and protective factors that cluster into three categories: 1) condition specific, 2) physical and social environment, and 3) individual and family. The process of self-management is also described within three defined categories: 1) knowledge and beliefs, 2) self-regulation skills and abilities, and 3) social facilitation. Outcomes are temporally differentiated with proximal outcomes such as condition specific self-management behaviors and distal outcomes such as health status and quality of life. The contextual factors include condition-specific factors, physical and social environment, and individual factors. The process of self-management is influenced by the individual's knowledge and self-efficacy, self-regulation abilities, and social facilitation, such as support and collaboration (Areri, Marshall, & Harvey, 2020b). In planning self-management, the details of the

patient situation must first be assessed, including physical health, the physical and social environment of the patient, and the individual and family factors involved (Areri, Marshall, & Harvey, 2020a). Health behavior change, self-regulation, social support, and self-efficacy formulate the factors that may increase or decrease self-management within the IFSMT. These external influencing factors also consider knowledge and beliefs, self-regulation skills and abilities, and social facilitation (Ryan & Sawin, 2009).
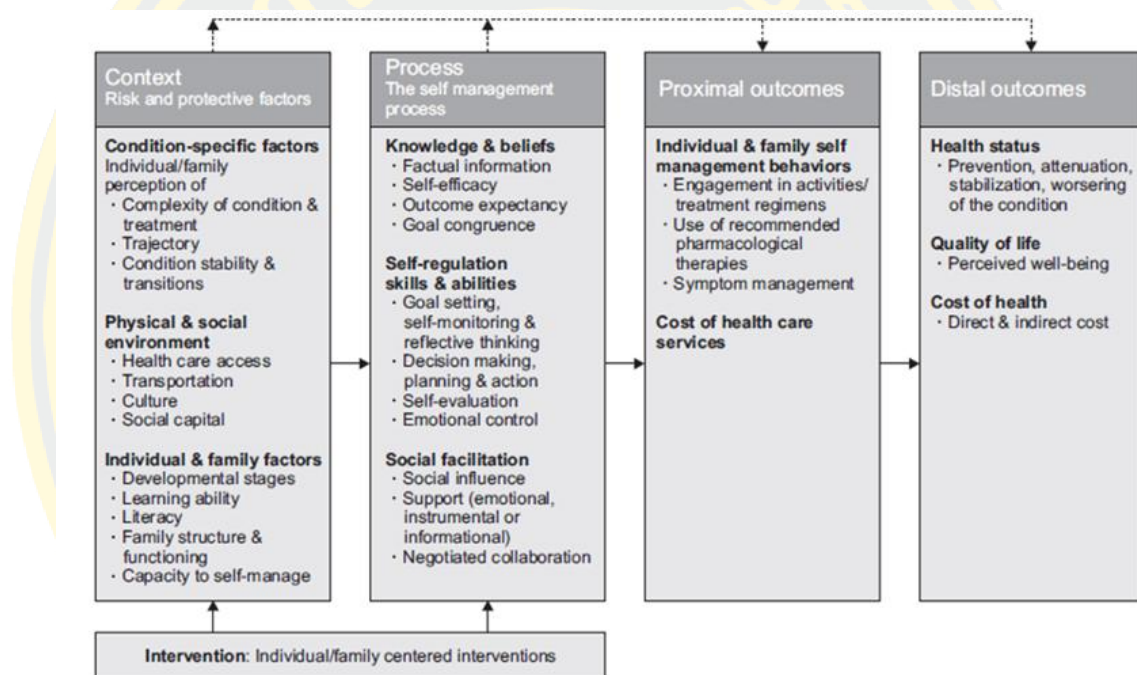
Figure 2 The individual and family self-management theory
(Ryan & Sawin, 2014)

The factors related to self-management behaviors among CHD patients and obtained from literature reviews can be linked into networks to illustrate their relationships. The nursing theory used as a conceptual framework in this research should cover these factors and explain the link between the causes of health outcome. The reason for this study was decided upon using IFSMT. The IFSMT theory was used to guide the hypothesized model of self-management behaviors among CHD patients in this study.

Factors influencing self-management among coronary heart disease

This study guided by individual and family self-management theory (IFSMT). SM are affected by various factors, such as context factors (family functioning, health literacy and depression), process factors (knowledge, self-efficacy, social support). SM is proximal outcome among this theory.

Family functioning

Family functioning has been widely discussed in nursing practice, education, and research. In practice, family functioning is an essential component of patient and family centered care. Nurse researchers have developed theories regarding family functioning in the context of illness. Family functioning refers to a process of providing various resources for family members to help them accomplish their tasks (Epstein, Baldwin, & Bishop, 1983), is positively associated with self-management (r = 0.15, p < .05) (Bennich et al., 2017). Family functioning usually contains elements including communication abilities, problem solving, task performance and mutual support (Bennich et al., 2020). An exploratory study (Bennich et al., 2018), including 127 patients with type 2 diabetes, also found the association between family functioning and self-management. Zhang et al study showed that family functioning were significantly related to the total subscales of self-management (β=0.182, P=0.003) among elderly patients with hypertension (Zhang, Qiu, Zheng, Zang, & Zhao, 2020). Lan et al study showed that family functioning has positive effect on SM among patients with chronic obstructive pulmonary disease (r=0.353, P<.01) (Lan, Lu, Yi, Chen, & Jin, 2022). Zhang et al study revealed that family functioning were positively associated with self-management in elderly patients with hypertension (r=0.19, p < .01) (Zhang, Zheng, Qiu, Zhao, & Zang, 2020). Huang et.al's study showed that family functioning plays an essential role in supporting the self-management, which is consistent with the results of Dachesa' study (Daches et al., 2018). Bennich et al. (2017) conducted an integrative review, and their findings stressed the importance of family to target patients' SM adherence. The family

functioning plays a more important role on them to keep positive emotions and a healthy lifestyle (Bennich et al., 2017). Family functioning is a multifaceted structure and a complex integrated system designed to meet the basic needs of its members; when the family meets an individual's needs, it indicates that there is good family functioning (Zhang, 2018).

Family functioning was significantly associated with social support in patients with heart failure (p<.001) (Shamali et al., 2021). Another study reported that people who have good family functioning have a better attitude toward seeking professional psychological help; thus, good family functioning can provide more possibilities in the process of disease management (Chen et al., 2020). Liu's study found that good family functioning was positively associated with depression self-management knowledge (r =.278, p < .001), their finding implied that family functioning and/or family support played an important role in depression self-management (Liu et al., 2021). Better family functioning is related to better mental status among subjects, in both single and non-single households (Cheng et al., 2017; Takeda, Sasagawa, & Mori, 2017). These findings emphasize the importance of family functioning and the need for interventions that improve family functioning, especially for patients living alone. Family functioning is positively associated with SM. Family functioning had an indirect effect on SM through social support and direct effect on only self-efficacy (Yun & Kim, 2017).

Health literacy

Health literacy is an important predictor of successful SM in other chronic diseases, including diabetes, human immunodeficiency virus, and asthma (Adams, 2010). Health literacy is believed to be a basic criterion for patients to perform SM and it is defined as 'the personality traits and social resources needed for individuals to access, understand, appraise and use information and services to make decisions about health' (Maneze, Everett, Astorga, Yogendran, & Salamonson, 2016). Inadequate health literacy is associated with decreased patient engagement, which

leads to worse SM and, ultimately, poor health outcomes. It is also associated with preventable health care resource use, including emergency department use and hospitalization (Papadakos et al., 2018).

Paasche-Orlow and Wolf (Paasche-Orlow & Wolf, 2007) postulated that the mechanisms contributing to poorer outcomes among those with low health literacy include low self-efficacy, lack of access to and utilization of resources and services. It is important, however, to acknowledge that socioeconomic and demographic factors such as age, educational level, ethnocultural background, and having conditions that require complex care are underscoring limited health literacy. Low levels of health literacy have been found to be common among patients who are from lower socioeconomic backgrounds and among migrants with limited English language proficiency, the elderly, and those with chronic diseases. While some studies have found that low health literacy is associated with poor diabetes self-management, poor control, and more complications (Schillinger et al., 2002).

Patients with CHD and low HL are likely to face psychosocial challenges when managing their health problems. These challenges may include perceptions of difficulty understanding health information, limited knowledge of their health problems, discomfort about asking for help with understanding information, lack of confidence about exercising, and low social support. Past studies showed that low health literacy result in poor self-management (Chen et al., 2018; Devraj, Borrego, Vilay, Pailden, & Horowitz, 2018). Suarilah' findings emphasize that health literacy is the cornerstone of maintaining self-management among patients with early-stage chronic kidney disease (CKD) (Suarilah & Lin, 2022). Suarilah viewed that improving health literacy has an enabling effect and can help improve self-efficacy that influence CKD self-management. Besides, health literacy and self-efficacy showed a significant correlation in this study, this also been proved in wang et.al study, which demonstrated that Self-efficacy was positively correlated to health literacy (Wang, Lang, Xuan, Li, & Zhang, 2017). Last but not least, health literacy

showed positive significant correlation with total self-management. Health literacy is known to determine the successful achievement of health outcomes, as well as improve patients' diabetes self-management (Rachmawati, Sahar, & Wati, 2019).

Health literacy in CHD patients

Deficits in health literacy are common in patients with CHD, and this is associated with increased morbidity and mortality. A meta-analysis showed that the average prevalence of low health literacy was 30.5% among CHD patients. However, the level of health literacy is much lower in CHD patients in China. Lu's study demonstrated that 74.5% of the patients had limited health literacy, and health literacy was related to heart-healthy lifestyle adherence (Lu et al., 2019). Low health literacy was consistently associated with hospital readmission, low health-related quality of life, higher anxiety and lower social support (Ghisi, Chaves, Britto, & Oh, 2018). Health literacy is a prerequisite for CHD patients to self-manage their health (Beauchamp et al., 2022).

Components of health literacy

Nutbeam (Nutbeam, 2000) distinguished three levels of health literacy: Basic/functional literacy refers to sufficient basic skills in reading and writing to be able to function effectively in everyday situations. This means being able to read health related pamphlets or reading the label on a pill bottle.

Functional health literacy describes basic level skills that are sufficient for individuals to obtain relevant health information (for example on health risks, and on how to use the health system), and to be able to apply that knowledge to a range of prescribed activities.

Communicative/interactive literacy refers to more advanced cognitive and literacy skills which, together with social skills, can be used to actively participate in everyday activities, to extract information and derive meaning from different forms of communication, and to apply new information to changing circumstances. At this

level a person can, for instance, read and interpret health information from the internet and discuss this with a physician when negotiating treatment.

Interactive health literacy describes more advanced literacy skills that enable individuals to extract health information and derive meaning from different forms of communication, to apply new information to changing circumstances, and engage in interactions with others to extend the information available and make decisions.

Critical literacy refers to more advanced cognitive skills which, together with social skills, can be applied to critically analyze information, and to use this information to exert greater control over life events and situations. A person with critical literacy can effectively self-manage, ask for help when appropriate and make informed decisions.

Critical health literacy describes the most advanced literacy skills which can be applied to critically analyze information from a wide range of sources, and information relating to a greater range of health determinants, and to use this information to exert greater control over life events and situations that impact on health.

The description and use of functional, interactive, and critical health literacy contain similarities with several self-management skills. Both concepts of health literacy and self-management contain aspects of the use and interpretation on health related information and application to promote health in daily life and as such have some overlap (Maasdam et al., 2022). Guo and her colleagues revealed that health literacy was positively correlated with knowledge (r=0.29; 95% CI 0.09, 0.45; P<0.001), self-efficacy (r=0.28; 95% CI 0.15, 0.41; P<.00001) and social support (r=0.2; 95% CI .07, 0.33; P<.00001) (Guo, Zhai, & Hou, 2020).

Depression

Mental health distress, such as depression and anxiety, often co-exist with chronic physical conditions. Depression is defined as "an affective disorder manifested by either a dysphoric mood or loss of interest or pleasure in usual

activities, and the mood disturbance is prominent and relatively persistent (Hacking, 2013)." Depression is a major risk factor for morbidity and mortality of cardiovascular disease (Le et al, 2020). A study reported that the prevalence of depression in patients with CHD ranged from 8.2 to 35.7% in men and from 10.3 to 62.5% in women. Depression has an adverse impact on the treatment and prognosis of chronic disease (Lichtman et al., 2014; Nekouei et al., 2014). In view of the theoretical assumptions and empirical evidence, depression showed negative effects on SM (Schulman-Green et al, 2016).

Maneze et.al finding that depressed mood predicted both low health literacy and low diabetes self-management stresses the importance of screening for depression (Maneze et al., 2016). Dong et.al study showed depression and self-efficacy significantly affected self-management behaviors among patients with liver cirrhosis (Dong et al., 2020). In addition, this study shows that depression was a significant predictor of self-management behaviors. Depression can interfere with patients' ability to function in their daily activities and can limit their performance of self-management to reduce symptoms (Korpershoek, Vervoort, Nijssen, Trappenburg, & Schuurmans, 2016). Schmitt's study (Schmitt et al., 2017) found that depression in people with diabetes can be associated with hyperglycaemia due to suboptimal diabetes self-management. Following this evidence, it is reasonable to assume that the successful treatment of comorbid depression may facilitate the provision of optimal diabetes care to this high-risk patient group (and support of self-care) (Park, Katon, & Wolf, 2013). Depression not only acts as a confounding factor but also acts in an independent manner on the quality of self-care (Schmitz et al., 2014) .

Knowledge

Knowledge can be described as the facts about the disease and its management that patients need to understand to enable them to perform complex self-management activities (Dong et al., 2020). Studies have shown that improving self-management of chronic disease means increasing patients' knowledge about their

condition(Gray, 2004). Lack of knowledge was considered as a barrier for engaging in disease self-management for older adults and patients with rheumatoid arthritis (Chaleshgar-Kordasiabi et al., 2018; Petroka et al., 2017). To effectively manage their disease, CHD patients should equip themselves with knowledge of how to live with the disease and how to address the simple but unpleasant symptoms (Dong et al, 2020). Disease knowledge may help patients to understand health problems and therapies better, which would lead to beneficial changes in health behavior (Lu et al, 2015) and is essential in grasping self-efficacy skills. Studies have shown that improving SM of chronic disease means increasing patients' knowledge about their condition (Gray, 2004).

The knowledge, attitude and behavior theory holds that knowledge is the basis of health related behavior change and belief and attitude are the driving force of health related behavior change. Disease-related knowledge plays an important role in influencing health-related behaviors (Shen, Teo, Yap, & Yeo, 2017), and patients with more knowledge of cardiac rehabilitation show better diet and exercise behaviors. Zhang Xiaoman et al. (Zhang, Shi, Hu, & Zuo, 2013) showed that knowledge of coronary heart disease is an influential factor of disease knowledge management and treatment compliance management, and patients with higher knowledge level of coronary heart disease will have better disease knowledge management and treatment compliance management. Shen Chuanlin (Shen, 2016) through the network form of percutaneous coronary interventional therapy of CHD patients with intervention measures, including CHD related knowledge, PCI postoperative knowledge, such as CHD first aid knowledge content, found that after the intervention in patients with angina frequency, degree of pain, duration, self-care ability and life quality were improved significantly, compared with before, It can be seen that CHD knowledge plays an important role in improving symptoms and behavior of patients.

Self-efficacy

Self-efficacy has been suggested as a powerful factor of health-promoting behaviors (Geng et al., 2018). Self-efficacy refers to an individual's belief regarding his capability to carry out certain activities to achieve a desired outcome (Bandura, 1986). Self-efficacy was related to medication adherence, health behaviors and quality of life in patients with diabetes, liver cirrhosis and heart disease (Bowen et al., 2015; Dong et al., 2020; Wu et al., 2015). Self-efficacy has been shown to be a significant determinant of SM in patients with diabetes and heart failure (Huang, Zhao, Li, & Jiang, 2014; Young et al., 2017). Bandura's social cognitive theory suggests that self-efficacy is a key factor affecting behaviors directly. Cross-sectional studies suggest that higher self-efficacy is also associated with better self-management behaviors (Devarajooh & Chinna, 2017; Kav, Yilmaz, Bulut, & Dogan, 2017; Lin et al., 2017; Yuan, Sun, Yu, Zhao, & Dong, 2017; Zhao et al., 2017). Social cognitive theory also suggests that sources of information can influence behavior by affecting self-efficacy, emotional status can affect the judgment of individuals' self-efficacy, and personal characteristics might have an impact on self-efficacy (Bandura, 1997). Knowledge about the disease can increase the patients' confidence in controlling the disease, and strengthen their motivation (Yang et al., 2017).

Self-efficacy is considered by many authors as 'one of the possible mechanisms by which SM can be achieved (Peterson et al., 2014; Pfaeffli Dale et al., 2015; Sol, van der Graaf, van Petersen, & Visseren, 2011; Tung et al., 2014; Zhang et al., 2018). Perceived self-efficacy is the extent to which people believe they can exercise control over their health behaviors (Bandura, 2004). In addition, Tung, H. H. et.al (Tung et al., 2014) found self-efficacy to be a strong predictor of better self-management. In patients with vascular diseases, improvements in self-efficacy are associated with an improvement in cardiovascular lifestyle, namely, more exercise and better food choices (Sol et al., 2011). For women with CAD, self-efficacy has

been shown to predict self-management behaviors including medication adherence, physical activity, stress management and diet (Clark & Dodge, 1999).

Social support

Social support refers to companionship, informational, esteem, and instrumental resources provided by a social network consisting of family members and friends (Ding et.al, 2018). Social support was found to increase disease knowledge for patients with diabetes (Pan et al., 2018; Yang et al., 2017). Previous studies showed social support was associated with self-management behaviors and health outcomes in patients with diabetes, cancer survivors and heart disease (Geng et al, 2018), but inconsistent evidence for these associations exists in patients with chronic obstructive pulmonary disease (Bourbeau, Nault, & Dang-Tan, 2004).

Many studies showed that family members or caregivers often engaged in the process of self-management (Wang, Jiang, He, & Koh, 2016). Social support facilitates patients' interactions with healthcare providers and contributes to treatment adherence and the adequate monitoring of self-management behaviors at home (Bustamante, Vilar-Compte, & Lagunas, 2018). It is known though that about 90% of the time, patients manage their chronic conditions alone with little in the way of support and education from healthcare providers (Lorig & Holman, 2003). Lack of support from healthcare professionals also seems to have an impact on the efficacy of angina symptom management. Social support could facilitate patients to perform SM by providing both subjective, objective support and support usage (Schulman-Green et al, 2016).

Moreover, the use of peer support is increasingly being studied as a means to improve patient outcomes such as improving risk factor control in diabetes patients, mental health in people with brain injury, and quality of life in cancer patients (Sakakibara et al., 2017). Individuals can self-regulate their behavior by enlisting social support from others to maintain their motivation (Pfaeffli Dale et al., 2015).

Osborn et al founded that social support has the potential to influence SM significantly, either directly or indirectly, through self-efficacy (Osborn et al, 2011). Zhang et al study revealed that social support were positively associated with self-management in elderly patients with hypertension (r=0.19, p < .01) (Zhang et al., 2020). Lan et al study showed that subjective support, objective and availability of social support has positive effect on SM among patients with chronic obstructive pulmonary disease (r=0.509, P<.01; r=0.333, P<.01; r=0.467, P<.01) (Lan et al., 2022). Preliminary studies showed that social support has the potential to influence self-management behavior significantly, either directly or indirectly, through self-efficacy (Ding, Li, Su, Yuan, & Lin, 2018). Ding et.al found that social support was negatively correlated with age, CVD risk, and disease course and positively with disease knowledge (Ding, Tong, Su, Yuan, & Lin, 2018). Higher social support could lower levels of perceived stress and depressive symptoms, promote practicing healthy-lifestyle behaviors, and improve self-management (Mizutani et al., 2016; Yang, Boen, & Harris, 2015), and even decrease the risk of disease (Leigh-Hunt et al., 2017; Yang et al., 2016) and the risk of all-cause mortality (Leigh-Hunt et al., 2017).

Summary

Previous studies have explored the interrelationships of the above factors and self-management behaviors. Pan et al. (2018) found disease knowledge indirectly influenced self-management through self-efficacy, and social support indirectly influenced self-management through knowledge among individuals with type 2 diabetes. In addition, self-efficacy (Kamp et al., 2019; Martinez et al., 2018) and social support (Kamp et al., 2019; Whitehead, Jacob, Towell, Abu-qamar, & Cole-Heath, 2018) were consistently associated with self-management of chronic illness in systematic reviews. Cosansu and Erdogan (2014) reported social support had an indirect effect on self-management via self-efficacy in patients with diabetes. Living with CHD affects every aspect of the patient's life, and successful management of the

condition is of great importance. However, there are limited studies focusing on self-management behaviors among this population. Although evidence suggests the associations of family functioning, health literacy, depression, disease knowledge, self-efficacy, social support and self-management behaviors in some chronic conditions, it is unknown if these effects are also similar for patients with CHD. Identifying the relationships of these factors and self-management behaviors is important to develop appropriate interventions to improve self-management behaviors for patients with CHD.
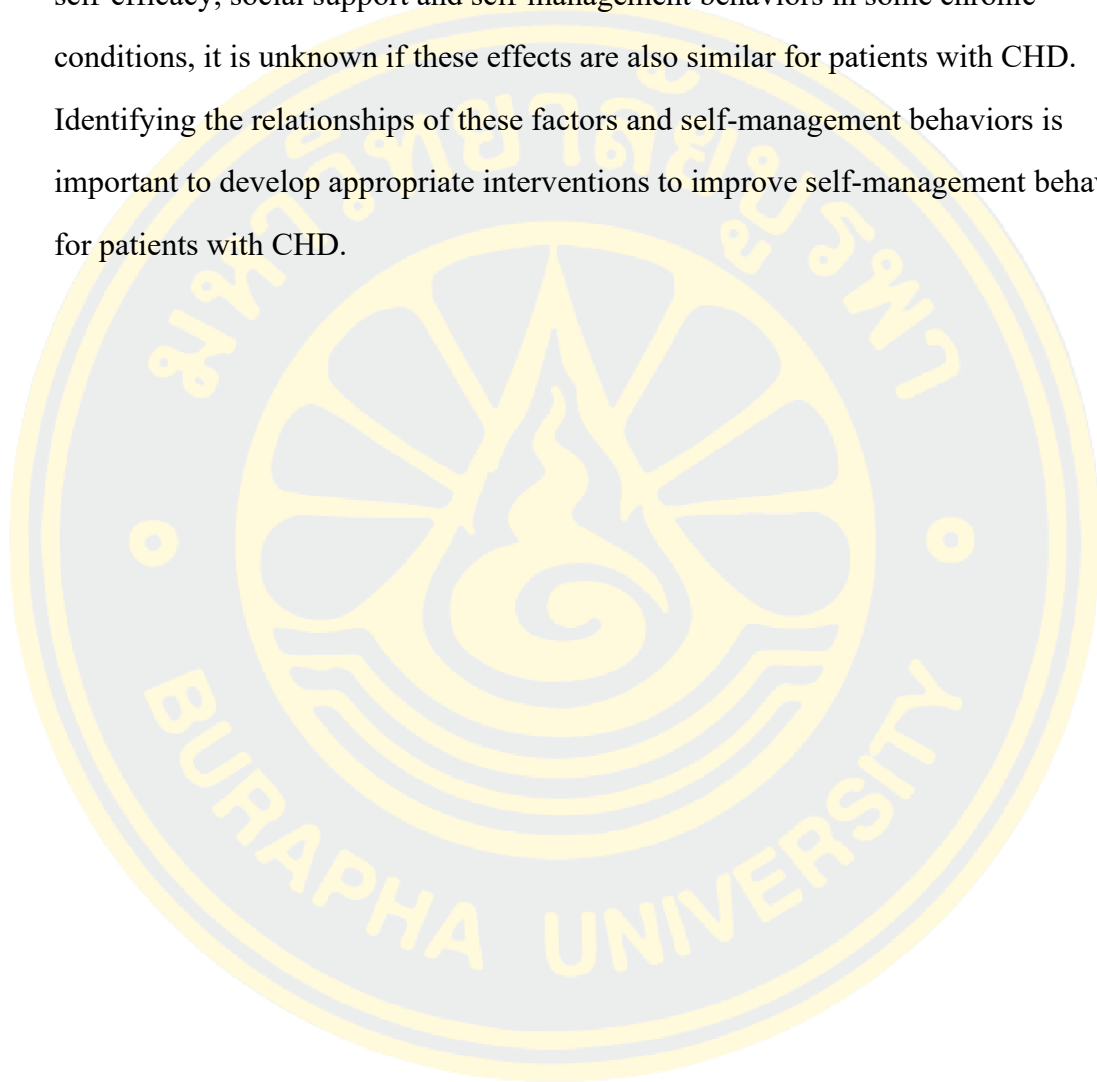
CHAPTER 3

RESEARCH METHODOLOGY

The purposes of this study were to develop and test a hypothesized model of self-management behaviors among coronary heart disease. 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 descriptive model-testing, cross-sectional design was used to test the hypothesized model of Self-management behaviors among CHD patients. Independent variables included family functioning, health literacy, depression, knowledge, self-efficacy, and social support. The dependent variable was Self-management behaviors of CHD patients.

Setting of the study

The study's sample were recruit at cardiology clinics in the outpatient departments of two tertiary hospitals in Yancheng city, Jiangsu province, China. In 2015, Yancheng city had reported that coronary heart disease become the fourth highest number of chronic diseases compared with hypertension, stroke and diabetes (Ma, He, & Bian, 2015). The incidence rate of coronary heart disease in Yancheng had increased from 1.25% in 2003 to 1.47% in 2015 (Yancheng city for Disease Control and Prevention, 2003, 2015).

The Yancheng city was set up ccardiology clinics in outpatient departments at the following three tertiary hospitals: Yancheng First people's hospital, Yancheng Third people's hospital, and Yancheng Traditional Chinese Medicine Hospital. The

mission of the cardiology clinics is to prevent myocardial infarction and sudden death, improve survival, alleviate symptoms and ischemic attacks, improve quality of life, improve prognosis of CHD patients. Treatment follows the guidelines 2020 set by the Chinese Medical Association (CMA) for the diagnosis and treatment of CHD in China, which is an easy-to-follow, standardized procedure (CMA, 2020). In addition, physicians, pharmacists, and nurses working in cardiology clinics have obtained the registration of practicing qualification from the Ministry of Health.

When receiving treatment at cardiology clinics, patients are assessed for the severity of their CHD. Before the patients meet a physician, nurses assess them for any underlying disease and their self-care behaviors. If a problem is detected, nurses advise and engage patients in individual problem-solving activities. Nurses also advise them about lifestyle modifications that are appropriate. CHD patients are assessed for cardiac function grading using a questionnaire and the symptoms occur with Electrocardiograph [ECG] to monitor the progress of CHD. The physician provides treatment according to the treatment guidelines. A pharmacist gives advice about CHD medication (CMA, 2020).

Population and sample

Population

The target population in this study was patients diagnosed with CHD who received follow up care at cardiology clinics at tertiary hospitals in Yancheng, Jiangsu province, China.

Sample

Samples were patients diagnosed with CHD who received follow up care at cardiology clinics at tertiary hospitals in Yancheng, Jiangsu province, China. Eligible participants were patients who had been diagnosed with coronary heart disease for at least three months with the following inclusion criteria:

1. Aged more than 30 years

2. Able to communicate, read, and write in Chinese

3. No disabilities that may affect their ability to perform ADL

4. No cognitive impairment screened by (screening by mini-cognitive assessment instrument (the mini-cog) (Borson, Scanlan, Chen, & Ganguli, 2003).

Patients were excluded if they had severe complications such as heart failure, renal failure, advanced cancer, or other lung disease.

Sample size

The sample size was calculated using a ratio of 5 to 10 respondents per estimated parameter (Hair, Black, Babin, & Anderson, 2010). It requires a sample size between 250 and 500 subjects to maintain power and obtain stable parameter estimates and standard errors (Schumacker & Lomax, 2010). The current study has a total of 32 estimated parameters (15 errors, 9 factor loadings, 7 path coefficients, and 1 variance covariance). Therefore, there were 320 patients as a sample size. Due to the possibility of data missing and attrition rate was considered. Kristman, Manno, and Cote (2005) estimated that attrition might account for at least 10% of the sample. Therefore, the number of participants was set at 352 patients with CHD to account for total sample size.

Sampling

Samples of 352 CHD persons were drawn from the target population by using a simple random sampling technique. Sampling procedures was conducted as follows:

1. The researcher identified the cardiology clinics in the following three tertiary hospitals in Yancheng city: Yancheng First people's hospital, Yancheng Third people's hospital and Yancheng Traditional Chinese Medicine Hospital.

2. The names of two of the three hospitals were drawn using a simple random sampling technique with a ratio of 2:3, (Neuman, 1991). The two selected hospitals were Yancheng First people's hospital and Yancheng Third people's hospital.

3. Simple random sampling was used to select 176 eligible participants from each of the cardiology clinics at these two hospitals. If the first and subsequent picks did not meet the inclusion criteria, the next number was drawn until 352 CHD patients who meet the inclusion criteria were selected.

Research instruments

This study employed eight self-reported questionnaires as describe below:

1. The demographic record form

The demographic record form developed by the researcher was used to measure patients' personal data. It included 2 parts: 1) general information included age, gender, review hospital, marital status, educational level, types of insurance, family income, family members with CHD and 2) disease-related characteristics included cardiac function grading, disease duration. This information was measured by self-report questionnaires.

2. The Family APGAR Index

The Family APGAR Index was used to measure family functioning. Smilkstein et al. (1982) developed the original English version, it was translated into Chinese version by Lv and Gu (1995). This scale was composed of five items: adaptation, partnership, growth, affection and resolve and was a 3-point scale ranging from 0 (hardly ever) to 2 (almost always). The total score ranged from 0 to 10 and the higher score indicated a higher level of satisfaction with family functioning. Severe family dysfunction: $0 \sim 3$ points, family dysfunction: $4 \sim 6$ points, family functioning: $7 \sim 10$ points. The Kappa (w) value for the five items and the total score were .55–.91 and .73, respectively (Fan & Zengguang, 1999). The Cronbach α coefficient for the present study was .866.

3. The Chew 's Set of Brief Screening Questions

The Chew 's Set of Brief Screening Questions was used to measure health literacy. Chew developed the original English version, which is a validated subjective

measure of health literacy (Chew, Bradley, & Boyko, 2004). It was translated into simplified Chinese version by Sarah Mantwill (2016). The Set of Brief Screening Questions consists of three items: ''How confident are you filling out forms by yourself?'' (Confident With Forms), ''How often do you have someone (like a family member, friend, hospital/clinic worker or caregiver) help you read hospital materials?'' (Help Read), and ''How often do you have problems learning about your medical condition because of difficulty understanding written information?'' (Problems Reading). Responses were scored on a 5-point Likert scale ranging from 0 (always = not at all confident) to 4 (never=extremely confident). Lower scores reflect lower health literacy skills (Fransen, Van, Twickler, & Essink-Bot, 2011). Health literacy was rated as high (> 9 points), medium (6-9 points), and low (< 6 points). The mean score on the three items was used in analyses as a continuous variable. The Cronbach α coefficient for the present study was .740.

4. The Self-rating Depression Scale (SDS)

The SDS was used to measure depression. Smilkstein et al. (1982) developed the original English version, it can be used for depression symptom screening and severity assessment and can also be used to measure mood changes in treatment. SDS is a widely used scale with 20 items. Each item is rated from 1 to 4. The number 2, 5, 6, 11, 12, 14, 16, 17, 18 and 20 are scored in reverse direction, while the rest are scored in positive direction. The total score ranges from 1 to 80, wherein a higher score reflects more severe depression status. Then multiply the total rough score by 1.25 and take the rounded part to get the standard total score. The standard cut-off point is 53, with 53 or more indicating depression. The Chinese version of SDS is confirmed to be reliable and valid (Zhang et al., 2012) and the Cronbach's α was .762. The Cronbach α coefficient for the present study was .856.

5. The coronary heart disease knowledge questionnaire

The coronary heart disease knowledge questionnaire was used to measure knowledge related to heart disease. It designed by Chinese scholar Xiao Meilian

(2008). The questionnaire has 8 dimensions. There are 52 items in the questionnaire, which are coronary heart disease, risk factors, inducing factors, clinical manifestations, examination methods, treatment methods, drug knowledge and secondary prevention knowledge after discharge. In response to "yes", "no" and "uncertain" points, the correct item was scored 1 point, the answer error and the uncertain answer were not scored, and the comparison between the dimensions was divided by the number of items. The intrinsic consistency Cronbach 's coefficient is .907, and the content validity index (CVI) is .88 (Xiao, 2008). The Cronbach α coefficient for the present study was .965.

6. The Self-efficacy for Chronic Disease 6-item Scale (SECD6)

The SECD6 was used to measure self-efficacy. The Center for Patient Education and Research at Stanford University developed the original English version, which is an instrument to assess confidence in managing chronic disease symptoms (Lorig, Sobel, Ritter, Laurent, & Hobbs, 2001). The SECD6 consists of six-item with two domains: (a) confidence in controlling symptom (CCS) with 4 items related to confidence in preventing fatigue, physical discomfort, emotional distress, and other symptoms; (b) confidence in maintaining function (CMF) with 2 items related to confidence in managing health condition and decreasing the effects of the disease. The total mean score ranges from 1 (not at all confident) to 10 (totally confident). The average score of all items reflects the level of self-efficacy. The higher scores indicate stronger self-efficacy. A score of ≥ 7 is considered high level of self-efficacy; < 7 is considered low level of self-efficacy. The Chinese version of SECD6 has good internal consistency with a Cronbach's α of 0.91 in Jiang et.al study (Jiang et al., 2020). The Cronbach α coefficient for the present study was .929.

7. The Social Support Rating Scale (SSRS)

The SSRS was used to measure social support. It comprises 10 items designed to evaluate objective support (3 items), subjective support (4 items), and support usage (3 items). The overall score ranges from 12 to 66. Higher scores

indicate stronger social support. Low level: 0 ~ 22, medium level: 23 ~ 44, high level: 45 ~ 66. The scale showed good internal consistency (Cronbach's α = .89) and test-retest reliability .92 (Xiao, 1994). The Cronbach α coefficient for the present study was .833.

8. The Coronary artery disease Self-management Scale (CSMS)

The CSMS was used to measure self-management behaviors. The scale was developed by Chinese scholars Ren Hongyan in 2009. It consists of a 27-item Likert scale from 1(never) to 5 (always) to measure the self-management behaviors in three dimensions including: (a) Daily life management with 8 items addressing different contents of lifestyle, including risk behavior management and healthy lifestyle management; (b) Disease medical management with 14 items measuring symptom management, disease knowledge management, compliance management and emergency management; (c) Emotional management with 4 items measuring recreational activities, emotional distress and coping style. The total score ranges from 27 to 135 points, with higher scores indicating higher levels of self-management behaviors. Ren Hongyan Self-Management Scale transforms the scores of each dimension and total scale into a 100-point scale for evaluation. After transformation, scores ≥80 were classified as high level, 60-80 as medium level, and < 60 as low level. The Chinese version CADSs has good internal consistency with a Cronbach's α of .85 (Ren et al., 2009). The Cronbach α coefficient for the present study was .908.

Psychometric properties of the instruments

Validity

There were eight self-report research instruments for this study. These instruments were already in Chinese and had 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 seven instruments

with 30 participants who had similarities to the study's sample at Yancheng First People's Hospital, but they were not included in the actual study. Internal consistency for the seven instruments was acceptable in the study's sample. The internal consistency reliability was presented in Table 1.

Table 1 Reliability of study instruments

Questionnaire	Number of items	Cronbach's alpha	
		Pilot study	Current study
The Family APGAR Index	5	.790	.866
The Chew 's Set of Brief Screening Questions	3	.710	.740
The Self-rating Depression Scale [SDS]	20	.830	.856
The coronary heart disease knowledge questionnaire	52	.901	.965
The Self-efficacy for Chronic Disease 6-item Scale [SECD6]	6	.903	.929
The Social Support Rating Scale [SSRS]	10	.911	.833
The Coronary artery disease Self-management Scale [CSMS]	27	.870	.908

Protection of Human subjects

The study received approval from the institutional review board [IRB] of Burapha University (G-HS052/2565) and the Committee of Rights for Human Research of Yancheng First People's Hospital (2022-K-037), Yancheng Third People's Hospital (2022-16). After obtaining permission to conduct the study, CHD patients were recruited to participate in the study. The researcher informed participants of this study's objectives, risks, benefits, voluntary participation, and confidentiality. CHD patients were also assured that the study would not affect the

quality of their care or their access to future nursing care at hhospitals. Participants had the right to refuse to participate in this study. They were asked to sign consent forms after receiving the given information. All information acquired from this study would be kept confidential. The identification of participants be disclosed, and no one has access to this data except the researcher. The questionnaires of CHD patients assigned code numbers for confidentiality purpose. The reports presented in an aggregated data without mentioning personal or institution identities. Data was used only for this research study. The data was erased after completion of the study.

Data Collection procedures

The researcher and research assistants collected data in this phase using procedures as follows:

1. After obtaining permission from the IRB of Burapha University and the IRB of hospitals related to this study, the researcher asked for permission to collect data and contact directors of the cardiology clinics at the selected hospitals. The researcher made appointments with the physicians and nurses at cardiology clinics to inform them about the research objectives and process, and then invited them to participate in the study.

2. The researcher selected two research assistants who were registered nurses with two or more years' experience in caring for adults with CHD. The two research assistants received the following training:

2.1 The researcher described the research procedures, inclusion criteria of participant eligibility, instruments to be used, and data collection process, including human rights protection.

2.2 Initially, the research assistants observed the researcher collecting data. The researcher demonstrated how to answer each questionnaire, ask questions, and induce her to complete the questionnaires in simulation situation with all

instruments in her hands. Any misunderstandings about data collection procedures were discussed and reviewed.

2.3 The research assistants practiced collecting data under the supervision of the researcher until they could collect data independently.

3. The researcher contacted the head nurse of cardiology clinics at the appropriate time for collecting data after the research permission was granted. The researcher and research assistants collect all data and select participants who meet the inclusion criteria based on their medical records and interest to be a participant.

4. The researcher and research assistants introduced themselves to the eligible participants in each hospital setting and explained the research purpose, study process, and its risks and benefits. Informed consent was signed if they agreed to participate.

5. The participants completed the self-administered questionnaire and instruments in a private place before meeting the physician. If participants had an eyesight problem or it was inconvenient for them to read the items, the researcher and research assistants read the items to them. Data collection took approximately 30 to 45 minutes to complete at a private room in the outpatient unit of each hospital.

6. The participants could ask any question during the process. If the participants did not allow the data collection process to continue, the research was discontinued, and they were withdrawn from the study.

7. During data collection, if the participants were display physical or emotional symptoms, such as severe chest pain, stress, or not being ready to answer, the researcher and research assistants would stop and help participants to rest in a provided location. The researcher and research assistants were prepared to encourage the participants to relax by taking deep breaths. If the symptoms do not improve, the researcher and research assistants will inform the physician. However, no participant experienced symptoms or wished to leave the study. Additionally, 5 participants were at risk of unpleasure emotion during the data collection for the long time to fill the

forms. After have a break and negotiated accompany by doctors and nurse, the bad mood was relieved and then make the data collection successfully.

8. After a participant finished completing the questionnaires, the researcher and research assistants checked for the completeness of the data. If there were blanks or non-responses, the researcher/assistants encouraged the participants to complete all missing items.

Data Analysis

Data analyses were performed using SPSS and AMOS version 20.0 (IBM Corporation, Armonk, NY). Statistical significance level was set at $p < .05$. Assumptions for the statistical tests were tested to determine their appropriateness in analyzing particular statistics.

1. Describe characteristics of CHD patients as age, gender, educational level, family characteristic and comorbidities using frequency, percentage, mean, and standard deviation.

2. Describe the study variables include family functioning, health literacy, depression, knowledge, self-efficacy, social support, and self-management behaviors by descriptive statistics of possible range, actual range, mean, and standard deviation.

3. The assumptions underlying the structural equation model analysis were evaluated, including normality of distributions, linearity of relationships, homogeneity of variance, and multicollinearity.

4. Determine factors, including family functioning, health literacy, depression, knowledge, self-efficacy, social support, and self-management behaviors by path analysis.

CHAPTER 4

RESULTS

This chapter presents the results of data analyses. It includes descriptions of the sample's characteristics and the study variables, including family functioning, health literacy, depression, knowledge, self-efficacy, social support, and self-management behavior. Finally, hypothesis testing is carried out.

Characteristics of sample

A total of 352 CHD patients were recruited from Yancheng First people's hospital and Yancheng Third people's hospital in Jiangsu province, China. Their demographic characteristics were shown in Table 2 and 3. Most of the participants was male (73.86 %). Most of them were aged more than 60 years old (64.77 %), while 28.13 % of them were in the 45 to 60 years age group with a mean of 64.11 years age group (SD = 12.78). In terms of BMI, most of participants exceeded 24 (59.94 %), which attained the overweight, while 3.98 % of them had BMI less than 18.5. Most of them had a Junior high school or below educational level (53.98%), and most of them were married (81.82%). The majority (89 %) of the participants were living with family members or others (92.05 %).

In terms of average individual income, most of the participants' families had monthly earnings of 3,000-5,000 RMB per month (38.07 %), while 32.1 % of the participants had monthly earnings of 5,000-10,000 RMB per month. Most families had a 3000 - 5,000 RMB Per capita monthly household income (42.89%). The majority (55.96 %) of types of medical insurance were resident medical insurance. Most of the patients did not need assistance required from others to carry out their daily activities at home (67.05%). 76.98% participants reported they had no history of drinking alcohol, while 17.05% of them were former alcohol drinkers. Compared with

drinking status, only 44.89% of participants had no history of smoking, with 44.03% of them were former smokers, while current smoker was at 11.08% proportion.

Table 2 Demographic characteristics of CHD patients (n = 352)

Characteristics	*n*	%
Gender		
Male	260	73.86
Female	92	26.14
Age (years) (M = 64.11, SD = 12.78, range = 30-87)		
30-44	25	7.10
45-59	99	28.13
60-70	123	34.94
71-80	74	21.02
81-87	31	8.81
BMI (M = 24.8, SD = 3.25, range = 16.33-36.8)		
< 18.5	14	3.98
18.5-23.9	127	36.08
24-28	172	48.86
> 28	39	11.08
Education Level		
Primary school or below	102	28.98
Junior high school	88	25.00
Senior high school	81	23.01
College degree or above	81	23.01
Marital Status		

Table 2 (Continued)

Characteristics	n	%
Married	288	81.82
Single	4	1.14
Divorced	25	7.10
Widowed	35	9.94
Living condition		
Living alone	28	7.95
Living with family members or others	324	92.05
Average individual income (income/month in RMB)		
Less than ¥ 3000	70	19.89
¥ 3000 - 5,000	134	38.07
¥ 5,000 - 10,000	113	32.10
More than ¥ 10,000	35	9.94
Per capita monthly household income (YUAN)		
Less than ¥ 3000	99	28.13
¥ 3000 - 5,000	151	42.89
¥ 5,000 - 10,000	95	26.99
More than ¥ 10,000	7	1.99
Types of medical insurance		
Resident medical insurance	197	55.96
Employee medical insurance	148	42.05
Self-pay	7	1.99
Assistance required from others		

Table 2 (Continued)

Characteristics	n	%
None	236	67.05
Minimal	74	21.02
Moderate	39	11.08
Maximum	3	0.85
Alcohol drinking status		
Current alcohol drinker	21	5.97
Former alcohol drinker	60	17.05
No history of drinking alcohol	271	76.98
Smoking status		
Current smoker	39	11.08
Former smoker	155	44.03
No history of smoking	158	44.89

From table 3, In terms of diagnosis duration, 68.75 % of the participants had diagnosed with CHD for 1-2 years, the mean duration was 3.29 years (SD = 4.291). For cardiac function grading, more than half of them (77.84 %) were level II. The number of stent implants mean was 1.7 (SD = 0.959), with the majority (57.10 %) of the participant had 1 time stent implants experience. The majority (55.97 %) of the participants had 1 time of coronary angiography and 25.00% (88 participants) had an AMI history. Most participants (236 participants, 67.05%) had 1 or 2 chronic diseases combined with CHD. 35 participants (9.94%) had a family history of CHD. The majority (71.02 %) of the participants reported never or had one visit to cardio clinic in l year with a mean of 1.4 of cardio clinic visit (*SD* = 0.816). The condition of these participants medication therapy mean was 3.44 （SD = 2.105), with the majority (57.10 %) of the participants had 1 to 3 medications.

Table 3 Disease-related characteristics of CHD patients (n = 352)

Characteristics	n	%
Duration of CHD (years) (M = 3.29, SD = 4.291, range =1-30 years)		
< 2	242	68.75
3-10	92	26.14
>10	18	5.11
Cardiac function grading		
Leve I	39	11.08
Level II	274	77.84
Level III	32	9.09
Level IV	7	1.99
Number of stent implants (M=1.7, SD=0.959)		
1 time	201	57.10
2 time	84	23.86
3 time	39	11.08
more than 3 times	28	7.96
Number of coronary angiographies		
1 time	197	55.97
more than 2 times	155	44.03
History of acute myocardial infarction		
Yes	88	25.00
No	264	75.00
Comorbidity		

Table 3 (Continued)

Characteristics	n	%
None	84	23.86
1-2	236	67.05
>3	32	9.09
Hypertension	144	40.09
Diabetes	43	12.22
Stroke	27	7.767
Others (e.g. rheumatoid arthritis, gastritis, thyroid, gout, cancer, other	66	18.75
Family history of coronary heart disease		
Yes	35	9.94
No	317	90.06
Frequency of visit to cardio clinic (in l year) (M = 1.4, SD = 0.816, range = 0-5)		
0-1	250	71.02
≥2	102	28.98
Types of Medications (M = 3.44, SD = 2.105, range = 1-9)		
1-3	201	57.10
4-5	95	26.99
>5	56	15.91

Descriptive statistics of the studied variables

Descriptive statistics for the continuous study variables were presented in Table 4, The variables in this study included family functioning, health literacy, depression, knowledge, self-efficacy, social support, and self-management behaviors. The total score for patients' family functioning ranged from 4 to 10 with a mean of 7.93 (SD = 2.073). The total score for health literacy ranged from 3 to 14 with a mean of 8.93 (SD = 2.921). The total score of depression ranged from 20 to 56 with a mean

of 30.76 (SD = 7.617). The total score of knowledge ranged from 4 to 52 with a mean

of 29.56 (SD = 9.895). The mean total score of self-efficacy was 6.083 (*SD* = 2.096)

and ranged from 1 to 10.

Social support: The total score of social support ranged from 12 to 58 with

mean of 41.50 (*SD* = 6.919). The results also showed mean score of objective support

equal 10.971 (SD = 2.525), subjective experience of support with mean score of

23.929 (SD = 4.034) and utilization level of support with mean score of 6.6

(SD =1.86).

Self-management behaviors: The total score of self-management behaviors

ranged from 58 to 109 with a mean of 82.23 (SD = 11.863). The results also showed

mean score of daily life management equal 29.39 (SD = 3.406), disease medical

management with mean score of 39.6 (SD =9.369) and emotional management with

mean score of 13.243 (SD =2.216).

Table 4 Descriptive statistics of the study variables (*n* = 352)

Variable	Possible range	Actual range	M	SD
Family functioning	0-10	4-10	7.93	2.073
Health literacy	3-15	3-14	8.93	2.921
Depression	20-80	20-56	30.76	7.617
Knowledge	0-52	4-52	29.56	9.895
Self-efficacy	1-10	1-10	6.083	2.096
Social support	12-66	26-58	41.50	6.919
- objective support	1-22	5-16	10.971	2.525
- subjective experience of support	8-32	14-32	23.929	4.034

Table 4 (Continued)

Variable	Possible range	Actual range	M	SD
- utilization level of support	3-12	3-12	6.6	1.86
Self-management behaviors	27-135	58-109	82.23	11.863
-Daily life management	8-40	21-36	29.39	3.406
-Disease medical management	15-75	21-64	39.6	9.369
-Emotional management	4-20	8-20	13.243	2.216

Assumption testing for the SEM analysis

The commonly used assumptions testing for SEM analysis were tested for outliers, normality, linearity, and multicollinearity. Both univariate normality and multivariate normality were tested and resulted in deletion of outliers to remediate and reanalyze the remaining data. Two univariate outliers in family functioning (1outliers) and depression (1 outlier) as shown in table (Appendix E-1) were deleted from raw data. Therefore, 350 cases were tested for multivariate outliers, multivariate normality of distribution, linearity, and multicollinearity. The multivariate outliers were examined using Mahalanobis' distances. A distance which probability value of the chi-square statistic less than .001 is considered an outlier (Tabachnick, Fidell, & Ullman, 2013). The results showed that there were no multivariate outliers for any of the tested variables (Table Appendix E-2).

Multivariate normality was tested by calculating statistics (Table Appendix E-3). The statistics of multivariate normality were skewness and kurtosis. A symmetric distribution of skewness and distribution of kurtosis are zero meanwhile the critical ratio for both of them is between -1.96 and 1.96 corresponding to the .05 significant level (Hair, 2010). The results showed that data were multivariate normality of distribution for critical value of 11.358 and 8.031 respectively.

Linearity: using Pearson correlation matrix between pairs of the studied variables (Table Appendix E-4) was the test of linear relationships. Twenty-one relations proved to be linear. The bivariate relationships between the study variables did not show a non-zero correlation. However, this linearity assumption could be ignored for the SEM analyses (Schumacker & Lomax, 2010).

Finally, multicollinearity, which refers to high correlations among in dependent variable ($r > .90$) was evaluated. Multicollinearity was the tested that use a correlation matrix with tolerances value less than 0.2 and variance inflation factor [VIF] greater than 4 (Tabachnick et al., 2013). Bivariate correlation matrix (Table Appendix E-4) indicated no evidence of multicollinearity among predictors for all presented correlation coefficients were less than 0.9. The tolerances value and VIF presented in table appendix E-5 revealed that tolerance value ranges from .496 to .649 and variance inflation factor ranged from 1.531 to 2.016 indicating no multicollinearity among studied variables.

Hypothesized model testing

The analysis of moment structures [AMOS] software program (version 25.0) was used in testing the model. The package of AMOS was easily used for comparing, confirming, and refining the models of study (Hair, 2010; Kline, 2011). It also helped in drawing the graphical model to represent the relationships among a set of predictor variables (Blunch, 2012; Kline, 2011). Thus, the AMOS program was used to test how well the hypothesized model fit the sample data by assessing the relationships among context variables (family functioning, health literacy, and depression), process variables (knowledge, self-efficacy, and social support), and outcome variables (self-management behaviors).

In testing the model using AMOS program, bootstrap method was performed to solve the problem of violating multivariate normality assumption and having small sample size. The bootstrap method was a resampling technique that

helped for estimating model test statistics probability values and parameter standard errors under non-normality of the variables (Byrne, 2013; Kline, 2011; Nevitt & Hancock, 2001). When using the bootstrap estimated standard errors, a completely nonparametric approach was taken. In summary of bootstrap iterations, 2000 usable samples were obtained.

Model fit indices

Primary goal of SEM is finding a statistically significant theoretical model that has practical and substantive meaning using three criteria: First, global fit measures of a non-statistically significant chi square test and a root-mean-square error of approximation [RMSEA] less than or equal to .05. A minimum chi-square value [CMIN] should be non-significant ($p > .05$) with CMIN/ degree of freedom (*df*) less than 2. A non-statistically significant chi-square indicates that the sample covariance matrix and the reproduced default model covariance matrix are similar. The chi-square index is affected by sample size. As sample size is more than 200 the chi-square statistic has a tendency to indicate a significant probability level that rejects null hypothesis of model fit (Schumacker & Lomax, 2004).

The second criterion is the statistical significance of each parameter estimate for the paths in the model. These are critical values computed by dividing the parameter estimates by their respective standard errors at the 0.5 level of significance. Third criterion is consideration of magnitude and direction of the parameter estimates especially a positive/ negative coefficient.

The analysis of moment structure [AMOS] program was used to analyze fit indices of the hypothesized model and a modified/ default model. These results are shown in Table 5. Although there were several goodness-of-fit indices provided for causal model testing. This study used chi-square [$\chi2$], norm-fit indices [NFI], the goodness-of-fit Index [GFI], the adjusted goodness-of-fit-index [AGFI], and root mean square error of approximation [RMSEA]. The goodness of fit index [GFI] should be between .90 to 1.00, the norm-fit indices [NFI] should be between .90 to

1.00, the adjusted goodness-of-fit-index [AGFI] between .90 to 1.00 (Schumacker & Lomax, 2010).

Table 5 Statistics of model fit index between the hypothesize and modified model (n = 350)

Model fit criterion	Acceptable score	Hypothesized model	Modified model
CMIN		$\chi^2 = 246.762$	$\chi^2 = 7.919$
	$p > .05$	P = .000 (df=5)	P = . 340 (df = 7)
CMIN/df	< 2	49.352	1.131
GFI	.90-1.00	.835	.991
NFI	.90-1.00	.917	.993
AGFI	.90-1.00	.078	.966
RMSEA	< .05	.439	.023

The hypothesized model

Testing hypothesized model entered all of variables into SEM analysis based on the hypothesized model (figure 3). The score for hypothesized model showed that the CMIN was equal to 246.762 ($p = .000$, ($df = 5$), CMIN/ df was 49.352, GFI was .835, NFI was.917, AGFI was .078 and RMSEA was .439. Fifty-three percent of total variance was accounted for the hypothesized model. These findings indicated the hypothesized model was not supported by the sample data. Subsequently, the hypothesize model was modified by deleting parameters. One at a time, until the remaining estimated parameters achieved the criteria for model goodness of fit (Schumacker & Lomax, 2010). A path diagram of the hypothesized casual model of self-management behaviors was tested using parameter estimates and is displayed in figure 3 and table 6.
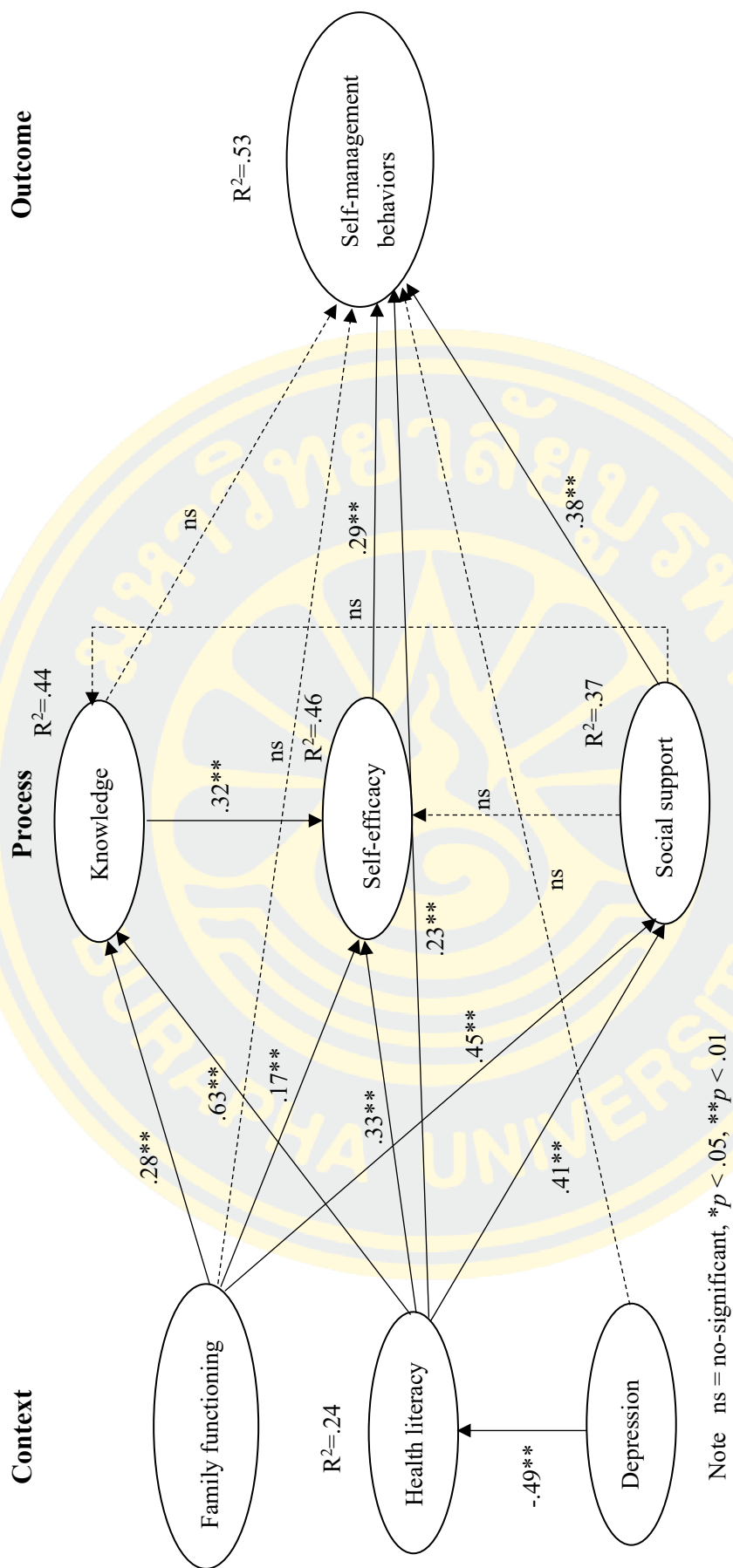
Figure 3 The hypothesized model of self-management behaviors of CHD patients

Note ns = no-significant, *p < .05, **p < .01

Table 6 Standardized regression weights (estimate), standard errors (*SE*), critical ratio
(C.R.), and *p*-value of the hypothesized model (*n* = 350)

Path	Estimate	*SE*	C.R.	*p*-value
Family functioning				
→ Knowledge	.28	.279	4.089	**
→ Self-efficacy	.17	.382	2.296	**
→ Social support	.45	.194	6.668	**
→ Self-management behaviors	-.08	.351	-1.138	.287
Health literacy				
→ Knowledge	.63	.205	9.329	**
Self-efficacy	.33	.315	4.047	**
→ Social support	.45	.144	6.125	**
→ Self-management behaviors	.23	.283	3.120	**
Depression				
→ Health literacy	-.49	.021	-8.928	**
Self-management behaviors	.07	.090	1.204	.319
Knowledge				
→ Self-efficacy	.32	.084	4.854	**
Self-management behaviors	.10	.076	1.676	.103
Self-efficacy				

Table 6 (Continued)

Path	Estimate	SE	C.R.	p-value
⟶ Self-management behaviors	.29	.058	4.876	**
Social support				
⟶ Knowledge	-.046	.084	4.854	.392
⟶ Self-efficacy	.02	.111	.248	.819
⟶ Self-management behaviors	.38	.097	6.877	**

Note * = $p < .05$, ** = $p < .01$, *** = $p < .001$

The modified model

Additionally, the hypothesized model did not fit the data. The model modification [MI] was used to improve model fit, by examining the MI indices from the results of analysis, by considering recommendation to adjust parameters in the model, and by considering the index model from the data analysis (Blunch, 2012; Schumacker & Lomax, 2010). The model trimming was used by deleting 5 parameter estimates with non-significant paths in the hypothesized model. The MI suggested adding paths among endogenous variables including, the path from health literacy to family functioning, the paths from depression to self-efficacy. Next, the path from family functioning and depression to self-management behaviors was deleted. There was only a significant parameter from social support to self-management behaviors. Furthermore, the parameter estimates from social support to both knowledge and self-efficacy were not significant.

Finally, the modified model tested until the model accomplished significant goodness-of-fit coefficients and specified parameters as shown in figure 4. After eliminating some parameters to arrive at a well-fitting model, the results for the modified model showed CMIN was equal to 7.919 ($p =. 340$, $df = 7$), CMIN/ df was 1.131, GFI was .991, NFI was .993, AGFI was .966 and RMSEA was .023. The

modified model was preferred; because RMR, GFI, AGFI and RMSEA values were above cut of point of acceptable and the model was identified. The modified model fitted the data exceptionally well. Therefore, GFI (.991), NFI (.993), AGFI (.966), and RMSEA (.023) were acceptable as shown in table 5.

The path diagram and parameter estimate of the modified model were presented in figure 3. In the final model, exogenous variables were family functioning, health literacy and depression, mediator variables were knowledge, self-efficacy, and social support, and the endogenous variables was self-management behaviors.

The relationships between exogenous and endogenous variable as follows: there were significant parameters from family functioning to knowledge in a positive direction (β = .26, p < .01, 95 % CI: .01-.21) and to social support in a positive direction (β =.40, p < .01, 95 % CI:.278-.517). There were also significant parameters from health literacy to knowledge in a positive direction (β = .46, p < .01, 95 % CI: .311-.606) to self-efficacy in a positive direction (β = .31, p < .01, 95 % CI: .149-.436) and to social support in a positive direction (β = .37, p < .01, 95 % CI: .249-.488). There was also significant parameters from depression to self-efficacy in a negative direction (β =-.34, p < .01, 95 % CI: -.460- -.233). Besides, there were significant parameter estimates among exogenous variables as follows: there was significant parameter estimates from health literacy to family functioning in positive direction (β = .48, p < .01, 95 % CI: .381-.573). There also was a significant parameter estimate from depression to health literacy in a negative direction (β = -.49, p < .01, 95 % CI: -.589- -.376). Moreover, family functioning and depression had a correlation between them (r = -.48), and depression and knowledge had a correlation between them (r=-.23).

The relationships between mediator and endogenous variables as follows: there was a significant parameter estimate from self-efficacy to self-management behaviors in a positive direction (β = .28, p < .01, 95 % CI: .109-.447). There was also

a significant parameter estimate from social support to self-management behaviors in a positive direction (β =.36, p < .01, 95 % CI:.249-.461). Moreover, there were significant parameter estimates among mediator variables as follows: there were significant parameter estimates from knowledge to self-efficacy in positive direction (β = .23, p < .01, 95 % CI: .099-.371).

Additionally, health literacy had a positive direct effect (β =.25, p < .01,95 % CI:.100-.403), indirect effect (β = .328, p < .01, 95 % CI:.238-.438), and total effect (β =.576, p < .01, 95 % CI:.448-.649) on self-management behaviors. Family functioning had a positive direct effect to social support (β =.40, p < .01, 95 % CI:.278-.517), indirect effect (β =.161, p < .01, 95 % CI:.113-.223), and total effect (β =.161, p < .01, 95 % CI: .113-.223) on self-management behaviors.

Furthermore, depression had a negative direct effect on self-efficacy (β = -.34, p < .01, 95 % CI: -.460- -.233), indirect effect (β = -.379, p < .01, 95 % CI: -.458- -.294), and total effect (β = -.379, p < .01, 95 % CI: -.458- -.294) on self-management behaviors as show in Table 6.

The final model

Consequently, there was one final model as follows:

In this model, fifty-seven percent of the total variance was explained in the modified model. Health literacy combination with depression accounted for 40 % (R^2 = .40) of the variance of family functioning. Depression accounted for 24 % (R^2 = .24) of the variance of health literacy. Family functioning, health literacy combination with depression accounted for 53 % (R^2 = .53) of the variance of knowledge and accounted for 46 % (R^2 = .46) of the variance of self-efficacy and accounted for 49 % (R^2 = .49) of the variance of social support. Health literacy and self-efficacy combination with social support accounted for 57 % (R^2 =.57) of the variance of self-management behaviors.

The summary of standardized path coefficients and square multiple correlations ($R2$) of the final model were presented in table 7. In conclusion, this

chapter presented the demographic characteristics of study samples as well as context factors. Descriptive statistics of the study variables were also reported. Preliminary analyses were tested and presented the results. The AMOS software program was utilized to test and modify the study model by using bootstrap method. The hypothesized model was modified based on chi-squares and modification indices. A trimming model was performed in deleting the paths with levels of significance higher than .05. The final model was modified to have a good fit with the data. There was one final model of self-management behaviors of CHD patients. Family functioning, health literacy, depression, knowledge, self-efficacy and social support accounted for self-management behaviors directly and indirectly.

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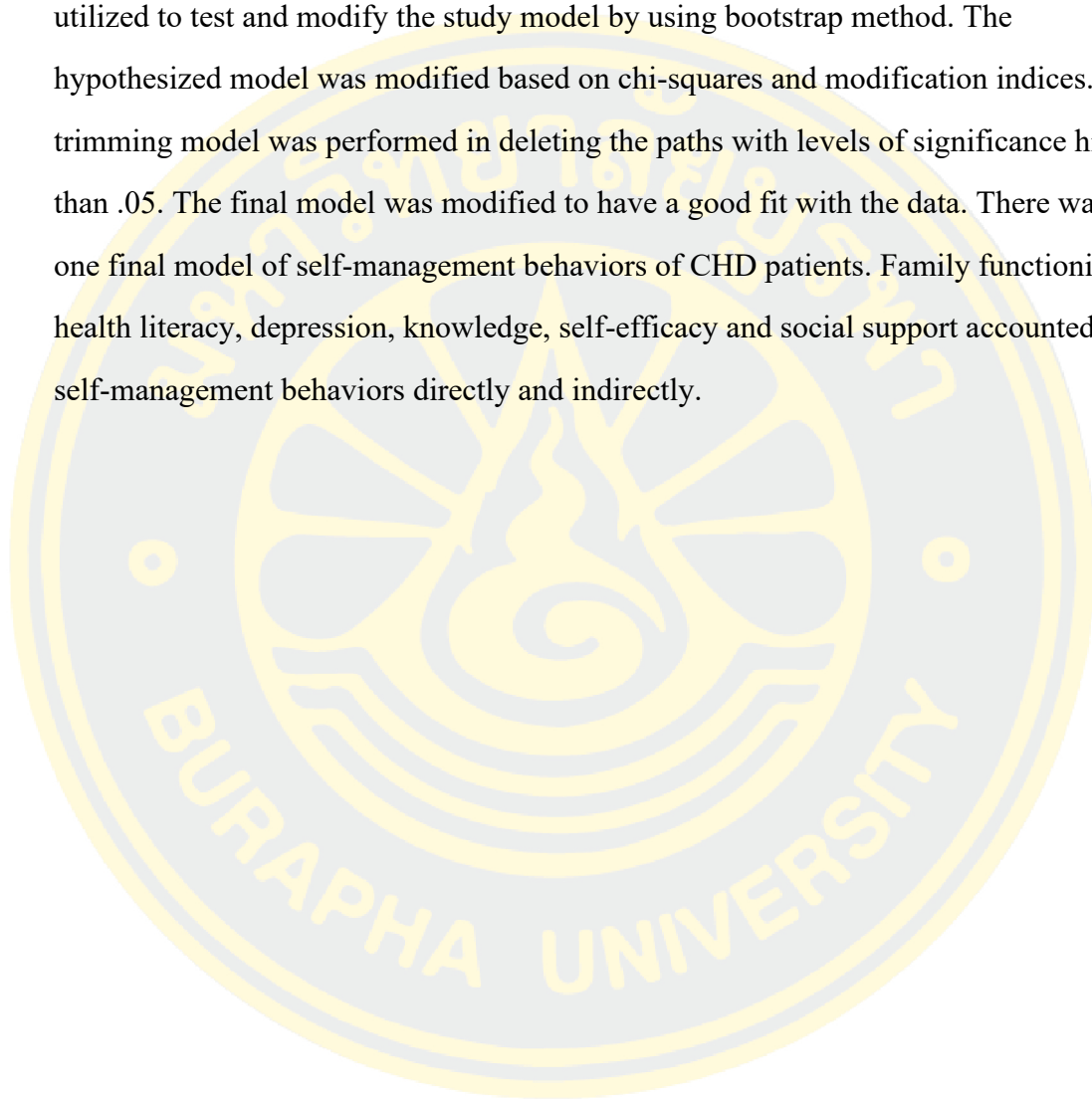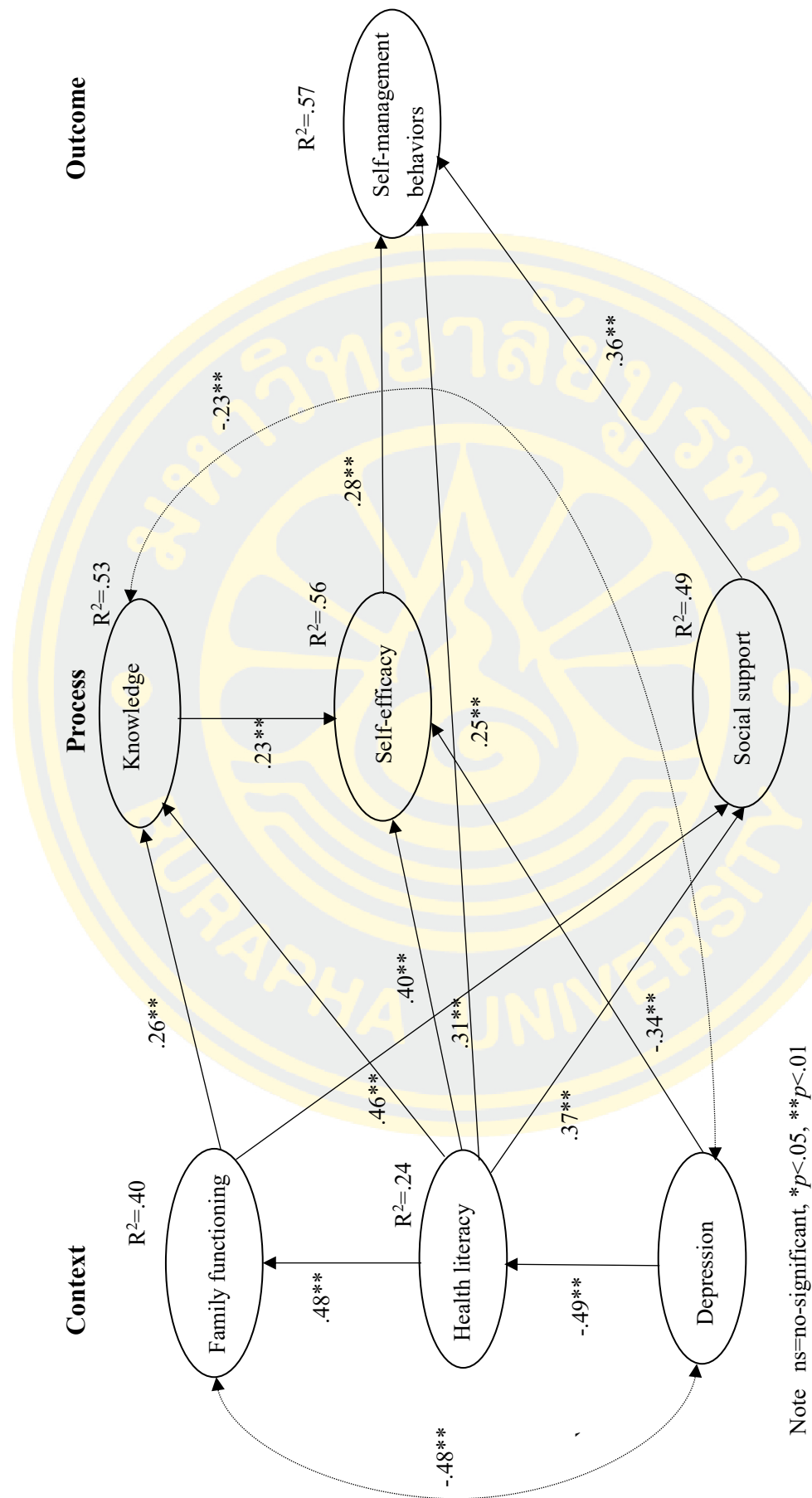
Figure 4 The modified model of self-management behaviors of CHD patients

Note ns=no-significant, *p<.05, **p<.01

Table 7 Direct, indirect, and total effects of causal variables on effect variables of the modified model ($n = 350$)

Causal variables	FF			HL			Knowledge			SE			SS			SM		
	DE	IE	TE	DE	IE	TE	DE	IE	TE	DE	IE	TE	DE	IE	TE	DE	IE	TE
FF	-	-	-	-	-	-	.26**	-	.26**	-	.06**	-	.40**	-	.40**	-	.17**	.17**
HL	.48**	-	.48**	-	-	-	.46**	.12**	.59**	.31**	.14*	.45**	.37**	.19**	.56**	.25**	.33**	.58**
Depression	-	-.24**	-.24**	-.49**	-	-.49**	-	-.29**	-.29**	-.33**	-.22**	-.55**	-	-.28**	-.28**	-	-.38**	-.38**
Knowledge	-	-	-	-	-	-	-	-	-	.23**	-	.23**	-	-	-	-	.07**	.07**
SE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.28**	-	.28**
SS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.36**	-	.36**
	$R^2 = .40$			$R^2 = .24$			$R^2 = .53$			$R^2 = .56$			$R^2 = .49$			$R^2 = .57$		

Note $*p < .05$, $**p < .01$

DE = Direct effect, IE = Indirect effect, TE = Total effect,

FF=Family functioning,

HL=Health literacy,

SE=Self-efficacy,

SS=Social support,

SM=Self-management behaviors

SE=Self-efficacy,

SS=Social support,

The study findings in responding to research hypotheses

The results of this study are described here for each research hypothesis. The magnitude of causal effects, both direct and indirect, on CHD patients' self-management behaviors was analyzed with structural equation modeling [SEM] using the AMOS program, with a significance level set at $p < .05$ for all analyses.

Hypothesis 1: Family functioning has a direct positive effect and indirect effect on SM behaviors through social support and self-efficacy.

Family functioning has indirect effect on self-management behaviors through social support. There was significant relationships of parameter estimates between a path from family functioning to social support in a positive direction ($\beta = .40, p < .01$). However, there was not statistically significant direct effect of family functioning on self-efficacy ($\beta = .015, p = .816$). Thus, the results support this hypothesis partially.

Hypothesis 2: Health literacy has a direct positive effect and indirect effect on SM behaviors through knowledge, self-efficacy and social support.

The parameter estimate for health literacy has a statistically significant direct positive effect on self-management behaviors both in the hypothesized model ($\beta = .23, p < .01$) and the modified model ($\beta = .25, p < .01$). Health literacy has indirect effect on self-management behaviors through self-efficacy, knowledge and social support. There was significant relationships of parameter estimates between a path from health literacy to knowledge in a positive direction ($\beta = .26, p < .01$), self-efficacy in a positive direction ($\beta = .31, p < .01$) and social support in a positive direction ($\beta = .37, p < .01$). Therefore, the hypothesis was confirmed.

Hypothesis 3: Depression has a direct negative effect on SM behaviors.

There was not statistically significant direct negative effect of depression on self-management behaviors ($\beta = .07, p = .319$). The study findings did not support this hypothesis.

Hypothesis 4: Disease knowledge has a direct positive effect on SM, has an indirect effect on SM behaviors through self-efficacy.

Disease knowledge has indirect effect on self-management behaviors through self-efficacy. There was significant relationships of parameter estimates between a path from disease knowledge to self-efficacy in a positive direction ($\beta =$

.23, $p < .01$). However, there was not statistically significant direct effect of disease knowledge on self-management behaviors ($\beta = .10$, $p = .103$). Thus, the results support this hypothesis partially.

Hypothesis 5: Self-efficacy has a direct positive effect on SM behaviors.

The parameter estimate for self-efficacy has a statistically significant direct positive effect on self-management behaviors both in the hypothesized model ($\beta = .29$, $p < .01$) and the modified model ($\beta = .28$, $p < .01$). Thus, the results support this hypothesis self-efficacy has a positive direct effect on SM.

Hypothesis 6: Social support has a direct positive effect on SM behaviors, has an indirect effect on SM behaviors through knowledge and self-efficacy.

The parameter estimate for social support has a statistically significant direct positive effect on self-management behaviors both in the hypothesized model ($\beta = .38$, $p < .01$) and the modified model ($\beta = .36$, $p < .01$). However, there was not statistically significant indirect effect of social support on self-management behaviors through self-efficacy ($\beta = .02$, $p = .819$) and knowledge ($\beta = -.046$, $p = .392$).

In summary, the results of testing a causal model of self-management behaviors in parents with CHD were presented. Descriptive statistics indicated the characteristics of CHD patients. The assumptions for SEM including outlier, normality, linearity, and multicolinearity were firstly tested and found acceptable regarding the assumptions for the multiple regression statistics used.

The hypothesized model was tested using model-fit criteria compared to specific acceptance values and modified based on the results. Paths of the modified model of self-management behaviors among CHD patients fit the sample well. The modified model did not include the path to self-management behaviors from family functioning, depression and knowledge, path from social support to knowledge and self-efficacy, path from family functioning to self-efficacy as hypothesized.

After modification, the model indicated that health literacy had a positive direct effect on self-management behaviors ($\beta = .25$, $p < .01$). Self-efficacy had a positive direct effect on self-management behaviors ($\beta = .28$, $p < .01$). Social support had a positive direct effect on self-management behaviors ($\beta = .36$, $p < .01$). Additionally, family functioning had an indirect effect on self-management behaviors through knowledge ($\beta = .26$, $p < .01$) to social support ($\beta = .40$, $p < .01$) and

depression had an indirect effect to self-management behaviors in a negative direction through health literacy (β = -.49, p < .01) and self-efficacy (β = -.34, p < .01). Besides, knowledge had an indirect effect on self-management behaviors through self-efficacy (β = .23, p < .01). Which accounted for 57 % of the variance in CHD patients' self-management behaviors (R^2 = .57).

CHAPTER 5
DISCUSSION AND CONCLUSION

This chapter presents in three main parts. The first part presented the study's summary and results. The second part discussed the research findings related to the research hypotheses and the results of the final model. In the third and final section, the study limitations and recommendations were presented.

Summary of the study

The purpose of the study was to test the model of self-management behaviors of CHD patients in Yancheng, China. Participants were 352 CHD patients recruited by a cluster sampling technique residing in Yancheng, Jiangsu province, China, from August to December 2022. Research instruments included seven questionnaires of the family APGAR index, the Chew 's set of brief screening questions, the self-rating depression scale (SDS), the coronary heart disease knowledge questionnaire, the self-efficacy for chronic disease 6-item scale (SECD6), the social support rating scale (SSRS) and the coronary artery disease self-management scale (CSMS) with their Cronbach's alpha ranged from .740-.965. Data were analyzed by using descriptive statistics and the path analysis. Findings are presented as following:

1. General information of the participants: Study results found that majority of the participants were male (73.86 %) and married (81.82 %), mean age 64.11years old (SD = 12.78) and had a primary school or below education level school (28.98 %). Most participants (92.05 %) lived with family, only 7.95 % lived alone. More than half had co-morbidities (76.14 %).

2. Descriptive information of the variables: The APGAR score was between 4 and 10, with a mean score of 7.93 indicating fair or good family functioning. Health literacy had moderate level. Actual score of health literacy ranged from 3 to 14, with a mean score of 8.93 (SD = 2.921). The actual score of depression ranged from 20 to 56, with a mean score of 30.76 (SD = 7.617).

The mean score of knowledge was 29.56 (SD = 9.895), indicating a negative attitude towards CHD knowledge. The average self-efficacy score was between 6 and

60 with a mean score of 36.65 (SD = 12.578), which indicates low level of self-efficacy. Average social support score was between 26 and 58 with a mean score of 41.50 (SD = 6.919). The results also showed a moderate level of mean score of each dimension. Mean score of objective support was 10.971 (SD = 0.58), mean score of subjective experience of support was 23.929 (SD = 4.034) and mean score of utilization level of support was 6.6 (SD = 1.86).

The CSMS score was between 58 and 109, with a mean score of 82.23 indicating low level of self-management behaviors among CHD patients. Mean score of daily life management indicated general life management, bad hobby management, with a mean score of 29.39 (SD = 3.406). Disease medical management had its mean score of 39.6 (SD = 9.369). Emotional management had its mean score of 13.243 (SD = 2.216).

3. Results of the model testing found that the hypothesized model did not fit the data. Then, the trimming model was further performed until the final model was reached the goodness-of-fit criteria. Results of the final models of self-management behaviors of CHD patients showed that the final model indicated that family functioning had a significantly positive indirect effect on self-management behaviors through depression, knowledge, self-efficacy and social support. Furthermore, health literacy had a significantly positive direct effect on self-management behaviors and had a significantly positive indirect effect on self-management behaviors through family functioning, knowledge, self-efficacy and social support. Depression had a significantly negative indirect effect on self-management behaviors through family functioning, knowledge and self-efficacy. The model explained 57 % (R^2 = .57) of the variances.

Discussion of research findings

The results of this study found that the sample reported low level of self-management behaviors (M = 82,23, SD = 11.863). This may be result of participants perceiving CHD as chronic and could be well controlled through treatment (Xiong et al., 2023). Most of the participants (61.93%) were elderly patients whose age was more than 60 years. Mostly CHD elderly patients with low education levels and low levels of literacy. In our study, most of participants had a Junior high school or below

educational level (53.98%). Furthermore, they have limited reading proficiency and access to the internet. Hence, they are unable to take advantage of the large amount of information from the Internet and books.

The BMI of the overweight or obesity group ($M = 24.8$, SD $= 3.25$) is another factor that can hinder the self-management behaviors of CHD patients. Obesity is a disease that can impact nine organs and involve 40 conditions. Studies discover obese patients and CHD risk demonstrate that to manage their risk of CHD, the patient will need to eat less and do exercise. It demonstrated that these participants were in unsatisfactory self-management behaviors on the other side. In addition, most of the participants (76.14%) had co-morbidities. Comorbidity can affect the physical and psychological status that can affect patients' health behaviors. In our study, the highest incidence of comorbidity is hypertension. Hypertension is a risk factor that is related to elevated blood cholesterol levels. Its effect on organ degeneration and morbidity and mortality is astounding (Buttaro et al., 2013).

Low level of self-management behaviors of CHD patients may be influenced by a person's education, income, and occupation. Most of them had a Junior high school or below educational level (53.98%), which may result in participants having a low health literacy. They ignore the importance of the benefits of self-management behaviors, like make a daily exercise routine, living tobacco-free life, while restricting the use of alcohol, and keeping an ideal weight, and so on. Moreover, more than half of the participants were male; gender can affect self-management behaviors from previous studies. Many studies indicated that female had better self-management behaviors than male.

Factors influencing self-management behaviors

There were six factors that influenced self-management behaviors. Results showed that family functioning, health literacy, depression, knowledge, self-efficacy, social support had direct and/or indirect effects on self-management behaviors. Additionally, there were three factors found to be mediators between family functioning, depression, knowledge, and self-management behaviors in the modified model, including health literacy, self-efficacy, and social support.

This model supported the individual and family self-management theory [IFSMT] (Ryan & Sawin, 2014). The IFSMT guided this study and illustrated how an

individual or family member should cope to achieve personal health goals. The ideal state of health is associated with the realization of self-management behaviors, which are specific actions taken to manage a condition or maintain a state of health (Ryan & Sawin, 2009; 2014). This study established that self-management behaviors in adults with CHD requires individual and family self-management behaviors and emphasis the importance of family members to attend in patients' self-management behaviors in daily life. It also showed how these factors affected self-management behaviors among CHD patients. Knowledge, self-efficacy, and social support within the process dimensions emphasize the facilitation to promote self-management behaviors of CHD patients. In the context dimension, family functioning, health literacy, and depression all affect an individual's and family's ability to engage in the self-management process, which directly affects outcomes. Additionally, health literacy, self-efficacy, and social support also directly affected the success of CHD self-management behaviors. The researcher discussed the effect of various factors as follows.

Direct effect on self-management behaviors

The results of model testing found that health literacy, self-efficacy, and social support had direct effects on self-management behaviors.

Health literacy in adults with CHD had a direct effect on self-management behaviors ($\beta = .25$, $p < .01$). Inadequate health literacy is a potential barrier to self-management behaviors.

Health literacy has been considered an important factor in predicting survival outcomes of patients with chronic non-communicable diseases. It refers to the knowledge and abilities that enable people to identify, acquire, understand, and apply health information or services to maintain or promote their health. A systematic review found that health literacy was instrumental in improving disease knowledge and self-efficacy (Dahal & Hosseinzadeh, 2019). The results was consistent with Kim et.al research, they founded that health literacy have association with disease knowledge and medication regimen adherence (Kim et al., 2022).

The study's results were consistent with previous research that has shown that health literacy is significantly related to self-management behaviors. Qiu et.al discovered that health literacy can impact on self-management behaviors through acceptance of illness among patients with hypertension (Qiu et al., 2020b). Li et.al

detected that health literacy positively affected self-management and have indirect effect on self-management via self-efficacy (Lee et al., 2021). Dinh et.al discovered that health literacy, social support and self-efficacy were significantly associated with greater self-management behaviors (Dinh & Bonner, 2023). Evidence showed that health literacy and social support were related to self-management behaviors in patients with obstructive sleep apnea-hypopnea syndrome (Yu et al., 2022). Moreover, evidence was founded in previous studies that health literacy affects self-management behaviors via self-efficacy be demonstrated among Chinese patients with chronic non-communicable diseases (Wu et al., 2022). These findings verify the hypothesis of our research findings.

Self-efficacy in adults with CHD had a direct effect on self-management behaviors (β = .28, p < .01). Self-efficacy is a person's belief in his/her ability to commit an action that has been described as a self-regulatory process affecting a person's motivation to engage in behavior change. Self-efficacy is associated with self-management directly through motivation toward behavior change (Al-Dwaikat, Rababah, Al-Hammouri, & Chlebowy, 2021). According to Bandura's self-efficacy theory, patients who lack the confidence to execute a certain behavior are less likely to participate in problem solving and decision-making in the context of their own health (Bandura, 2001). Papadakos et.al (2022) revealed that participants with higher self-efficacy had higher chemotherapy self-management scores compared to participants with low self-efficacy (Papadakos et al., 2022).

The study's results were consistent with previous research that has shown self-efficacy is significantly associated with self-management behaviors. Another explanation is that, in the long-term process of treatment and care, self-efficacy improves cardiac patients' adaptability to the disease, which then improves their psychological state (Banik, Schwarzer, Knoll, Czekierda, & Luszczynska, 2018). Indeed, increased self-efficacy and self-management behavior are associated with adequate medication use, pain management, and exercise in various patient groups. In patients with cardiovascular diseases, self-efficacy was found to have a beneficial effect on exercise and diet. Stimulating self-efficacy offers opportunities for better health for many patients with vascular diseases in many countries. Patients with high self-efficacy have the confidence to deal with various difficulties or problems in

disease rehabilitation, promote their behavior changes, actively cooperate with medical staff and participate in management (Zhou et al., 2022). The above aspects will help to promote patient disease management.

Social support in adults with CHD had a direct effect on self-management behaviors (β = .36, p < .01). Social support has a direct positive effect on SM, which is corresponded with previous research findings (Song, Chen, Wang, Yang, & Jiang, 2022). Social support is an essential external resource for patients during treatment. Patients with CHD mainly obtain social support from family members, close relatives, and friends (Golubinski, Oppel, & Schreyögg, 2020). Social support theory holds that older patients living with their children can get more emotional support from family members to have more confidence to deal with the challenges and actively participate in disease management (McNeely, Sachdev, Rahman, Zhang, & Skolasky, 2021). Patients with better support are more likely to have more positive states of mind and solve problems with better use of available resources.

Since Mainland China began implementing the one-child policy in 1981, it has reduced the family size and increased the number of older "empty nests" who have no children or children have left home, resulting in decreased social support and self-efficacy (McNeely et al., 2021). A high level of social support can reduce the psychological stress caused by the disease, help patients build confidence in overcoming the disease and make patients more inclined to participate in health management actively (Rodriguez et al., 2022).

Poor social support is associated not only with an increase in mortality, morbidity and psychological distress but a decrease in overall general health and well-being. Several studies have found social support vital to SM in people with chronic diseases. Social support can be either emotional or physical. Emotional, social support is defined as the degree to which interpersonal relationships serve the purpose of providing emotional, informational or influential quality of life for the individual. Physical support is defined as the forms and numbers of social relationships (marital status, the number of friends) and the degree of connection between these relationships (social network). Earlier studies have shown that social support and social networks influence health behaviors and health outcomes. Additional information about the influence of social support on chronic illness self-management

has been supported by research. A systematic review reported evidence for a modest positive relationship between social support and chronic illness self-management, particularly for diabetes (Werfalli, Kalula, Manning, & Levitt, 2020). The finding was that a large information network is beneficial for self-management capabilities, especially in low education populations. This may be of an advantage in many cultures such as in South Africa where strong family relationships and family caring are important and highly valued (Moore, Prybutok, Ta, & Amey, 2018).

Indirect effect on self-management behaviors

The results of model testing found that family functioning, depression, and knowledge had indirect effects on self-management behaviors.

Family functioning had an indirect effect on self-management behaviors through social support (β = .40, p < .01) in adult persons with CHD. The findings indicated that CHD patients who were taken care by their families perceived greater social support and had higher level of self-management behaviors. Most of the patients' self-management behaviors occur within family and community environment because after discharge, especially for elderly patients spend almost all time in family and community, since most of them are retired. In that situation, social support and family function play important roles in patients' disease management (Zhang et al., 2020). Meanwhile, Cheng et al. (2017) conducted a cross-sectional survey in China and found that better family functioning was significantly related to better mental status whether in urban or rural (Cheng et al., 2017). Zou et al. (2018) also found that when the elderly were sick and hospitalized, a dysfunctional family dynamic might contribute to the occurrence of poor mental status (Zou et al., 2018). Bennich et al. (2017) conducted an integrative review, and their findings stressed the importance of family to target patients' self-management adherence. The family functioning plays a more important role on them to keep positive emotions and a healthy lifestyle (Bennich et al., 2017). An exploratory study (Bennich et al., 2019), including 127 patients with type 2 diabetes, also found the association between family function and self-management. Multiple studies were found the relationships between family functioning and self-management behaviors can be mediated by well-being (Zhang, et al., 2020), family support (Tang, Luo, Li, Wang, & Li, 2023), social

support and resilience (Luo et al., 2019). Overall, family functioning and social support play an important role with self-management, which is supported by previous studies (Lan et al., 2022; Tang et al., 2023).

Model testing found that depression had an indirect effect on self-management behaviors through health literacy (β = -.49, p < .01) and self-efficacy (β = -.34, p < .01) in a negative direction. However, from previous literature, it founded that depression have significantly negative effect on SM among both T1DM and T2DM (Andreas Schmitt et al., 2021), the same as Daniali et.al research among chronic disease (Daniali et al., 2019). Although their findings support negative associations between depression and SM. The finding results are consistent with our hypothesis. However, Chlebowy et.al conducted the research in African American adults with type 2 diabetes founded that depression were not significantly correlated with self-management behaviors (Chlebowy, Batscha, Kubiak, & Crawford, 2019), the results are similar with our model testing findings. S.F. V. Wu and colleagues further found that higher levels of self-efficacy were associated with lower levels of depression and anxiety among persons with T2D. Similarly, Sympa et al. (2018) found that depression was negatively correlated with self-efficacy (Sympa et al., 2018). These results are consistent as the modified model findings.

The results of model testing found that knowledge had indirect effect on self-management behaviors through self-efficacy (β = .23, p < .01). These findings imply that knowledge cannot influence SMB directly. However, Yang et.al research revealed that there was a significant positive correlation between the level of knowledge of COPD and self-management behaviors, suggesting that the higher the mastery of disease knowledge, the higher the level of self-management behavior of patients, and vice versa (Yang et al., 2019). Due to the low or mediate health literacy, patients may hard to understand the knowledge that doctor, or nurse told to them, which may result in a low level of disease knowledge, it cannot influence SM directly, only can affect SM through self-efficacy. Besides, it can explain the fact that CHD patients were mostly elderly patients with low education levels and low levels of literacy. Furthermore, they have limited reading proficiency and access to the internet. Hence, they are unable to take advantage of the large amount of information from the Internet and books. Therefore, healthcare professionals need to use simple and easy-

to-understand methods to inform patients about the natural course and prognosis of their disease and improve their disease knowledge.

The knowledge of patients of the disease is the key factor in determining the behavior of patients. The more knowledge they acquire, the more likely they are to make decisions that are beneficial for their health. On their own, more health education and more knowledge for patients with chronic illness do not translate into well-controlled disease. Although patients' knowledge may increase, the corresponding disease management may not necessarily be changed. Therefore, knowledge is not enough for good disease control. More effective means of conveying disease knowledge are needed, including methodological interventions that improve self-efficacy. Combining schemes to improve individual self-efficacy with strategies to improve disease knowledge should synergistically increase self-management. Many studies of chronic illness have mentioned that improving the disease-related knowledge and self-efficacy of patients has a positive effect on their health behaviors (Wu et al., 2019), which can increase patients' health outcomes, improve quality of life, reduce medical costs, and decrease the frequency of hospitalization (Timmerman et al., 2019). Bandura's Social Cognitive Theory (SCT) suggests that self-efficacy would mediate associations between disease knowledge and self-management behavior, determining whether CHD patients act on their CHD knowledge and implement self-management strategies. The finding result are consistent as Chuang and his colleague' finding, a cross-sectional study suggested that self-efficacy was a mediator between knowledge and self-management of patients with early-stage chronic kidney disease in Taiwan (Chuang et al., 2021). It is plausible that CHD patients have the knowledge necessary for good self-management, but without self-efficacy, they may not take the necessary steps.

According to the IFSMT, factors in the context dimension affect an individual's and family's ability to engage in the process dimension and directly impact proximal and distal outcomes (Ryan & Sawin, 2009; 2014). This model showed family functioning, health literacy and depression were in the context dimension. Family functioning, health literacy and depression directly affected self-efficacy or/ and social support in the process dimension. Health literacy directly affected CHD self-management behaviors, which were the proximal outcome.

In the process dimension, constructs in the process dimension are linked to constructs in the context dimension, are internally related, and affect the outcome dimension (Ryan & Sawin, 2009; 2014). This model showed knowledge, self-efficacy and social support in the process dimension received influence from family functioning, health literacy and depression. Furthermore, knowledge and self-efficacy are interrelated, with knowledge affecting self-efficacy. In addition, knowledge, self-efficacy and social support affected CHD self-management behaviors or proximal outcomes in the IFSMT.

In the outcome dimension, the proximal and distal outcomes were affected by both context and process dimensions (Ryan & Sawin, 2009; 2014). The context dimension, including: family functioning, health literacy and depression, and the process dimension, including: self-efficacy and social support, directly affected CHD self-management behaviors. In overview, this model represented the IFSMT.

Conclusion

Self-management behaviors have been widely recognized as a way to support patients in living the best possible quality of life with their chronic condition (Kimble, 2018). Self-management can reduce symptom aggravation and the recurrent rate of cardiac events and improve the quality of life for patients. However, the self-management behaviors level of CHD patients in China is generally at a low level. Although the hypothesized model with six factors derived from the literature did not fit the data well, modification of the model retained the six factors with significant paths showing their effects on self-management behaviors. The total variance explained was 57% for self-management behaviors. The results of this study are explained by the IFSMT. By model testing, it was shown that risk and protective factors in the context dimension, constructs in the process dimension, and proximal outcome were interrelated. The six factors that influenced self-management behaviors were family functioning, health literacy, depression, knowledge, self-efficacy, social support. Health literacy, self-efficacy and social support were mediators of self-management behaviors. Social support was the strongest factor influencing CHD self-management behaviors.

Implications for nursing

   The results of this study provide an understanding of the six factors that influence self-management behaviors in adults with CHD. These are useful for nursing practice, nursing education, nursing research, and nursing administration.

   Implication to nursing practice

   The results of this study provided new knowledge about the pattern of relationships among factors that influence self-management behaviors among CHD. Health literacy, self-efficacy and social support affect patients' self-management behaviors positively. Health literacy has an indirect effect on patients' self-management behaviors through self-efficacy and social support. Family functioning has an indirect positive effect on self-management behaviors through social support.

   Depression has an indirect negatively effect on self-management behaviors through health literacy and self-efficacy. The findings provide viewpoints on nursing care. It suggested that nurses should be aware about these factors because it might foster or impede self-management behaviors. Patients whose self-management behaviors is less optimal. Nurses should assess self-management level in different stage of CHD and treatment. Nursing intervention should directly address patients' self-management behaviors. The findings from this study imply that nursing care for CHD patients should have guidelines to strengthen positive beliefs and challenging negative beliefs about CHD and treatments. Moreover, supporting CHD patients to manage their symptoms and promote health outcomes. Nurses should guide patients and their family members to enhance their health literacy, knowledge, self-efficacy and social support because it is likely to foster patients' self-management behaviors.

   Relieving the level of depression among CHD patients is also important due to depression having negative indirect effects on self-management behaviors. Nursing intervention would seem to be that patients' self-management behaviors could be strengthened by reducing depression, stimulating patients about existential well-being that influence on positive feelings, hope, meaning, purpose and satisfaction in their life. Additionally, it is recommended patients to participate in various social activities, communicate more with doctors and nurses, and communicate with family members in time if there is any unhappiness and trouble might help patients to promote self-management behaviors.

Implication to nursing education

Nursing curriculum should contain knowledge about CHD patients' self-management in nursing subjects related to cardiovascular diseases in internal nursing care. Medical nurses should guide and teach nursing students to gain the ability to care for enhance patients' self-management behaviors. When students have found patients who difficulty to take self-management behaviors with CHD, medical nurses should assist them to care and guide them regarding importance of care to promote self-management behaviors.

Implication to nursing research

The findings support the individual and family self-management theory [IFSMT]. Nurses can use this knowledge to develop evidence-based interventions that reduce depression, whereas promote family functioning, health literacy, knowledge, self-efficacy and social support to improve self-management behaviors in adults with CHD.

Implication to nursing administration

For nursing administration, knowledge about successful of taking self-management behaviors is essential for our society. The results of this study can monitor and evaluate the factors to promote patients taking self-management behaviors successfully among adults with CHD.

Limitations of the study

This study has some limitations that should be mentioned. Firstly, the modeling testing with cross-sectional study design does not identify true causal relationships because data are collected at a single time point. Self-management behaviors can change throughout the duration of the illness and treatment. Secondly, the participants and collecting data selected were at two tertiary hospitals in only one province in China which limited the ability to generalize to the entire population of adults with CHD. Thirdly, the instrument to measure CHD patients' health literacy was not specific and did not have high sensitivity to measure health literacy among CHD patients because just three items asked for literacy in general situation, which measure patients' confident with forms, help read and problems reading. The Chew 's set of brief screening questions has only three item to measure health literacy that

might not be perfectly appropriate with SEM. Finally, the data collected during the COVID-19 pandemic might have exposed participants to unforeseen problems that may normally would not have experienced the situation. This might have affected the results.

Recommendations for future research

The results of this study provided guidance for future research as follows:

1. Further research could recruit participants from a variety of local and settings in China to have a better representation of Chinese adults with CHD. The results would expand the understanding of CHD self-management behaviors in China.

2. A longitudinal study with a more variety of settings and cultural background of clients should be further conducted in fulfill understanding of CHD patients' self-management behaviors in China.

3. Future studies should develop intervention programs to promote and enhance self-management behaviors in adults with CHD. They would be designed and based on significant factors found in this and other studies, including family functioning, health literacy, depression, knowledge, self-efficacy, and social support.

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APPENDICES

APPENDIX A

Institutional review board

สำเนา

เอกสารรับรองผลการพิจารณาจริยธรรมการวิจัยในมนุษย์
มหาวิทยาลัยบูรพา

คณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยบูรพา ได้พิจารณาโครงการวิจัย

รหัสโครงการวิจัย :   G-HS052/2565
โครงการวิจัยเรื่อง :   Predictive factors of self-management behaviors among patients with coronary heart disease: A structural equation modeling
หัวหน้าโครงการวิจัย : MRS.YANG WANG
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 August 2022

2. Research Protocol Version 1 : 16 June 2022

3. Participant Information Sheet Version 2 : 8 August 2022

4. Informed Consent Form Version 1 : 16 August 2022

5. Research Instruments Version 2 : 8 August 2022

6. Others (if any) Version - : -

วันที่รับรอง : วันที่ 11 เดือน สิงหาคม พ.ศ. 2565
วันที่หมดอายุ : วันที่ 11 เดือน สิงหาคม พ.ศ. 2566

ลงนาม นางสาวรมร แย้มประทุม
(นางสาวรมร แย้มประทุม)
ประธานคณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยบูรพา
ชุดที่ 3 (กลุ่มคลินิก/ วิทยาศาสตร์สุขภาพ/ วิทยาศาสตร์และเทคโนโลยี)

บันทึกข้อความ

ส่วนงาน กองบริหารการวิจัยและนวัตกรรม งานมาตรฐานและจริยธรรมในการวิจัย โทร. ๒๖๒๐

ที่ อว ๘๑๐๐/- **วันที่** ๑๗ เดือน สิงหาคม พ.ศ. ๒๕๖๕

เรื่อง ขอส่งสำเนาเอกสารรับรองผลการพิจารณาจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยบูรพา

เรียน MRS.YANG WANG

    ตามที่ท่าน ได้ยื่นเอกสารคำร้องเพื่อขอรับการพิจารณาจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยบูรพา รหัสโครงการวิจัย G-HS052/2565(C1) โครงการวิจัย เรื่อง Predictive factors of self-management behaviors among patients with coronary heart disease: A structural equation modeling นั้น

    บัดนี้ โครงการวิจัยดังกล่าว ได้ผ่านการพิจารณาจากคณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยบูรพา สำหรับโครงการวิจัยระดับบัณฑิตศึกษาและระดับปริญญาตรี ชุดที่ 3 (กลุ่มคลินิก/ วิทยาศาสตร์สุขภาพ/ วิทยาศาสตร์และเทคโนโลยี) เป็นที่เรียบร้อยแล้ว กองบริหารการวิจัยและนวัตกรรม ในฐานะผู้ประสานงาน จึงขอส่งสำเนาเอกสารรับรองผลการพิจารณาจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยบูรพา จำนวน ๑ ฉบับ เอกสารชี้แจงผู้เข้าร่วมโครงการวิจัย เอกสารแสดงความยินยอมของผู้เข้าร่วมโครงการวิจัย และเอกสารเครื่องมือที่ใช้ในการวิจัย โดยประทับตรารับรองเรียบร้อยแล้ว มายังท่าน เพื่อนำไปใช้ในการเก็บข้อมูลจริงจากผู้เข้าร่วมโครงการวิจัยต่อไป

    จึงเรียนมาเพื่อโปรดทราบ

นางสาวรมร แย้มประทุม

(นางสาวรมร แย้มประทุม)

ประธานคณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยบูรพา

สำหรับโครงการวิจัยระดับบัณฑิตศึกษาและระดับปริญญาตรี

ชุดที่ 3 (กลุ่มคลินิก/ วิทยาศาสตร์สุขภาพ/ วิทยาศาสตร์และเทคโนโลยี)

盐城市第一人民医院伦理委员会

科研项目伦理审查批准件

伦审号【2022】-（K-037）
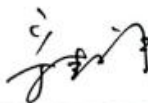
项目名称	冠心病患者自我管理行为的预测因素的结构方程模型构建		
申请人	王洋	申请专业	护理
审查人所在单位	盐城市第一人民医院		
审查材料	试验方案　有■　无□ 知情同意书　有■　无□ 申报书　有□　无■	审查途径	会议审查□ 快速审查■
伦理委员会审评意见			

项目符合伦理学基本原则，同意申报。

主任委员签名：　　　　　　　　　2022.06.28

盐城市第三人民医院

伦理审查批件

批件号：伦审-2022-16

项目名称	冠心病患者自我管理行为预测因素的结构方程模型构建		
申请者	王洋	科室	心内科
审查文件	1. 初始审查申请表； 2. 临床科研项目可行性与安全性论证报告； 3. 研究方案； 4. 主要研究者履历； 5. 免知情同意的申请。		
审查类别	☑初始审查 □跟踪审查： 　□年度/定期跟踪审查 　□修正案审查 　□严重不良事件和非预期事件报告审查 　□不依从/违背方案事件审查 　□暂停或终止已批准研究审查 　□结题审查 　□受试者抱怨 　□实地访查 　□复审		
审查方式	□会议审查　☑简易审查　□紧急会议审查		
审查意见	审查决定：批准 　　根据《涉及人的生物医学研究伦理审查办法》（2016 年）、《药物临床试验质量管理规范》（2020 年）、《药物临床试验伦理审查工作指导原则》（2010 年）、WMA《赫尔辛基宣言》的伦理原则。经		

	本伦理委员会审查同意按所同意的临床研究方案、知情同意书开展本项研究。
	注：
	1、请遵循 GCP 原则、遵循伦理委员会同意的方案开展临床研究保护受试者的健康和权利。
	2、对研究方案、知情同意书、招募材料等的任何修改请提交修正案审查申请。
	3、发生 SAE 请及时提交严重不良事件报告。
	4、如有不依从/违背方案的情况请及时提交违背方案报告。
	5、请根据年度/定期跟踪审查频率及时提交研究进展报告。
	6、暂停或终止临床研究请及时提交暂停/终止研究报告。
	7、完成临床研究请提交结题报告。
年度定期/跟踪审查频率	12 个月
主任委员（被授权者）签名	盐城市第三人民医院伦理委员会（盖章）

APPENDIX B

Participant information and consent form

เอกสารชี้แจงผู้เข้าร่วมโครงการวิจัย
(Participant Information Sheet)

รหัสโครงการวิจัย : ....G-HS052/2565...
(สำนักงานคณะกรรมการพิจารณาจริยธรรมในมนุษย์ มหาวิทยาลัยบูรพา เป็นผู้ออกรหัสโครงการวิจัย)
โครงการวิจัยเรื่อง : Predictive factors of self-management behaviors among patients with coronary heart disease: A structural equation modeling

Dear Participants ....

I am Wang Yang, a doctoral student in the faculty of nursing, Burapha University, Thailand. Now I'd like to invite you to my research project. Before you agree to participate in the study, I will inform you of the details of the research project:

The purpose of this study was to evaluate the influencing factors of self-management behaviors in patients with coronary heart disease from the perspectives of individual and families.

You are invited to participate in this research. Because you are a sample group of coronary heart disease patients who meets the criteria for this study. It is the most important thing to give this information. This research will collect Data collected from September 2022 to March 2023.

When you participate in the research, what you will need to do is cooperation in answering the questionnaire by answering truthful questions about the family functioning, health literacy, depression, knowledge, self-efficacy, social support, and self-management behaviors, it will takes about 30-40 minutes to answer the questionnaire in total.

Since this research is a survey, the results may not directly benefit you. But the research results can be used to create guidelines for health professionals including nurses working with coronary heart disease patients concerning their disease management without complications and have a good quality of life.

Your participation in this research is voluntary. You have the right to request withdrawal. You can leave this research project at any time without prior notice to the researcher. Which will not affect medical care for you. The information obtained from you will be kept confidential in the file cabinet. The questionnaire will not specify your last name and will be coded instead. Those who have access to the information are researchers and assistants. In addition, research reporting and research dissemination will be a descriptive overview and use information for research purposes only. Upon completion of the research publication, the researcher will destroy the research data within 1 year.

If you have any problems or questions inquiries can be made directly from the researcher on the day of data collection. Or you can inquire about this research anytime at Ms. Wang Yang, telephone number +8615050592195298 or or e-mail is 15050592195@163.com. If the

researcher fails to comply with the provisions of the statement, you can complain to the human research ethics committee of Burapha University in Thailand. The complainant can state the contents of the violation statement by phone (038-102-620) or email (buuethics@buu. ac.th)

Ms. Wang Yang

เอกสารแสดงความยินยอม
ของผู้เข้าร่วมโครงการวิจัย (Consent Form)

รหัสโครงการวิจัย : ....

(สำนักงานคณะกรรมการพิจารณาจริยธรรมในมนุษย์ มหาวิทยาลัยบูรพา เป็นผู้ออกรหัสโครงการวิจัย)

โครงการวิจัยเรื่อง ...Predictive factors of self-management behaviors among patients with coronary heart disease: A structural equation modeling..

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

　　　Before giving my signature below, I have been informed by researcher Ms. Wang Yang about the purposes, method, procedures, benefits, and possible risks associated with participation in this study thoroughly, and I understood all the explanations. I consent voluntarily to participate in this study. I understand that I have the right to withdraw from the study any time, without any affects regarding the quality of services that I will receive from the hospitals.

　　　The researcher Ms. Wang Yang has explained to me that all data and information of the participants will be kept confidential and only be used for this study. I have read and understood the information related to participation in this study clearly and I am signing this consent form.

Signature .... Participant

(...)

Signature ....Witness

(...)

BUU-IRB Approved
11 Aug 2022

APPENDIX C

Questionnaires

Part 1: The Demographic Questionnaire

Direction: Please read questions in part 1 carefully and give an honest answer. Answers to question part 2 will be collected from the medical record by the researcher. Please write "√" in the box of your answer or write your information in the space provided.

Part 1: General information (To be completed by the participant)

1. Gender: ☐ male ☐ female
2. Age …………years …………month
3. Weight………….kg   Height………….cm   BMI………………
4. Education Level:
   ☐ Primary school or below   ☐ Junior high school
   ☐ Senior high school   ☐ College degree or above
5. Marital Status: ☐ Married ☐ Single ☐ Divorced ☐ Widowed
6. Living condition
   ☐ Living alone   ☐ Living with family members or others
7. Average individual income (income/month in RMB)
   ☐ Less than ¥ 3000   ☐ ¥ 3000 - 5,000
   ☐ ¥ 5,000 - 10,000   ☐ More than ¥ 10,000
8. Per capita monthly household income (YUAN) :
   ☐ Less than ¥ 3000   ☐ ¥ 3000 - 5,000
   ☐ ¥ 5,000 - 10,000   ☐ More than ¥ 10,000
9. Types of medical insurance: ☐ resident medical insurance
                                ☐ employee medical insurance
                                ☐ self-pay
10. Assistance required by you from others to carry out daily activities at home
    ☐ None   ☐ Minimal   ☐ Moderate ☐ Maximum
    Relationship with caregiver (if assistance is required) _____

11. Alcohol drinking status

    ☐ Current alcohol drinker

    Duration _____ years   Quantity _____ glass/day

    ☐ Former alcohol drinker

    Duration _____ years   Quantity (in the past) _____ glass/day

    ☐ No history of drinking alcohol

12. Smoking status

    ☐ Current smoker

    Duration _____ years   Quantity _____ cigarettes/day

    ☐ Former smoker

    Duration _____ years   Quantity (in the past)_____ cigarettes/day

    ☐ No history of smoking

Part 2: Disease-related information (To be collected by the researcher from the patient record)

13. Review hospitals: ☐ Yancheng First People's Hospital

                      ☐ Yancheng Third People's Hospital

14. Duration of CHD: _____years

15. Cardiac function grading：

    ☐ Leve I ☐ Level II ☐ Level III ☐ Level IV

16. Number of stent implants:

    ☐ 1 time ☐ 2 times ☐ 3 times ☐ more than 3 times

17. Number of coronary angiography: ☐ 1 time ☐ more than 2 times

18. History of acute myocardial infarction：

    ☐ Yes Area of infarction…_____

    ☐ No

19. Comorbidity: (can select more than 1 answer)

   ☐ None   ☐ Hypertension   ☐ DM ☐ Chronic kidney disease

   ☐ Stroke   ☐ Others, specify _____

20. Family history of coronary heart disease: ☐ Yes ☐ No

21. Frequency of visit to cardio clinic (in l year)

22. Last date of admission to hospital due to CHD (if applicable)

23. Medications (make a list, group of med. Ex. beta blocker, calcium….

    ☐ …… (Dose/frequency/day) _____

    ☐ ………. (Dose/frequency/day) _____

    ☐ ………..(Dose/frequency/day) _____

    ☐ Others ____ (Dose & frequency/day) _____
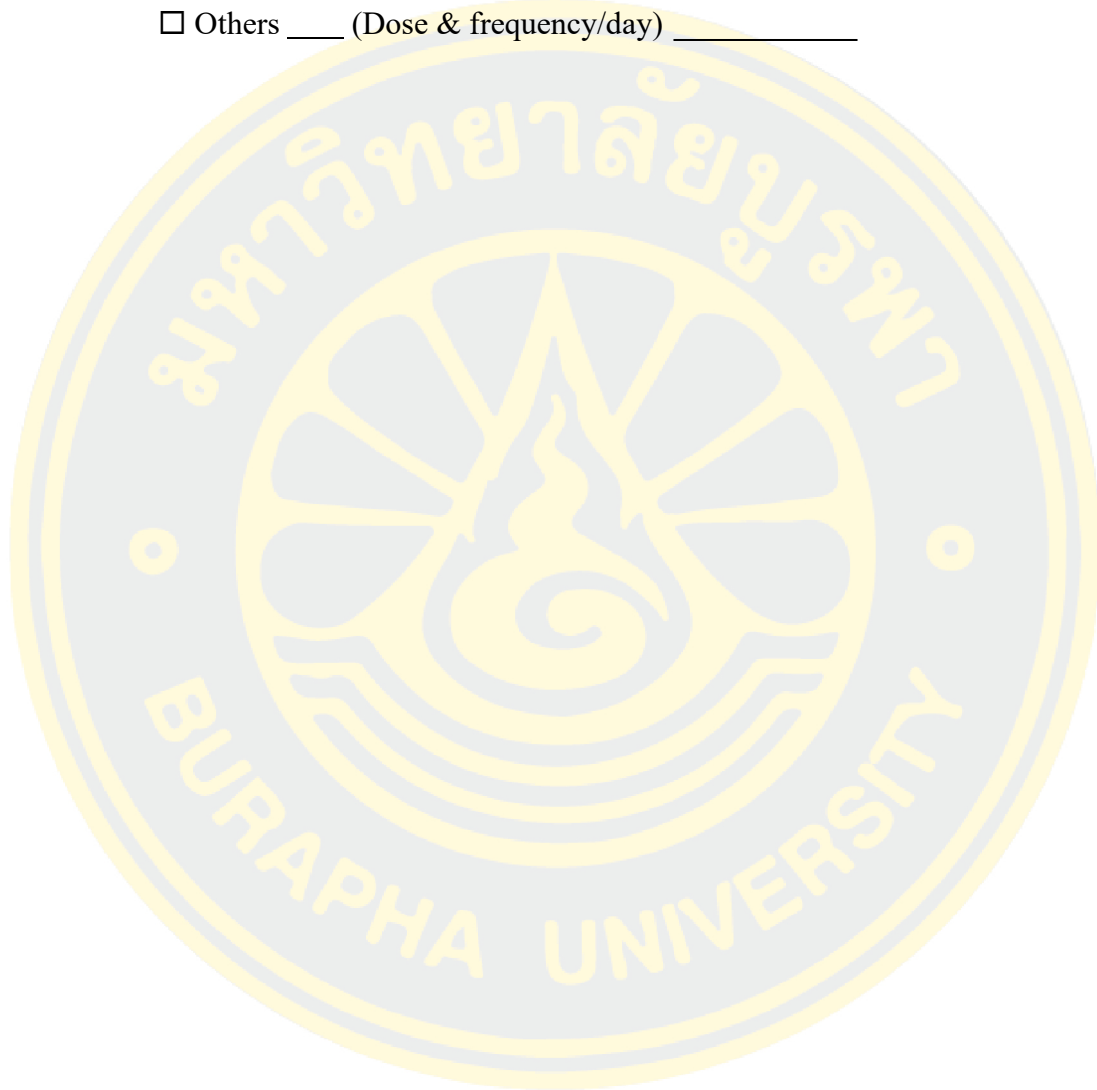
一般资料调查表

1. 性别：□男 □女

2. 年龄（岁）：…………周岁 …………月

3. 体重…………Kg 身高…………cm BMI…………

4. 文化程度：□小学及以下 □初中 □高中 □大专及以上

5. 婚姻状况：□已婚 □未婚 □离异 □丧偶

6. 您的日常居住方式：□独居 □与家人或其他人生活在一起

7. 个人平均收入(收入/月以人民币计算)

  □￥3000以下 □￥3000-5000 □￥5000-10000 □￥10000以上

8. 家庭人均月收入（元）：

  □￥3000以下 □￥3000-5000 □￥5000-10000 □￥10000以上

9. 医保类型：□ 居民医保 □职工医保 □自费

10. 您在家中是否需要他人协助进行日常活动

  □ 没有 □ 很少 □ 经常 □ 总是

  与照顾者的关系(如果需要帮助)

11. 饮酒状态

  □ 目前饮酒

  饮酒时间＿＿ 年 量 ＿＿ 杯/天

  □ 过去饮酒，现已戒酒

  饮酒时间＿＿ 年 量（过去） ＿＿ 杯/天

  □ 从不饮酒

12. 吸烟状态

  □ 目前吸烟

  吸烟时间＿＿ 年 量 ＿＿ 支/天

  □ 过去吸烟，现已戒烟

  吸烟时间＿＿ 年 量（过去） ＿＿ 支/天

  □ 从不吸烟

疾病相关资料表

13.　　　复查就诊医院：□ 盐城市第一人民医院 □盐城市第三人民医院

14.　　　病程：____年

15.　　　心功能分级：□Ⅰ级　　□Ⅱ级　　□Ⅲ级　　□Ⅳ级

16.　　　支架植入个数：□ 1个 □ 2个 □ 3个 □ 3个以上

17.　　　冠脉造影次数：□ 1次 □ 2次以上

18.　　　急性心梗史：□ 有　梗死部位…………… □ 无

19.　　　有无其他慢性慢性病及种类：（可选择多个）

　　　□无　　　□高血压　　□糖尿病　　□慢性肾脏病

　　□中风　□其他，请列出 _____

20.　　　冠心病家族史：□ 有 □ 无

21.　　　心内科门诊就诊次数(1年内)____

22.　　　最近一次因冠心病住院的时间（如果有的话）_____

23.　　　长期服用药物种类（请列出，药物种类。例如倍他乐克、钙通道阻滞

剂）

　　　□ …… (剂量/次/天) _____

　　　□ ………. (剂量/次/天) _____

　　　□ ………..(剂量/次/天) _____

　　□其他 ___ (剂量&次/天) _____

Part 2: The Family APGAR INDEX Questionnaire

Direction: In order to understand your family functioning, your family functioning are related to your disease recovery, please fill in truthfully according to your actual situation. Thank you for your cooperation, and I wish you a speedy recovery!

Items	always	sometimes	hardly
1. I can get satisfactory help from my family when I am in trouble	☐ 2	☐ 1	☐ 0
2. I was satisfied with all the way the family discussed things with me and how they shared them	☐ 2	☐ 1	☐ 0
....			
....			
5. I was happy with the way my family spent time with me	☐ 2	☐ 1	☐ 0

家庭关怀指数问卷

亲爱的朋友，您好！

为了了解您的家庭功能，您的家庭功能与您的疾病恢复有关，请您根据自己的实际情况，如实填写。谢谢您的配合，祝您早日康复！

	经常	有时	几乎不
1. 当我遇到困难时，可以从家人得到满意的帮助	□2	□1	□0
2. 我很满意家人与我讨论各种事情以及分担问题的方式	□2	□1	□0
....			
....			
5. 我很满意家人与我共度时光的方式	□2	□1	□0

Part 3: The Chew's set of Brief Screening Questions

The Chew's set of Brief Screening Questions

Direction:

This scale is to understand how you access and understand health information and use it to maintain and promote your own health. This table anonymously answers, the answer is no right or wrong, the results are only academic research, and will be strictly confidential for you.

Please judge on your reality and call "√" in the appropriate options box.

Items	never	once in a while	sometimes	often	always
1. How often do you have someone (like a family member, friend, hospital/clinic worker or caregiver) help you read hospital materials?	□0	□1	□2	□3	□4
....					
3.How often do you have problems learning about your medical condition because of difficulty understanding written information?	□0	□1	□2	□3	□4

简短的健康素养筛查

尊敬的先生/女士：

您好！本量表是想了解您获取和理解健康信息，并运用这些信息维护和促进自身健康的情况。本表匿名回答，答案没有对错之分，其结果只做学术研究，且会严格为您保密。

请根据您的实际情况进行判断，并在相应的选项框内打"√"。

条目	从不	偶尔	有时	经常	总是
1.你有多少人帮你阅读医院材料	□0	□1	□2	□3	□4
……………………………					
3.你有多少时间因为理解困难而无法了解你的病情书面信息	□0	□1	□2	□3	□4

Part 4: The Self-rating depression scale (SDS)

Direction: There are 20 questions in this section. Please read each of the four options in each entry indicate, then please mark " √ " in the appropriate square based on your actual feel in the last week.

A little of the time   refers to   No more than one day in the past week

Some of the time   refers to   1 to 2 days in the past week

Good part of the time   refers to   3 to 4 days

Most or all of the time   refers to   5 to 7 days in the past week

Items	A little of the time (1)	Some of the time (2)	Good part of the time (3)	Most of the time (4)
1. I feel down-hearted and blue	□1	□2	□3	□4
2. Morning is when I feel the best	□4	□3	□2	□1
....				
....				
....				
....				
....				
19. I feel that others would be better off if I were dead	□1	□2	□3	□4
20 I still enjoy the things I used to do	□4	□3	□2	□1

Zung氏抑郁自评量表

指导语：下面有 20 条题目，请仔细阅读每一条请根据您最近一周的实际感觉，在适当的方格里划"√"。

每个条目中的四个选项分别表示：没有或很少时间（过去一周内，出现这类情况的日子不超过一天）；小部分时间（过去一周内，有 1～2 天有过这类情况）；相当多时间（过去一周内，3～4 天有过这类情况）；绝大部分或全部时间（过去一周内，有 5～7 天有过这类情况）。

条目	没有或很少时间	小部分时间	相当多时间	绝大部分或全部时间
1.我觉得闷闷不乐，情绪低沉	□1	□2	□3	□4
2.我觉得一天之中早晨最好	□4	□3	□2	□1
…………………………………				
…………………………………				
…………………………………				
…………………………………				
…………………………………				
19.我认为如果我死了别人会生活的更好些	□1	□2	□3	□4
20.平常感兴趣的事我仍然照样感兴趣	□4	□3	□2	□1

Part 5: The Chinese version of coronary heart disease knowledge questionnaires

Direction: This section asking about your understanding of the coronary heart disease. Please read each item carefully, then select the answer whether you agree, disagree, or unsure about that item. Then, please write "√" in the box that matched with your choice.

Items	Agree	Disagree	Unsure
1.The heart needs a blood supply, and the blood vessels that supply the heart are the coronary artery			
2. Coronary artery stenosis, spasticity, reduce the blood flow, cannot meet the needs of the heart, leading to angina attack.			
....			
....			
....			
....			
....			
....			
51. After discharge, I need to see my doctor regularly to understand the progress of my recovery.			
52. If I have frequent chest pain attacks, or increased intensity, or prolonged duration, or radiation elsewhere, shortness of breath, especially at rest with a blind halo, irregular heartbeat, etc., I need to see a doctor immediately.			

冠心病相关知识问卷·

指导语： 本节询问您对冠心病的了解。 请仔细阅读每一项，然后选择你是否同意、不同意或不确定的答案。 然后，请在与你的选择相匹配的方框里打"√"。

条目	同意	不同意	不知道
1. 心脏需要血液供应，供应心脏血液的血管是冠状动脉。··			
2. 冠状动脉狭窄、痉挛，使血流量减少，不能满足心脏的需要，导致心绞痛发作。··			
…………………………………			
…………………………………			
…………………………………			
…………………………………			
…………………………………			
…………………………………			
51. 出院后，我需要定期看医生，了解我康复的进展。··			
52. 如果我胸痛发作频繁、或强度加剧、或持续时间延长、或者放射到其他部位，气短，尤其是在休息时出现瞎晕、不规则的心跳等，我需要马上看医生。			

Part 6: The Self-efficacy for Chronic Disease 6-item Scale (SECD 6)

Direction: We want to know how confident you are in conducting certain activities. For the following questions, please draw " √ " on the consistent numbers based on your current situation, each number indicates that your recent confidence in solving these problems **"1" represents "no confidence" and "10" represents "very confidence".**

1. How confident do you feel that you can keep the fatigue caused by your disease from interfering with the things you want to do?

no confidence 1 2 3 4 5 6 7 8 9 10 very confidence

2. How confident do you feel that you can keep the physical discomfort or pain of your disease from interfering with the things you want to do?

no confidence 1 2 3 4 5 6 7 8 9 10 very confidence

3. ……………………………………………………………

4. ……………………………………………………………

5. How confident do you feel that you can the different tasks and activities needed to manage your health condition so as to reduce your need to see a doctor?

no confidence 1 2 3 4 5 6 7 8 9 10 very confidence

6. How confident do you feel that you can do things other than just taking medication to reduce how much your illness affects your everyday life?

no confidence 1 2 3 4 5 6 7 8 9 10 very confidence

慢性病自我效能量表

指导语：我们想知道您对进行某些活动有多大信心。针对以下问题，请根据您现在的实际情况，在相符的数字上划"√"，各数字表示您最近在解决这些问题的自信程度"1"代表**"毫无自信"**，"10"代表**"非常自信"**。

1．您有多大信心控制疾病引起的疲劳，使其不会妨碍您想做的事？

毫无自信 1　　2　　3　　4　　5　　6　　7　　8　　9　　10　非常自信

2．您有多大信心控制疾病引起的身体不适或疼痛，使其不会妨碍您想做的事？

毫无自信 1　　2　　3　　4　　5　　6　　7　　8　　9　　10　非常自信

3．……………………………………………………………

4．……………………………………………………………

5．为了减少看医生的必要，您有多大信心采取各种措施来改善您的健康状况？

毫无自信 1　　2　　3　　4　　5　　6　　7　　8　　9　　10　非常自信

6．您有多大信心做其他事情，不单是吃药，来减轻疾病对您日常生活的影响？

毫无自信 1　　2　　3　　4　　5　　6　　7　　8　　9　　10　非常自信

Part 7: The Social Support Rating Scale (SSRS)

Direction: The following questions are used to reflect your support in the society. Please follow the specific requirements of each question and write according to your actual situation. Thank you for your cooperation.

1. How many close friends do you have that you can get support and help? (choose only one option)

   ☐ none

   ☐ 1-2

   ☐ 3-5

   ☐ 6 or more

2. …………………………………………………………

3. …………………………………………………………

4. …………………………………………………………

5. Support and care from family members (row "√") in the appropriate box

	None	A little	moderate	Totally support
A. Couples (lovers)	☐	☐	☐	☐
B. Parents	☐	☐	☐	☐
C. Sons and daughters	☐	☐	☐	☐
D. Brothers and sisters	☐	☐	☐	☐
E. Other members (such as their sister-in-law)	☐	☐	☐	☐

6. In the past, you have received financial support and practical help in emergency situations from the following sources:

(1) Without any source

(2) The following sources: <u>please mark "√" Infront of the letter , you can select multiple options</u>

A Spouse;   B Other family members;   C Relatives;

D Colleagues;   E Work unit;

F Official or semi-official organizations such as caucus union;

G Unofficial organizations such as religious and social organizations;

H Others (please list)

7. …………………………………………………………

8. How you talk in trouble: (choose only one answer)

☐ Never lawsuit to anyone

☐ Only to extremely close relationship 1-2 personal litigation

☐ If a friend voluntarily ask you will say

☐ Actively litigation their own troubles to gain support and understanding of

9. …………………………………………………………

10. For organizations (such as Party organizations, religious organizations, trade unions, student unions, etc.), you: (choose only one answer)

☐ Never attends

☐ Occasionally attends

☐ Frequently attends

☐ Actively participates and actively events

社会支持评定量表

指导语：下面的问题用于反映您在社会中所获得的支持，请按各个问题的具体要求，根据您的实际情况写，谢谢您的合作。

1、　　　您有多少关系密切，可以得到支持和帮助的朋友？（只选一项）

　　　□ 一个也没有·

　　　□ 1—2 个·

　　　□ 3—5 个·

　　　□ 6 个或 6 个以上

2. ……………………………………………………………

3. ……………………………………………………………

4. ……………………………………………………………

5、从家庭成员得到的支持和照顾（在合适的框内划"√"）

	无	极少	一般	全力支持
A、夫妻（恋人）	□	□	□	□
B、父母	□	□	□	□
C、儿女	□	□	□	□
D、兄弟姐妹	□	□	□	□
E、其他成员（如嫂子）	□	□	□	□

6、过去，在您遇到急难情况时，曾经得到的经济支持和解决实际问题的帮助的来源有：·

　（1）无任何来源

·（2）下列来源（可选多项）

　　　A、配偶；B、其他家人；C、亲戚；D、同事；E、工作单位；F、党团工会等官方或半官方组织；G、宗教、社会团体等非官方组织；H、其它（请列出）＿＿·

7. ……………………………………………………………

8、您遇到烦恼时的倾诉方式：（只选一项）

　　□ 从不向任何人诉讼

□ 只向关系极为密切的 1–2 个人诉讼

□ 如果朋友主动询问您会说出来·

□ 主动诉讼自己的烦恼，以获得支持和理解·

9. ……………………………………………………………

10、对于团体（如党组织、宗教组织、工会、学生会等）组织活动，您：（只选一项）

□ 从不参加·

□ 偶尔参加·

□ 经常参加·

□ 主动参加并积极活动

Part 8: The Chinese version of coronary artery disease self-management Scale (CSMS)

Direction: The following 27 questions are divided into 3 dimensions, and each question has 5 answers at the end of it. The answers range from 1 to 5. Please choose an answer at the end of each sentence according to your actual situation.

1.Your dietary salt intake in the past three months?

(3-5g daily sodium salt according to CHD dietary requirements)

         ☐ 1 score sodium per month >210g

         ☐ 2 score sodium per month 180-210g

         ☐ 3 score sodium 150-179g per month

         ☐ 4 score sodium per month 120-149g

         ☐ 5 score sodium per month <120g

2. How much fat and cholesterol did you eat in the past week?

(Recommended dietary evaluation table of the 2007 guidelines for the prevention and control of Chinese adult dyslipidemia was used)

Items	Score
1. Whether you eat meat for nearly a week is <75g/d: 0 = no, 1 = yes	☐
2. What kind of meat you eat: 0= lean meat, 1 = streaky pork, 2 = fat meat, 3 = viscera	☐
3. The number of eggs you eat in the past 1 week : 1 = 0~3/week, 2 = 4~7/week, 3 = more than 7	☐
3. The number of fried foods you have eaten in the past week (fried cakes, fried dough sticks, etc.): 0 = never, 1 = 1-4 times/week, 2=5-7 times/week, 3 = more than 7times	☐
4. How often you eat a cream pastry in nearly one week: 0 = never, 1 = 1~4 times/week, 2 = 5~7 times/week	☐
Total score	☐☐

Note: Fill in the number "0 , 1, 2 or 3" according to actual situation.

(According to the CSMS scoring requirements, the fat and cholesterol dietary assessment form scores were converted into:

☐ 1 score Dietary evaluation table scored> 6 points

☐ 2 score Dietary evaluation table scored 4-5points

☐ 3 score Dietary evaluation table scored 3points

☐ 4 score Dietary evaluation table scored 2points

☐ 5 score Dietary evaluation table scored 2 points)

3.   …………………………………………………………

4.   …………………………………………………………

5.   …………………………………………………………

6.   …………………………………………………………

7.   …………………………………………………………

8.   …………………………………………………………

9.   …………………………………………………………

10.Have you been able to monitor your pulse rate and heart rate regularly for the past 3 months?

☐ Never   ☐Almost ☐ Sometimes ☐ Often ☐ Always

11.   ……………………………………………………….

12.   ………………………………………………………….

13.   …………………………………………………………………

14.   …………………………………………………………………

15.   …………………………………………………………………

16.   …………………………………………………………………

17.   …………………………………………………………………

18.   …………………………………………………………………

19.   …………………………………………………………………

20.   …………………………………………………………………

21.   …………………………………………………………………

22.   …………………………………………………………………

23.In the past three months, when you were nervous and excited, could you use self-relaxation techniques?

☐ Never ☐ Almost ☐ Sometimes ☐ Often ☐ Always

24.   …………………………………………………………

25.   …………………………………………………………

26.   …………………………………………………………

27.Have you been vaccinated against influenza and pneumonia in the past two years?

Vaccination against influenza （0） （1） （2） （3） （4） （5） （6） times

Vaccination against pneumonia （0） （1） （2） times

(Scoring method: influenza vaccination: 0 = 0 points, 1 ~ 2 times = 1 point, 3 ~ 4 times = 2 points, 5 ~ 6 times = 3 points; Vaccination against pneumonia: 0 = 0 points, 1 ~ = 2 points; The two vaccine scores are added to the item score.)

冠心病自我管理行为量表

指导语：以下 27 个问题，共分为 3 个维度，每一个问题后面各有 5 个答案，5 个答案中从 1 分到 5 分，请你根据自己的实际情况在每句后面选择一个答案。

1. 过去三个月内，您饮食盐份的摄入情况？

    （根据冠心病饮食要求每日钠盐 3-5g）
- □ 1 分 每月钠盐 >210g
- □ 2 分 每月钠盐 180-210g
- □ 3 分 每月钠盐 150-179g
- □ 4 分 每月钠盐 120-149g
- □ 5 分 每月钠盐 <120g

2. 过去一周内，您饮食中脂肪和胆固醇摄入情况？

（采用 2007 年中国成人血脂异常防治指南推荐膳食评价表）

项　　目	评分
1．您近 1 周吃肉是否<75g/d：　0＝否，1＝是	□
2．您吃肉种类：0＝瘦肉，1＝肥瘦肉，2＝肥肉，3＝内脏	□
3．您近 1 周吃蛋数量：1＝0-3 个/周，2＝4-7 个/周，　3＝7 个以上/周	□
4．您近 1 周吃煎炸食品数量(油饼、油条炸糕等)：0＝未吃，　1＝1-4 次/周，2＝5-7 次/周，3＝7 次以上/周	□
5．您近 1 周吃奶油糕点的次数:0＝未吃，　1＝1-4 次/周，2＝5-7 次/周	□
评分总和	□□

    注：按实际情况在□里填数 "0 或 1"
    （根据 CSMS 评分要求将脂肪和胆固醇膳食评价表得分转化为：
- □ 1 分 膳食评价表得分>6 分
- □ 2 分 膳食评价表得分 4-5 分
- □ 3 分 膳食评价表得分 3 分
- □ 4 分 膳食评价表得分 2 分
- □ 5 分 膳食评价表得分 1 分）

3. ……………………………………………………………
4. ……………………………………………………………
5. ……………………………………………………………
6. ……………………………………………………………
7. ……………………………………………………………
8. ……………………………………………………………

9.   ………………………………………………………
10.   过去三个月中，您是否能自己定期监测脉率和心率？
　　　□从来不　　　□几乎不　　　□有时　　　□经常　　　□总是

11.   ………………………………………………………
12.   ………………………………………………………
13.   ………………………………………………………
14.   ………………………………………………………
15.   ………………………………………………………
16.   ………………………………………………………
17.   ………………………………………………………
18.   ………………………………………………………
19.   ………………………………………………………
20.   ………………………………………………………
21.   ………………………………………………………
22.   ………………………………………………………
23.   过去三个月中，当您紧张、激动时，能采用自我放松的技巧吗？
　　　□从来不　　　□几乎不　　　□有时　　　□经常　　　□总是

24.   ………………………………………………………
25.   ………………………………………………………
26.   ………………………………………………………
27.   过去两年中，您是否接种过免疫接种流感和肺炎疫苗？
　　　接种流感疫苗（0）（1）（2）（3）（4）（5）（6）次
　　　接种肺炎疫苗（0）（1）（2）次
　　　（记分方法：接种流感疫苗：0＝0 分，1～2 次＝1 分，3～4 次＝2 分，5～6次＝3 分;接种肺炎疫苗：0＝0 分，1 次～＝2 分;两种疫苗分值相加为该条目得分。）

APPENDIX D

Permission instruments

家庭功能量表的使用申请 （Permission request of using the instrument）　15050592195@163.com

G guyuan49　2022-12-14 16:02
发至 Yummy (Yang Wang) 王*

Hi, Wang Yang. Thanks for contacting with me. You have my permission to use this scale. Good luck with the project of your research.

收起引用 ∧

-------------- 原始邮件 --------------

发件人： "Yummy (Yang Wang) 王*" <15050592195@163.com>;
发送时间： 2022年12月14日(星期四) 下午3:57
收件人： "LMN"<943364622@qq.com>;
主题： 家庭功能量表的使用申请 （Permission request of using the instrument）

To Dr. Gu：

Firstly, let me introduce myself. I am Wang Yang, I work at Jiangsu vocational college of medicine, Yancheng, Jiangsu province, China. Now I am a Ph.D. in candidate (My code 62810075) in philosophy in Nursing science (International Program) at Faculty of nursing of Burapha university, Thailand. My topic of dissertation is "Predictive factors of self-management behaviors among patients with coronary heart disease: A structural equation modeling" and its design is a model testing design, with the objective of the project is to examine the factors effecting the coronary heart disease patients' self-management behaviors. Your tool is very good and important to my project.

Therefore, I would like to kindly request the assistance of you to let me use your tool (The Family APGAR Index) and provide information on this project. Your cooperation would be most appreciated and would greatly benefit for coronary heart disease patients to develop their self-management behaviors.

Thank you for your kind consideration of my request and I look forward to get your permission document from you soon.

Yours sincerely

Wang Yang

Re: Permission request of using the instrument

15050592195@163.com

Dr. Sarah Mantwill 2022-12-16 18:13
发至 m15050592195_2

详情

Dear Wang Yang,
You have my permission to use the Chew 's Set of Brief Screening Question in your research. I hope your research goes well.

---Original---

From: "m15050592195_2"<15050592195@163.com>
Date: Sat, Dec 16, 2022 17:10 PM
To: "Dr. Sarah Mantwill"<745037383@qq.com>;
Subject: Permission request of using the instrument

To Dr. Sarah Mantwill:

Firstly, let me introduce myself. I am Wang Yang, I work at Jiangsu vocational college of medicine, Yancheng, Jiangsu province, China. Now I am a Ph.D. in candidate (My code 62810075) in philosophy in Nursing science (International Program) at Faculty of nursing of Burapha university, Thailand. My topic of dissertation is "Predictive factors of self-management behaviors among patients with coronary heart disease: A structural equation modeling" and its design is a model testing design, with the objective of the project is to examine the factors effecting the coronary heart disease patients' self-management behaviors. Your tool is very good and important to my project.

Therefore, I would like to kindly request the assistance of you to let me use your tool (the Chew's Set of Brief Screening Questions in simplified Chinese) and provide information on this project. Your cooperation would be most appreciated and would greatly benefit for coronary heart disease patients to develop their self-management behaviors.

Thank you for your kind consideration of my request and I look forward to get your permission document from you soon.

Yours sincerely

Wang Yang

回复：抑郁自评量表工具的使用申请 （Permission request of using the instrument）

15050592195@163.com

15996825387 2022-09-12 19:39
发至 Yummy (Yang Wang) 王*

详情

好的，可以使用

---原始邮件---

发件人: "Yummy (Yang Wang) 王*" <15050592195@163.com>
发送时间: 2022年9月12日(周五) 晚上7:37
收件人: "15996825387" <15996825387@qq.com>;
主题: 抑郁自评量表工具的使用申请 （Permission request of using the instrument）

尊敬的教授：

教授，您好！我是王洋，目前就职于江苏医药职业学院，是一名护理学专业教师。现为泰国东方大学在读博士，正在进行的课题研究名称是《冠心病患者的自我管理行为影响因素的分析：结构方程模型》，需要使用您研发的抑郁自评量表（SDS）进行问卷调查。恳请获得您的批准！期待收到您的回信，谢谢！

泰国东方大学

Burapha university

王洋（Wang Yang）

回复：冠心病知识问卷量表的使用申请 （Permission request of using the instrument）

15050592195@163.com

meilianx2 2022-12-16 17:10
发至 m15050592195_2

Hi,
You can use this scale——good luck with your research!

---原始邮件---

发件人："m15050592195_2"<15050592195@163.com>
发送时间：2022年12月14日(周四) 下午5:41
收件人："Dr Xiao Meilian"<236727209@qq.com>；
主题：冠心病知识问卷量表的使用申请 （Permission request of using the instrument）

To Dr. Xiao Meilian:

   Firstly, let me introduce myself. I am Wang Yang, I work at Jiangsu vocational college of medicine, Yancheng, Jiangsu province, China. Now I am a Ph.D. in candidate (My code 62810075) in philosophy in Nursing science (International Program) at Faculty of nursing of Burapha university, Thailand. My topic of dissertation is "Predictive factors of self-management behaviors among patients with coronary heart disease: A structural equation modeling" and its design is a model testing design, with the objective of the project is to examine the factors effecting the coronary heart disease patients' self-management behaviors. Your tool is very good and important to my project.

   Therefore, I would like to kindly request the assistance of you to let me use your tool the coronary heart disease knowledge questionnaire and provide information on this project. Your cooperation would be most appreciated and would greatly benefit for coronary heart disease patients to develop their self-management behaviors.

   Thank you for your kind consideration of my request and I look forward to get your permission document from you soon.

                    Yours sincerely

                    Wang Yang

回复：慢性病自我效能量表工具的使用申请 (Permission request of using the instrument)

15050592195@163.com

傅东波 2022-09-12 21:43
发至 m15050592195_2

详情

You have permission to use the questionnaire for your research.

---------- 原始邮件 ----------

发件人："m15050592195_2" <15050592195@163.com>;
发送时间：2022年08月18日(星期一) 下午2:35
收件人："沧羽微蓝" <1282642504@qq.com>;
主题：慢性病自我效能量表工具的使用申请 (Permission request of using the instrument)

To Dr. Fu:

Firstly, let me introduce myself. I am Wang Yang, I work at Jiangsu vocational college of medicine, Yancheng, Jiangsu province, China. Now I am a Ph.D. in candidate (My code 62810075) in philosophy in Nursing science (International Program) at Faculty of nursing of Burapha university, Thailand. My topic of dissertation is "Predictive factors of self-management behaviors among patients with coronary heart disease: A structural equation modeling" and its design is a model testing design, with the objective of the project is to examine the factors effecting the coronary heart disease patients' self-management behaviors. Your tool is very good and important to my project.

Therefore, I would like to kindly request the assistance of you to let me use your tool the Self-efficacy for Chronic Disease 6-item Scale (SECD6) and provide information on this project. Your cooperation would be most appreciated and would greatly benefit for coronary heart disease patients to develop their self-management behaviors.

Thank you for your kind consideration of my request and I look forward to get your permission document from you soon.

Yours sincerely

Wang Yang

社会支持量表工具的使用申请 （Permission request of using the instrument）

15050592195@163.com

xiaosy 2022-09-02 12:17
发至 15050592195

详情

可以的

xiaosy@csu.edu.cn

邮箱：xiaosy@csu.edu.cn

收起引用 ∧

---- 回复的原邮件 ----

发件人	Yummy (Yang Wang) 王*<15050592195@163.com>
日期	2022年09月01日 00:34
收件人	xiaosy@csu.edu.cn
主题	社会支持量表工具的使用申请 （Permission request of using the instrument）

尊敬的肖水源教授：

肖教授，您好！我是王洋，目前就职于江苏医药职业学院，是一名护理学专业教师。现为泰国东方大学在读博士，正在进行的课题研究名称是《冠心病患者的自我管理行为影响因素的分析：结构方程模型》，需要使用您研发的社会支持量表（SSRS）进行问卷调查。恳请获得您的批准！期待收到您的回信，谢谢！

泰国东方大学

Burapha university

王洋（Wang Yang）

Dr Ren Hongyan 2022-12-21 20:09
发至 m15050592195_2

详情

Dear Wang Yang,
You have permission to use the the Coronary artery disease Self-management Scale (CSMS). Good luck with your project!

收起引用 ∧

---- 回复的原邮件 ----

发件人	m15050592195_2<15050592195@163.com>
发送日期	2022年12月14日 17:23
收件人	Dr Ren Hongyan<liuhong199106@163.com>
主题	冠心病患者自我管理量表工具的使用申请 (Permission request of using the instrument)

To Dr. Ren Hongyan:
Firstly, let me introduce myself. I am Wang Yang, I work at Jiangsu vocational college of medicine, Yancheng, Jiangsu province, China. Now I am a Ph.D. in candidate (My code 62810075) in philosophy in Nursing science (International Program) at Faculty of nursing of Burapha university, Thailand. My topic of dissertation is
 "Predictive factors of self-management behaviors among patients with coronary heart disease: A structural equation modeling" and its design is a model testing design, with the objective of the project is to examine the factors effecting the coronary heart disease patients' self-management behaviors. Your tool is very good and important to my project.
Therefore, I would like to kindly request the assistance of you to let me use your tool The Coronary artery disease Self-management Scale (CSMS) and provide information on this project. Your cooperation would be most appreciated and would greatly benefit for coronary heart disease patients to develop their self-management behaviors.

Thank you for your kind consideration of my request and I look forward to get your permission document from you soon.

APPENDIX E

Evaluation of assumptions

Table Appendix E-1 Standardized score of continuous variables for testing univariate outliers ($n = 352$)

ID	ZFF	ZHL	ZDep	ZKno	ZSE	ZSS	ZSM
1	-1.52902	-2.02905	0.162617	-2.04298	-1.23343	-2.13906	-1.62714
2	-0.61833	1.052462	-0.88768	1.375523	0.237493	-0.84657	1.563928
3	0.747693	1.394853	-1.01897	0.650386	2.03529	-0.27212	0.873967
4	1.203036	0.02529	-0.62511	0.443204	0.155775	1.020366	0.960212
5	0.292351	1.052462	1.738064	0.028841	-2.21405	0.589536	1.995153
6	-1.07368	0.02529	-0.09996	-1.00707	2.117008	0.589536	0.701476
7	0.747693	0.367681	-1.28154	-0.07475	0.237493	1.020366	0.011516
8	-1.07368	-1.00188	0.162617	-1.62861	-0.74312	-1.42101	-1.28216
9	0.747693	0.02529	-0.49382	-1.00707	-0.25282	1.020366	0.960212
10	-0.61833	-0.65949	-0.62511	-0.79989	-0.74312	-0.55935	-0.33346
11	-0.61833	-0.65949	-0.09996	0.339614	-0.25282	-0.70296	0.442741
12	1.203036	0.367681	-0.09996	0.236023	1.6267	0.302316	2.081398
13	0.747693	-0.3171	-0.23124	-1.11066	-0.74312	-0.70296	-1.02343
14	-0.61833	-0.65949	-0.75639	-0.59271	-0.25282	-0.41574	0.442741
15	1.203036	1.052462	-1.28154	0.339614	0.727801	1.307587	1.132702
16	1.203036	-0.3171	1.081628	1.893478	1.21811	-0.70296	0.960212
17	1.203036	-0.3171	-1.01897	0.546795	0.727801	1.020366	1.650173
18	-0.16299	-2.02905	-0.62511	-1.31784	-0.74312	-0.55935	-1.71339
19	-1.07368	-0.65949	-1.01897	-0.59271	-0.25282	-0.41574	0.356496
20	-0.16299	-0.65949	-0.36253	-0.48911	-0.25282	-1.42101	-0.76469
21	-1.07368	-0.65949	2.657075	-1.42143	-1.23343	-0.99018	-1.79963
22	-1.52902	-0.65949	0.162617	-1.11066	-0.74312	-0.27212	-1.62714
23	1.203036	0.02529	-0.62511	-0.07475	-0.74312	-1.2774	-1.10967
24	1.203036	0.02529	-0.88768	0.132432	-0.25282	-0.41574	-0.16097
25	1.203036	0.710072	-0.62511	0.236023	0.727801	-0.55935	0.356496
26	-0.61833	0.367681	-0.75639	-0.38552	2.198726	-2.13906	-1.02343
27	1.203036	0.710072	-1.15026	0.028841	0.727801	0.733146	0.615231
28	-1.52902	-0.65949	0.162617	-1.62861	-0.25282	-0.55935	-2.05837
29	1.203036	-1.00188	-0.75639	-1.93939	-0.74312	0.302316	-0.5922
30	1.203036	1.394853	0.425192	0.443204	-0.1711	0.876756	0.873967
31	0.747693	0.02529	-1.28154	-0.17834	0.237493	-0.27212	0.442741
32	1.203036	1.052462	-0.75639	0.753977	2.198726	2.312858	2.340133
33	-0.16299	-1.00188	1.212915	-1.62861	-0.74312	-0.70296	-0.67845
34	-0.16299	-1.68666	2.131926	-3.07889	-2.21405	-1.13379	-1.02343
35	1.203036	0.710072	-1.28154	1.06475	1.871854	1.882027	1.218947
36	0.747693	1.737243	-1.01897	-0.28193	0.237493	1.451197	-0.16097
37	-1.52902	-0.3171	1.344202	0.546795	-0.74312	-1.56462	-0.5922
38	0.292351	-2.02905	-0.75639	0.857568	-0.74312	0.158706	-0.93718
39	0.747693	-0.65949	-0.88768	0.857568	-0.25282	-0.70296	-1.62714

Table Appendix E-1 (Continued)

ID	ZFF	ZHL	ZDep	ZKno	ZSE	ZSS	ZSM
40	0.747693	-0.3171	-0.62511	0.857568	0.727801	-0.55935	-0.33346
41	0.292351	0.710072	-0.09996	1.06475	2.03529	0.158706	-0.67845
42	0.747693	0.367681	-0.75639	1.06475	-0.08938	0.302316	-0.50595
43	0.292351	1.052462	0.556479	1.375523	0.646083	-0.12851	1.046457
44	0.747693	0.710072	0.03133	0.857568	0.809519	0.158706	0.873967
45	-0.61833	1.052462	0.425192	1.06475	0.564365	0.302316	0.787722
46	-0.16299	-1.00188	-0.09996	1.06475	-0.66141	-0.84657	-1.45465
47	1.203036	1.394853	-0.62511	1.893478	1.21811	1.020366	0.528986
48	1.203036	1.394853	-1.28154	0.857568	1.21811	1.451197	0.787722
49	1.203036	1.052462	-0.36253	1.06475	0.891238	1.307587	-0.16097
50	0.747693	1.394853	-1.41283	1.06475	0.646083	0.015095	0.442741
51	1.203036	-0.65949	-1.28154	1.06475	0.727801	-0.41574	0.184006
52	1.203036	0.710072	-0.23124	0.857568	0.972956	-0.55935	-0.67845
53	-0.16299	-0.65949	-1.01897	0.546795	0.727801	-0.27212	-1.19592
54	0.292351	1.052462	-1.01897	0.236023	2.198726	0.733146	1.046457
55	-1.07368	0.02529	-0.62511	0.236023	1.21811	-0.41574	0.701476
56	0.747693	0.710072	-0.36253	0.236023	0.727801	-0.27212	0.097761
57	1.203036	0.710072	-0.88768	0.236023	0.237493	0.302316	0.615231
58	1.203036	1.052462	-1.28154	0.857568	0.237493	1.020366	0.184006
59	1.203036	1.052462	-1.15026	0.236023	0.727801	-0.55935	0.184006
60	0.292351	1.052462	-0.49382	1.06475	1.463264	1.020366	1.305192
61	0.747693	0.367681	-0.62511	1.375523	0.237493	1.882027	1.046457
62	0.747693	0.367681	-0.75639	0.236023	0.237493	0.876756	0.528986
63	-1.07368	-1.34427	-1.01897	-1.11066	-1.5603	-0.41574	-0.50595
64	-1.52902	-1.00188	-0.75639	0.236023	0.727801	-0.70296	-0.93718
65	1.203036	0.710072	1.606777	0.857568	1.463264	0.015095	-0.5922
66	1.203036	0.367681	-0.49382	0.546795	0.891238	1.451197	0.960212
67	-0.16299	-1.00188	-0.75639	0.546795	-0.25282	-0.70296	-0.24722
68	-1.52902	-1.68666	1.869351	-1.8358	-0.98828	-1.2774	-0.93718
69	-1.07368	0.367681	1.344202	0.236023	-0.49797	-2.28267	-0.67845
70	-0.16299	0.02529	-1.28154	0.857568	1.21811	-0.41574	-0.07473
71	-1.98436	-1.68666	1.869351	-1.31784	-1.07	-1.70823	-1.10967
72	0.747693	1.052462	-1.01897	0.650386	0.319211	1.020366	0.787722
73	-0.61833	-0.65949	1.081628	-0.17834	-0.82484	0.015095	-0.07473
74	0.292351	0.710072	-0.09996	0.546795	-0.1711	0.302316	0.442741
75	0.747693	1.394853	-0.36253	0.857568	0.319211	1.020366	0.701476
76	-1.07368	-0.65949	0.162617	-0.38552	-1.15171	-0.55935	-0.93718
77	-0.16299	0.710072	-0.23124	0.753977	-0.1711	-0.27212	0.615231
78	-1.52902	-1.34427	1.606777	-0.48911	-1.23343	-1.56462	-0.5922
79	-1.07368	-2.02905	1.081628	-0.6963	-0.90656	-0.41574	-0.24722
80	0.747693	1.052462	-1.15026	1.168341	0.482647	1.738417	0.960212

Table Appendix D-1 (Continued)

ID	ZFF	ZHL	ZDep	ZKno	ZSE	ZSS	ZSM
81	-1.98436	-2.02905	2.3945	-2.14657	-1.80546	-2.13906	-1.19592
82	-0.16299	0.02529	1.212915	-0.07475	-0.25282	0.589536	0.701476
83	-1.07368	-0.65949	0.950341	0.028841	0.155775	-0.41574	-0.07473
84	-0.61833	-0.3171	1.344202	-0.38552	-1.23343	-1.56462	-1.28216
85	0.747693	1.737243	0.556479	1.06475	-0.74312	1.020366	0.097761
86	-0.61833	0.710072	0.293904	0.546795	-1.23343	-0.27212	-1.10967
87	-1.07368	-0.65949	0.950341	-0.17834	-1.15171	-0.12851	-0.85094
88	0.747693	1.052462	-0.88768	1.168341	0.564365	1.163977	0.787722
89	-0.16299	-1.00188	0.162617	-0.17834	-0.25282	-0.27212	0.011516
90	-0.61833	0.367681	0.425192	0.443204	0.319211	0.015095	0.442741
91	-0.16299	1.394853	-0.09996	0.753977	0.400929	-0.12851	0.615231
92	-0.61833	0.710072	0.03133	0.546795	0.155775	-0.55935	0.528986
93	0.747693	1.737243	-0.36253	0.961159	0.972956	1.594807	1.477682
94	-1.52902	-1.00188	1.081628	-0.59271	-1.15171	-1.42101	-0.41971
95	-1.52902	-2.02905	2.657075	-2.25016	-2.13233	-2.13906	-1.97212
96	-0.61833	-0.65949	0.162617	-0.38552	-0.1711	-0.55935	0.011516
97	0.747693	1.052462	-0.36253	0.961159	0.809519	1.020366	1.218947
98	0.292351	1.394853	-0.49382	1.168341	0.891238	1.451197	2.253888
99	0.747693	1.737243	-1.15026	1.375523	0.972956	1.738417	2.340133
100	-1.52902	-1.34427	1.475489	-1.93939	-1.39687	-0.55935	-0.93718
101	-1.98436	-2.02905	2.3945	-2.14657	-1.80546	-2.13906	-1.19592
102	-0.16299	0.02529	1.212915	-0.07475	-0.25282	0.589536	0.701476
103	-1.07368	-0.65949	0.950341	0.028841	0.155775	-0.41574	-0.07473
104	-0.61833	-0.3171	1.344202	-0.38552	-1.23343	-1.56462	-1.28216
105	0.747693	1.737243	0.556479	1.06475	-0.74312	1.020366	0.097761
106	-0.61833	0.710072	0.293904	0.546795	-1.23343	-0.27212	-1.10967
107	-1.07368	-0.65949	0.950341	-0.17834	-1.15171	-0.12851	-0.85094
108	0.747693	1.052462	-0.88768	1.168341	0.564365	1.163977	0.787722
109	-0.16299	-1.00188	0.162617	-0.17834	-0.25282	-0.27212	0.011516
110	-0.61833	0.367681	0.425192	0.443204	0.319211	0.015095	0.442741
111	0.292351	0.710072	-0.09996	1.06475	2.03529	0.158706	-0.67845
112	0.747693	0.367681	-0.75639	1.06475	-0.08938	0.302316	-0.50595
113	0.292351	1.052462	0.556479	1.375523	0.646083	-0.12851	1.046457
114	0.747693	0.710072	0.03133	0.857568	0.809519	0.158706	0.873967
115	-0.61833	1.052462	0.425192	1.06475	0.564365	0.302316	0.787722
116	-0.16299	-1.00188	-0.09996	1.06475	-0.66141	-0.84657	-1.45465
117	1.203036	1.394853	-0.62511	1.893478	1.21811	1.020366	0.528986
118	1.203036	1.394853	-1.28154	0.857568	1.21811	1.451197	0.787722
119	1.203036	1.052462	-0.36253	1.06475	0.891238	1.307587	-0.16097
120	0.747693	1.394853	-1.41283	1.06475	0.646083	0.015095	0.442741
121	-0.61833	-0.65949	-0.09996	0.339614	-0.25282	-0.70296	0.442741

Table Appendix D-1 (Continued)

ID	ZFF	ZHL	ZDep	ZKno	ZSE	ZSS	ZSM
122	1.203036	0.367681	-0.09996	0.236023	1.6267	0.302316	2.081398
123	0.747693	-0.3171	-0.23124	-1.11066	-0.74312	-0.70296	-1.02343
124	-0.61833	-0.65949	-0.75639	-0.59271	-0.25282	-0.41574	0.442741
125	1.203036	1.052462	-1.28154	0.339614	0.727801	1.307587	1.132702
126	1.203036	-0.3171	1.081628	1.893478	1.21811	-0.70296	0.960212
127	1.203036	-0.3171	-1.01897	0.546795	0.727801	1.020366	1.650173
128	-0.16299	-2.02905	-0.62511	-1.31784	-0.74312	-0.55935	-1.71339
129	-1.07368	-0.65949	-1.01897	-0.59271	-0.25282	-0.41574	0.356496
130	-0.16299	-0.65949	-0.36253	-0.48911	-0.25282	-1.42101	-0.76469
131	0.747693	0.02529	-1.28154	-0.17834	0.237493	-0.27212	0.442741
132	1.203036	1.052462	-0.75639	0.753977	2.198726	2.312858	2.340133
133	-0.16299	-1.00188	1.212915	-1.62861	-0.74312	-0.70296	-0.67845
134	-0.16299	-1.68666	2.131926	-3.07889	-2.21405	-1.13379	-1.02343
135	1.203036	0.710072	-1.28154	1.06475	1.871854	1.882027	1.218947
136	0.747693	1.737243	-1.01897	-0.28193	0.237493	1.451197	-0.16097
137	-1.52902	-0.3171	1.344202	0.546795	-0.74312	-1.56462	-0.5922
138	0.292351	-2.02905	-0.75639	0.857568	-0.74312	0.158706	-0.93718
139	0.747693	-0.65949	-0.88768	0.857568	-0.25282	-0.70296	-1.62714
140	0.747693	-0.3171	-0.62511	0.857568	0.727801	-0.55935	-0.33346
141	-1.52902	-2.02905	0.162617	-2.04298	-1.23343	-2.13906	-1.62714
142	-0.61833	1.052462	-0.88768	1.375523	0.237493	-0.84657	1.563928
143	0.747693	1.394853	-1.01897	0.650386	2.03529	-0.27212	0.873967
144	1.203036	0.02529	-0.62511	0.443204	0.155775	1.020366	0.960212
145	0.292351	1.052462	1.738064	0.028841	-2.21405	0.589536	1.995153
146	-1.07368	0.02529	-0.09996	-1.00707	2.117008	0.589536	0.701476
147	0.747693	0.367681	-1.28154	-0.07475	0.237493	1.020366	0.011516
148	-1.07368	-1.00188	0.162617	-1.62861	-0.74312	-1.42101	-1.28216
149	0.747693	0.02529	-0.49382	-1.00707	-0.25282	1.020366	0.960212
150	-0.61833	-0.65949	-0.62511	-0.79989	-0.74312	-0.55935	-0.33346
151	-0.16299	1.394853	-0.09996	0.753977	0.400929	-0.12851	0.615231
152	-0.61833	0.710072	0.03133	0.546795	0.155775	-0.55935	0.528986
153	0.747693	1.737243	-0.36253	0.961159	0.972956	1.594807	1.477682
154	-1.52902	-1.00188	1.081628	-0.59271	-1.15171	-1.42101	-0.41971
155	-1.52902	-2.02905	2.657075	-2.25016	-2.13233	-2.13906	-1.97212
156	-0.61833	-0.65949	0.162617	-0.38552	-0.1711	-0.55935	0.011516
157	0.747693	1.052462	-0.36253	0.961159	0.809519	1.020366	1.218947
158	0.292351	1.394853	-0.49382	1.168341	0.891238	1.451197	2.253888
159	0.747693	1.737243	-1.15026	1.375523	0.972956	1.738417	2.340133
160	-1.52902	-1.34427	1.475489	-1.93939	-1.39687	-0.55935	-0.93718
161	0	-1.68666	1.869351	-1.31784	-1.07	-1.70823	-1.10967
162	0.747693	1.052462	-1.01897	0.650386	0.319211	1.020366	0.787722

Table Appendix D-1 (Continued)

ID	ZFF	ZHL	ZDep	ZKno	ZSE	ZSS	ZSM
163	-0.61833	-0.65949	1.081628	-0.17834	-0.82484	0.015095	-0.07473
164	0.292351	0.710072	-0.09996	0.546795	-0.1711	0.302316	0.442741
165	0.747693	1.394853	-0.36253	0.857568	0.319211	1.020366	0.701476
166	-1.07368	-0.65949	0.162617	-0.38552	-1.15171	-0.55935	-0.93718
167	-0.16299	0.710072	-0.23124	0.753977	-0.1711	-0.27212	0.615231
168	-1.52902	-1.34427	1.606777	-0.48911	-1.23343	-1.56462	-0.5922
169	-1.07368	-2.02905	1.081628	-0.6963	-0.90656	-0.41574	-0.24722
170	0.747693	1.052462	-1.15026	1.168341	0.482647	1.738417	0.960212
171	-1.07368	-0.65949	2.657075	-1.42143	-1.23343	-0.99018	-1.79963
172	-1.52902	-0.65949	0.162617	-1.11066	-0.74312	-0.27212	-1.62714
173	1.203036	0.02529	-0.62511	-0.07475	-0.74312	-1.2774	-1.10967
174	1.203036	0.02529	-0.88768	0.132432	-0.25282	-0.41574	-0.16097
175	1.203036	0.710072	-0.62511	0.236023	0.727801	-0.55935	0.356496
176	-0.61833	0.367681	-0.75639	-0.38552	2.198726	-2.13906	-1.02343
177	1.203036	0.710072	-1.15026	0.028841	0.727801	0.733146	0.615231
178	-1.52902	-0.65949	0.162617	-1.62861	-0.25282	-0.55935	-2.05837
179	1.203036	-1.00188	-0.75639	-1.93939	-0.74312	0.302316	-0.5922
180	1.203036	1.394853	0.425192	0.443204	-0.1711	0.876756	0.873967
181	1.203036	-0.65949	-1.28154	1.06475	0.727801	-0.41574	0.184006
182	1.203036	0.710072	-0.23124	0.857568	0.972956	-0.55935	-0.67845
183	-0.16299	-0.65949	-1.01897	0.546795	0.727801	-0.27212	-1.19592
184	0.292351	1.052462	-1.01897	0.236023	2.198726	0.733146	1.046457
185	-1.07368	0.02529	-0.62511	0.236023	1.21811	-0.41574	0.701476
186	0.747693	0.710072	-0.36253	0.236023	0.727801	-0.27212	0.097761
187	1.203036	0.710072	-0.88768	0.236023	0.237493	0.302316	0.615231
188	1.203036	1.052462	-1.28154	0.857568	0.237493	1.020366	0.184006
189	1.203036	1.052462	-1.15026	0.236023	0.727801	-0.55935	0.184006
190	0.292351	1.052462	-0.49382	1.06475	1.463264	1.020366	1.305192
191	0.747693	0.367681	-0.62511	1.375523	0.237493	1.882027	1.046457
192	0.747693	0.367681	-0.75639	0.236023	0.237493	0.876756	0.528986
193	-1.07368	-1.34427	-1.01897	-1.11066	-1.5603	-0.41574	-0.50595
194	-1.52902	-1.00188	-0.75639	0.236023	0.727801	-0.70296	-0.93718
195	1.203036	0.710072	1.606777	0.857568	1.463264	0.015095	-0.5922
196	1.203036	0.367681	-0.49382	0.546795	0.891238	1.451197	0.960212
197	-0.16299	-1.00188	-0.75639	0.546795	-0.25282	-0.70296	-0.24722
198	-1.52902	-1.68666	1.869351	-1.8358	-0.98828	-1.2774	-0.93718
199	-1.07368	0.367681	1.344202	0.236023	-0.49797	-2.28267	-0.67845
200	-0.16299	0.02529	-1.28154	0.857568	1.21811	-0.41574	-0.07473
201	-0.16299	0.02529	0.293904	-2.14657	-1.80546	1.020366	0.960212
202	-1.98436	-2.02905	0.950341	-0.07475	-0.25282	1.451197	-0.24722
203	-0.16299	1.052462	-0.88768	0.028841	0.155775	-0.27212	-0.93718

Table Appendix D-1 (Continued)

ID	ZFF	ZHL	ZDep	ZKno	ZSE	ZSS	ZSM
204	-1.07368	0.367681	0.162617	-0.38552	-1.23343	-1.56462	-0.67845
205	-0.61833	1.394853	0.425192	1.06475	-0.74312	1.020366	2.340133
206	**-3.33561**	1.052462	-0.09996	0.546795	-1.23343	-0.27212	-1.10967
207	-0.61833	0.710072	-1.28154	-0.17834	-1.15171	0.158706	0.787722
208	-1.98436	-0.65949	-0.36253	1.168341	0.564365	0.302316	-1.10967
209	0.747693	1.052462	-1.41283	-0.17834	-0.25282	-2.13906	0.011516
210	-0.16299	-1.00188	-0.09996	1.06475	0.727801	0.589536	0.442741
211	-0.61833	0.367681	-0.09996	0.443204	1.21811	-0.41574	-0.67845
212	0.292351	0.710072	-0.75639	1.06475	-0.74312	1.020366	-0.50595
213	0.747693	1.394853	0.556479	1.06475	0.891238	-0.55935	1.046457
214	0.292351	-0.65949	0.03133	0.857568	0.646083	-1.42101	0.873967
215	0.747693	0.367681	0.425192	1.06475	-0.25282	-0.27212	1.132702
216	-0.61833	0.367681	-0.09996	1.06475	1.6267	2.312858	0.960212
217	-0.16299	1.052462	-0.62511	1.893478	2.03529	-0.70296	1.650173
218	1.203036	1.052462	-1.28154	0.857568	-0.08938	-1.13379	-1.71339
219	1.203036	1.394853	-0.75639	1.06475	0.646083	1.882027	0.356496
220	1.203036	0.02529	1.212915	0.857568	0.809519	1.451197	-0.76469
221	0.747693	-0.65949	2.131926	0.546795	0.564365	-1.56462	0.701476
222	-0.61833	-0.3171	-1.28154	0.236023	-0.66141	0.158706	2.081398
223	1.203036	1.737243	-0.23124	-0.07475	1.21811	0.302316	-1.02343
224	0.747693	-0.3171	-0.75639	1.375523	0.727801	-0.84657	0.442741
225	-0.61833	-0.65949	-1.28154	0.339614	-1.23343	1.451197	1.046457
226	1.203036	1.052462	1.081628	1.893478	0.237493	-0.70296	0.701476
227	1.203036	-0.3171	-1.01897	0.546795	-0.74312	1.020366	0.097761
228	-1.07368	-0.3171	-0.62511	-1.31784	-0.74312	-0.55935	0.615231
229	-1.52902	-2.02905	-1.01897	-0.59271	0.237493	-0.41574	0.184006
230	1.203036	-0.65949	-0.36253	-0.48911	-0.25282	0.302316	0.184006
231	1.203036	-0.65949	1.606777	-0.17834	-0.90656	-0.70296	1.305192
232	-0.16299	1.394853	1.081628	0.753977	0.482647	-0.41574	2.340133
233	1.203036	0.02529	-0.75639	-1.62861	-1.23343	1.307587	-1.19592
234	-0.16299	1.052462	-1.15026	-3.07889	-0.74312	1.307587	-1.62714
235	-1.07368	-1.00188	0.162617	1.06475	-0.74312	0.015095	-1.10967
236	-0.16299	-1.68666	-1.01897	-0.28193	1.21811	-0.70296	-0.16097
237	1.203036	0.710072	1.344202	0.546795	0.727801	0.589536	0.356496
238	0.747693	1.737243	-0.75639	-1.31784	-0.74312	0.158706	-1.02343
239	1.203036	-0.3171	-0.88768	0.650386	-0.25282	-0.70296	0.615231
240	-0.16299	-2.02905	-0.62511	-0.38552	-0.74312	-0.55935	-0.33346
241	-1.52902	-0.65949	0.162617	-2.04298	-2.21405	-2.13906	-1.62714
242	0.747693	-0.3171	-0.88768	1.375523	1.871854	-0.84657	1.563928
243	-1.52902	-2.02905	-1.01897	0.650386	2.03529	-0.27212	0.873967
244	-0.61833	1.052462	-0.62511	0.443204	0.155775	-0.12851	0.960212

Table Appendix D-1 (Continued)

ID	ZFF	ZHL	ZDep	ZKno	ZSE	ZSS	ZSM
245	0.747693	1.394853	1.738064	0.028841	-2.21405	-0.55935	1.995153
246	1.203036	0.02529	-0.09996	-1.00707	2.117008	1.594807	0.701476
247	0.292351	1.052462	-1.28154	-0.6963	0.237493	-1.42101	0.011516
248	-1.07368	0.02529	0.162617	-1.62861	-0.74312	-1.42101	-1.28216
249	0.747693	0.367681	-0.49382	-1.00707	-0.25282	1.020366	0.960212
250	-1.07368	-1.00188	-0.62511	-0.79989	-0.74312	-0.55935	-0.33346
251	0.747693	0.367681	-0.09996	0.753977	0.400929	-1.70823	0.615231
252	-0.61833	-1.34427	0.03133	0.546795	0.155775	1.020366	0.528986
253	1.203036	-2.02905	-0.36253	0.857568	0.972956	-0.12851	1.477682
254	1.203036	-0.65949	1.081628	0.857568	-1.15171	0.015095	-0.41971
255	0.747693	0.02529	2.657075	0.857568	-2.13233	0.302316	1.218947
256	1.203036	-0.65949	**3.31351**	0.339614	-0.1711	-1.56462	-0.16097
257	0.747693	1.394853	-0.36253	0.236023	0.809519	-0.41574	-0.5922
258	-0.16299	0.710072	-0.49382	-1.11066	0.891238	1.738417	-1.97212
259	1.203036	0.710072	-1.15026	-0.59271	0.972956	-2.13906	0.011516
260	1.203036	-1.00188	1.475489	-1.93939	-1.39687	-0.55935	1.218947
261	-2.89505	1.052462	1.869351	-1.11066	-1.07	1.020366	0.787722
262	-1.07368	1.394853	-0.88768	-0.07475	0.319211	0.589536	-1.45465
263	-1.98436	-1.68666	-0.62511	-0.17834	-0.82484	1.738417	0.787722
264	0.747693	1.052462	-0.75639	0.546795	-0.1711	-0.55935	-0.07473
265	-0.61833	-0.65949	0.425192	0.857568	0.319211	1.020366	0.442741
266	0.292351	0.710072	-1.01897	-1.42143	-1.15171	1.163977	0.701476
267	0.292351	1.394853	-0.75639	0.753977	-0.1711	-0.27212	-0.93718
268	0.747693	-0.65949	1.606777	-0.48911	-0.25282	0.015095	0.615231
269	1.203036	0.710072	-0.49382	-0.6963	0.319211	-0.12851	-0.5922
270	-0.16299	-1.34427	-0.75639	-1.62861	-0.25282	1.020366	-0.24722
271	-1.07368	-2.02905	1.869351	-1.93939	0.727801	-0.99018	0.960212
272	0.747693	1.052462	-1.15026	0.443204	2.198726	-0.27212	-1.79963
273	-1.07368	-0.65949	2.657075	1.06475	-1.23343	-1.2774	0.528986
274	-1.52902	-0.65949	0.162617	0.236023	-0.25282	-0.41574	0.787722
275	1.203036	0.02529	-0.62511	0.236023	0.237493	-0.70296	-0.16097
276	1.203036	0.02529	-0.62511	0.236023	2.198726	0.015095	0.442741
277	1.203036	0.710072	-0.88768	0.857568	0.727801	1.451197	1.046457
278	-0.61833	0.367681	-1.28154	-0.90348	-0.25282	-2.28267	0.528986
279	1.203036	0.710072	-1.15026	1.168341	-0.74312	0.876756	-2.05837
280	-1.52902	-0.65949	-0.49382	0.753977	-0.1711	-0.41574	-0.5922
281	1.203036	-1.00188	-0.75639	-1.31784	0.727801	-0.55935	0.184006
282	0.747693	1.394853	-1.28154	0.961159	0.972956	-0.27212	-0.67845
283	-1.07368	-0.65949	-0.23124	-0.59271	0.727801	0.733146	-0.93718
284	-0.16299	0.710072	-1.01897	-2.25016	2.198726	-0.41574	-1.62714
285	-1.52902	-0.65949	-1.01897	-0.38552	1.21811	-0.27212	2.253888

Table Appendix D-1 (Continued)

ID	ZFF	ZHL	ZDep	ZKno	ZSE	ZSS	ZSM
286	1.203036	1.052462	1.081628	0.961159	0.727801	-0.55935	-0.07473
287	1.203036	0.02529	-0.09996	1.168341	0.237493	-2.13906	-1.28216
288	0.292351	0.710072	-0.36253	1.375523	0.237493	1.020366	0.097761
289	0.747693	0.710072	-1.01897	0.132432	0.727801	-0.55935	-1.10967
290	-0.16299	1.052462	-0.62511	0.236023	1.463264	1.020366	-0.85094
291	-1.52902	1.052462	-0.36253	-0.38552	0.237493	1.882027	-1.19592
292	-1.07368	-1.00188	2.3945	0.028841	0.237493	0.876756	0.442741
293	0.747693	0.710072	1.212915	0.236023	-1.5603	-0.41574	-0.50595
294	-0.61833	1.737243	0.950341	1.06475	0.727801	0.733146	-0.93718
295	-1.07368	-1.34427	1.344202	-0.79989	1.463264	-0.55935	-0.5922
296	0.747693	1.737243	1.344202	-0.90348	0.891238	0.302316	-0.67845
297	1.203036	-1.00188	-1.28154	1.168341	-0.25282	-0.70296	-1.02343
298	1.203036	0.367681	0.162617	-1.11066	-0.98828	-1.2774	-0.33346
299	1.203036	-1.00188	-0.23124	-0.90348	-0.49797	0.302316	0.787722
300	0.292351	-1.68666	0.556479	0.961159	1.21811	-0.41574	-0.07473
301	-1.07368	0.367681	-0.23124	0.443204	-0.1711	-0.27212	0.097761
302	-1.52902	-2.02905	2.000638	-1.42143	-1.31515	-0.70296	-1.28216
303	-0.16299	-1.34427	1.344202	-1.8358	-0.41625	0.733146	-0.24722
304	0.292351	0.02529	-0.23124	0.753977	0.319211	0.876756	0.787722
305	-1.07368	-0.65949	0.03133	0.443204	-0.66141	-0.27212	-0.24722
306	0.747693	0.710072	-0.36253	0.546795	0.809519	1.307587	0.701476
307	-0.16299	0.02529	-0.09996	0.650386	-0.1711	0.733146	0.011516
308	-1.52902	-1.34427	1.344202	-0.28193	-1.31515	-0.41574	-0.33346
309	-0.61833	-0.65949	1.081628	-0.07475	-1.47859	-0.27212	-1.88588
310	-0.61833	-0.3171	1.212915	-0.38552	-1.23343	-0.12851	-1.62714
311	-0.16299	0.02529	1.081628	-0.17834	-0.98828	0.015095	-1.10967
312	-1.52902	-1.00188	1.475489	-0.90348	-1.64202	-0.99018	-1.97212
313	-1.07368	-1.34427	1.606777	-1.52502	-1.72374	-0.70296	-2.05837
314	-0.61833	-0.65949	1.081628	-1.21425	-1.5603	-0.41574	-1.36841
315	-1.52902	-1.34427	0.03133	-1.00707	-1.80546	-0.55935	-1.97212
316	0.292351	0.02529	0.293904	-0.17834	-1.15171	0.876756	-1.28216
317	0.747693	0.710072	-0.36253	0.028841	-0.74312	1.594807	-1.19592
318	0.292351	0.02529	0.162617	-0.07475	-1.07	0.876756	-1.45465
319	0.747693	0.367681	-0.62511	0.753977	0.564365	1.307587	0.873967
320	1.203036	1.052462	-0.88768	1.168341	0.482647	1.738417	0.615231
321	-1.52902	-1.00188	1.081628	-0.28193	-0.98828	-0.41574	-0.33346
322	-1.07368	-1.00188	0.819053	-0.6963	-0.25282	-0.12851	0.184006
323	-0.61833	-0.65949	0.556479	-0.48911	-0.1711	0.015095	0.097761
324	0.292351	0.02529	0.293904	0.028841	-0.25282	0.302316	-0.07473
325	-0.16299	0.367681	0.556479	-0.48911	0.564365	0.158706	0.615231
326	-1.52902	-1.00188	1.081628	-0.79989	-0.82484	-0.84657	-0.41971

Table Appendix D-1 (Continued)

ID	ZFF	ZHL	ZDep	ZKno	ZSE	ZSS	ZSM
327	0.292351	0.02529	-0.23124	-0.59271	-0.08938	1.020366	0.184006
328	0.747693	0.710072	-0.09996	-0.38552	0.972956	1.163977	0.787722
329	0.747693	1.052462	-0.36253	0.236023	1.21811	1.451197	1.046457
330	-0.16299	0.02529	0.162617	-0.28193	-0.1711	0.589536	0.270251
331	-0.16299	-0.3171	0.03133	-0.17834	-0.25282	0.445926	-0.07473
332	0.292351	0.02529	0.293904	-0.48911	-0.1711	0.733146	-0.16097
333	0.747693	0.367681	0.162617	0.546795	0.155775	1.163977	0.615231
334	1.203036	0.710072	0.03133	0.857568	0.237493	1.451197	0.701476
335	-1.52902	-1.00188	1.212915	-1.42143	-0.66141	-0.41574	0.184006
336	-0.61833	-0.65949	1.081628	-1.31784	-0.57969	0.445926	0.442741
337	-0.61833	-0.3171	0.293904	-1.00707	-0.49797	0.589536	0.528986
338	-1.07368	-1.00188	1.344202	-1.73221	-0.74312	0.158706	0.270251
339	-1.52902	-0.3171	0.819053	-1.21425	-0.66141	-0.12851	0.356496
340	-0.61833	-0.65949	0.556479	-1.11066	-0.82484	0.302316	0.011516
341	-0.16299	0.02529	0.687766	-1.11066	-0.25282	0.445926	0.184006
342	1.203036	0.02529	0.03133	0.236023	-0.82484	1.594807	-0.33346
343	0.747693	0.710072	0.293904	-0.17834	-0.41625	1.307587	-0.24722
344	-1.52902	-1.00188	1.212915	-1.73221	-1.15171	-0.41574	-1.19592
345	-1.52902	-0.65949	1.081628	-1.62861	-0.98828	-0.84657	-1.10967
346	-0.61833	-0.3171	0.950341	-1.52502	-0.82484	0.158706	-1.02343
347	0.292351	0.367681	0.556479	0.028841	-0.57969	0.733146	-0.85094
348	0.747693	-0.3171	0.425192	-0.28193	-0.25282	0.876756	-0.16097
349	-0.16299	0.02529	0.293904	0.236023	-0.00766	0.589536	0.356496
350	-0.61833	-0.3171	0.162617	-0.17834	-0.1711	0.445926	-0.07473
351	-1.52902	-1.00188	1.081628	-1.31784	-0.74312	-0.12851	-0.41971
352	-1.52902	-1.34427	1.212915	-1.52502	-0.90656	-0.27212	-0.50595

Note   ID = number of sample

ZFF = Z score of Family functioning

ZHL = Z score of Health literacy

ZDep = Z score of Depression

ZKno = Z score of Knowledge

ZSE = Z score of Self-efficacy

ZSS= Z score of Social support

ZSM= Z score of Self-management behaviors

Table Appendix E-2 Test of multivariate outlier by using mahalanobis distanced
(*n* = 350)

ID	MAH_1	ID	MAH_1	ID	MAH_1	ID	MAH_1
1	20.44795	36	13.28534	71	9.610154	106	7.582372
2	19.18236	37	13.11611	72	8.98853	107	7.578482
3	18.80684	38	13.09421	73	8.966985	108	7.524867
4	18.5496	39	12.27038	74	8.738877	109	7.48838
5	18.3451	40	12.17332	75	8.72126	110	7.45201
6	18.2713	41	12.166	76	8.654407	111	7.432969
7	18.2713	42	12.16071	77	8.599098	112	7.423338
8	18.17195	43	11.95885	78	8.575028	113	7.338997
9	17.74112	44	11.95749	79	8.484891	114	7.312861
10	17.61704	45	11.8455	80	8.377574	115	7.299254
11	17.17951	46	11.73736	81	8.35888	116	7.28932
12	16.80424	47	11.61224	82	8.292485	117	7.257802
13	16.52209	48	11.49561	83	8.250698	118	7.235488
14	16.39366	49	11.47469	84	8.242533	119	7.170741
15	16.16168	50	11.45215	85	8.228916	120	7.11898
16	16.0874	51	11.36239	86	8.227163	121	7.093827
17	15.94438	52	11.07394	87	8.194033	122	7.07392
18	15.93695	53	11.06224	88	8.148356	123	7.01148
19	15.88272	54	10.89006	89	8.130308	124	7.00323
20	15.82207	55	10.74831	90	8.115827	125	6.982276
21	15.33348	56	10.62972	91	8.053068	126	6.948215
22	15.25988	57	10.52071	92	8.025581	127	6.922654
23	14.88817	58	10.49447	93	7.909438	128	6.880469
24	14.83127	59	10.44021	94	7.883204	129	6.842577
25	14.7312	60	10.43618	95	7.880029	130	6.783292
26	14.51693	61	10.24542	96	7.820314	131	6.780706

Table Appendix E-2 (Continued)

ID	MAH_1	ID	MAH_1	ID	MAH_1	ID	MAH_1
27	14.46838	62	10.19828	97	7.693047	132	6.777614
28	14.4599	63	10.16008	98	7.586394	133	6.745819
29	14.35227	64	10.14619	99	7.582372	134	6.727437
30	14.25705	65	9.983886	100	7.578482	135	6.680144
31	14.24544	66	9.921467	101	7.524867	136	6.660309
32	14.12313	67	9.83767	102	7.48838	137	6.625322
33	14.09539	68	9.724234	103	7.45201	138	6.613288
34	14.04018	69	9.658344	104	7.432969	139	6.558965
35	13.54096	70	9.634996	105	7.423338	140	6.487816
141	6.480682	176	5.337238	211	4.481746	246	3.903774
142	6.431784	177	5.330803	212	4.479518	247	3.874069
143	6.410946	178	5.325124	213	4.478242	248	3.834118
144	6.408515	179	5.298328	214	4.470396	249	3.821999
145	6.393052	180	5.258629	215	4.458855	250	3.78087
146	6.392082	181	5.224087	216	4.452682	251	3.778451
147	6.312153	182	5.20972	217	4.435139	252	3.762876
148	6.287839	183	5.154958	218	4.375286	253	3.704291
149	6.257533	184	5.121109	219	4.352537	254	3.693011
150	6.203746	185	5.098337	220	4.328017	255	3.6663
151	6.187858	186	5.077308	221	4.326803	256	3.649027
152	6.183166	187	5.061703	222	4.296636	257	3.595471
153	6.13721	188	5.026469	223	4.296227	258	3.580424
154	6.047478	189	4.956174	224	4.279547	259	3.50736
155	6.032655	190	4.909935	225	4.210697	260	3.496089
156	5.949965	191	4.909129	226	4.192179	261	3.48604
157	5.884142	192	4.867104	227	4.183999	262	3.482319
158	5.879144	193	4.853647	228	4.145764	263	3.436652

Table Appendix E-2 (Continued)

ID	MAH_1	ID	MAH_1	ID	MAH_1	ID	MAH_1
159	5.807828	194	4.844454	229	4.130091	264	3.393332
160	5.743354	195	4.829768	230	4.10424	265	3.332138
161	5.730237	196	4.820274	231	4.089942	266	3.287417
162	5.689924	197	4.803443	232	4.040893	267	3.282488
163	5.653302	198	4.78425	233	4.028056	268	3.249784
164	5.646685	199	4.753294	234	3.971062	269	3.239946
165	5.633631	200	4.741773	235	3.967253	270	3.221364
166	5.608567	201	4.741069	236	3.953188	271	3.219318
167	5.553506	202	4.740702	237	3.950254	272	3.200526
168	5.519365	203	4.732702	238	3.941697	273	3.175673
169	5.509561	204	4.728128	239	3.903774	274	3.167329
170	5.491925	205	4.715347	240	3.874069	275	3.151578
171	5.461501	206	4.708511	241	3.834118	276	3.148523
172	5.435201	207	4.622884	242	3.821999	277	3.141407
173	5.38722	208	4.583578	243	3.78087	278	3.098503
174	5.378141	209	4.575298	244	3.778451	279	3.090231
175	5.363627	210	4.570781	245	3.762876	280	3.088329
281	3.069221	299	2.767007	317	2.154033	334	1.858602
282	3.047749	300	2.752025	318	2.152109	335	1.845659
283	3.036563	301	2.702737	319	2.082662	336	1.704868
284	3.024475	302	2.689221	320	2.065668	337	1.659856
285	3.022488	303	2.663598	321	2.041996	338	1.616227
286	3.015865	304	2.641653	322	2.02017	339	1.522184
287	2.998841	305	2.639475	323	2.00402	340	1.405696
288	2.975914	306	2.569053	324	1.993944	341	1.374995
289	2.954861	307	2.548433	325	1.970193	342	1.343049
290	2.948628	308	2.507731	326	1.917741	343	1.311814

Table Appendix E-2 (Continued)

ID	MAH_1	ID	MAH_1	ID	MAH_1	ID	MAH_1
291	2.918178	309	2.467288	327	1.913184	344	1.282134
292	2.893349	310	2.463024	328	1.912909	345	1.226515
293	2.882982	311	2.446223	329	1.858602	346	1.217983
294	2.869475	312	2.403049	330	1.845659	347	1.19153
295	2.858727	313	2.384271	331	1.704868	348	0.76217
296	2.841915	314	2.38025	332	1.659856	349	0.709653
297	2.806091	315	2.364401	333	1.616227	350	0.697745
298	2.784418	316	2.323651	334	1.522184		

Note   ID = Number of sample

MAH_1 = Mahalanobis distance

Table Appendix E-3 Test for multivariate normality and outlier (n = 350)

Variable	Skewness	C. R. of Skewness	Kurtosis	C. R. of Kurtosis
Family functioning	-.352	-2.708	-1.096	-4.215
Health literacy	-.221	-1.700	-.836	-3.215
Depression	.698	5.369	-.358	-1.377
Knowledge	-.602	-4.631	.260	1.000
Self-efficacy	.102	0.785	-.411	-1.581
Social support	-.043	-0.331	-.471	-1.812
Self-management behaviors	.056	0.431	-.477	-1.835
Multivariate			11.358	8.031

Table Appendix E-4 Correlation matrix of studied variables (n =350)

Variable	FF	HL	Depression	Knowledge	SE	SS	SM
FF	1						
HL	.567**	1					
Depression	-.481**	-.414**	1				
Knowledge	.501**	.595**	-.415**	1			
SE	.461**	.513**	-.506**	.569**	1		
SS	.505**	.518**	-.382**	.396**	.405**	1	
SM	.394**	.445**	-.266**	.454**	.457**	.487**	1

** p < .001

Table Appendix E-5 Testing for multicolinearity of predictor variables ($n = 350$)

Variable	Tolerance	VIF
Family functioning	.549	1.821
Health literacy	.496	2.016
Depression	.653	1.531
Knowledge	.534	1.874
Self-efficacy	.558	1.794
Social support	.649	1.540

APPENDIX F

The measurement model assessment

The measurement model assessment

The measurement models were examined for construct validity of the measurement (Schumacker & Lomax, 2010; Hair et al., 2010). The measurement model had evaluated by using confirmatory factor analysis [CFA].

Five constructs including family functioning, health literacy, self-efficacy, social support, and self-management behaviors evaluated for their measurement model by using CFA. The chi-square (χ^2) was used to assess the statistical fit of the measurement models. The indices used to measure the descriptive fit of models were the minimum chi-square value [CMIN], CMIN/ degrees of freedom (*df*), the goodness of fit index [GFI], comparative fit index [CFI], adjusted goodness of fit index [AGFI], and root square error of approximation [RMSEA] (Schumacker & Lomax, 2010; Hair et al., 2010; Kline, 2011). The criteria for indices of goodness of fit were a non-significant value of χ^2 ($p > .05$), values ranging from less than 2.0 for CMIN/ degrees of freedom (*df*), values below 0.05 for RMSEA, and values exceeding 0.95 for CFI, GFI, and AGFI; (Hair et al., 2010; Schumacker & Lomax, 2010; Tabachnick & Fidell, 2007). Furthermore, factor loadings between construct and each indicator were concerned, which standardized factor loadings were accepted as t value more than 1.96, indicating a significance level of 0.05 ($p < 0.05$), t value more than 2.58 indicating a significant level of 0.01 ($p < 0.01$), and t value more than 3.29 indicating a significant level of 0.001 ($p < 0.001$) (Hair et al., 2010).

According to depression and knowledge have one observed variable, therefore these variables have no need to examine the measurement model, but family functioning, health literacy, self-efficacy, social support and self-management behaviors need to investigate the measurement model. The details were presented below.

The measurement model of family functioning
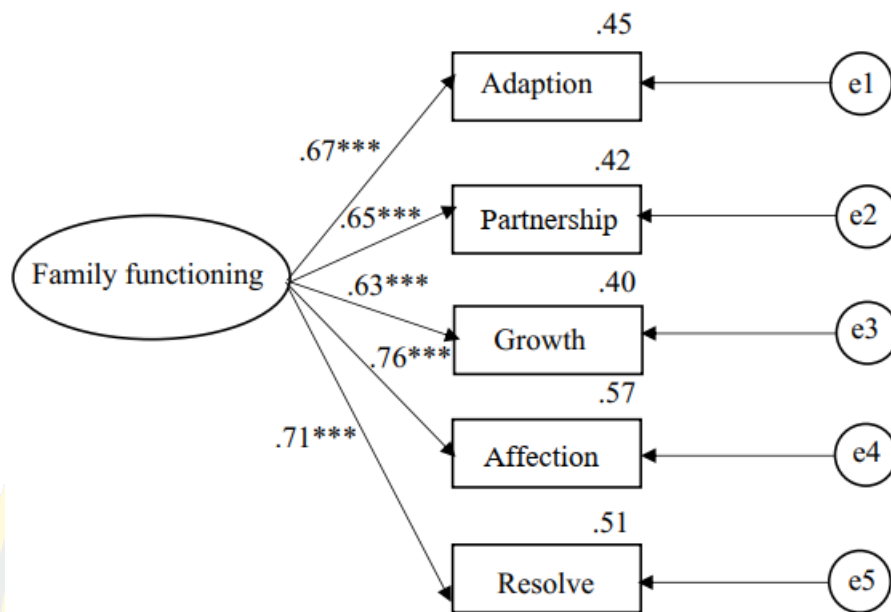
X^2=2.65, *df=5, X^2/ df=0.53, P=*.754, NFI=.991, CFI=1.000, RMSEA=.000, NCP=.000, ECVI=.164

Figure Appendix F-1 Standardized factor loading and measurement errors for the measurement model of family functioning

Family functioning had five indicators that comprise of adaption, partnership, growth, affection and resolve. The model of family functioning construct validity and fit to the empirical data at χ^2= 2.65, *df* = 5, CMIN/ *df* = 0.000, *p* = 0.754, NFI =.991, CFI = 1.000, RMSEA = 0.000, NCP=.000, ECVI=.164. Five factors loading was statistical significance at *p* < .001, the value of standard factor loading from .63 to .76. Affection had maximum values of standard factor as .76 and growth had minimum values of standard factor loading as .63. Those of all indicators had positive values of standard factor loading and greater than .30 that acceptable level (Kim & Whitely, 1978). Hence, five indicators were indicators of family functioning.
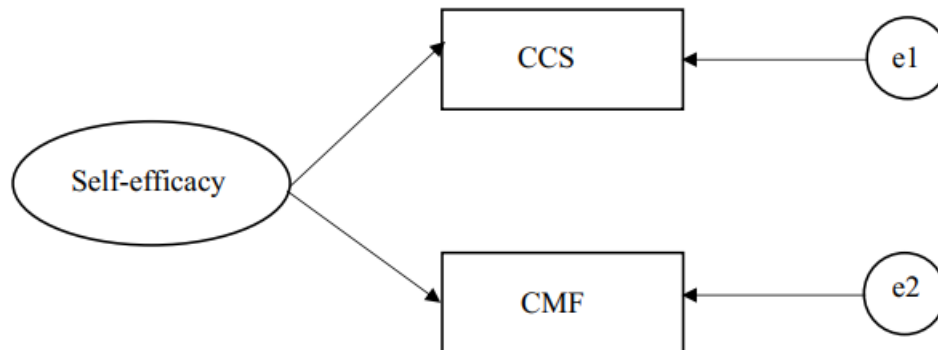
The measurement model of health literacy
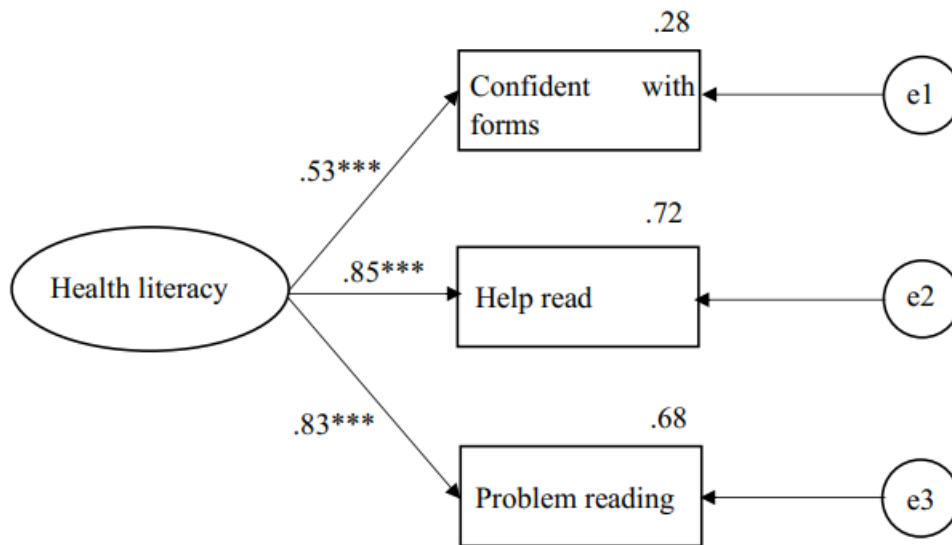
$X^2=.000$, *df=0*

Figure Appendix F-2 Standardized factor loading and measurement errors for the measurement model of health literacy

　　Health literacy had three indicators that comprise of confident with forms, help read, and problem reading. The model of health literacy had a construct validity and perfect fit to empirical data at $\chi^2=.000$, *df* = 0. Three factors loading were statistical significance at p < .001, the value of standard factor loading from .53 to .85. Help read had maximum values of standard factor as .85, and confident with forms had minimum values of standard factor loading as .53. Those of all indicators had positive values of standard factor loading and greater than .30 that acceptable level (Kim & Whitely, 1978). Thus, three indicators were indicators of health literacy.
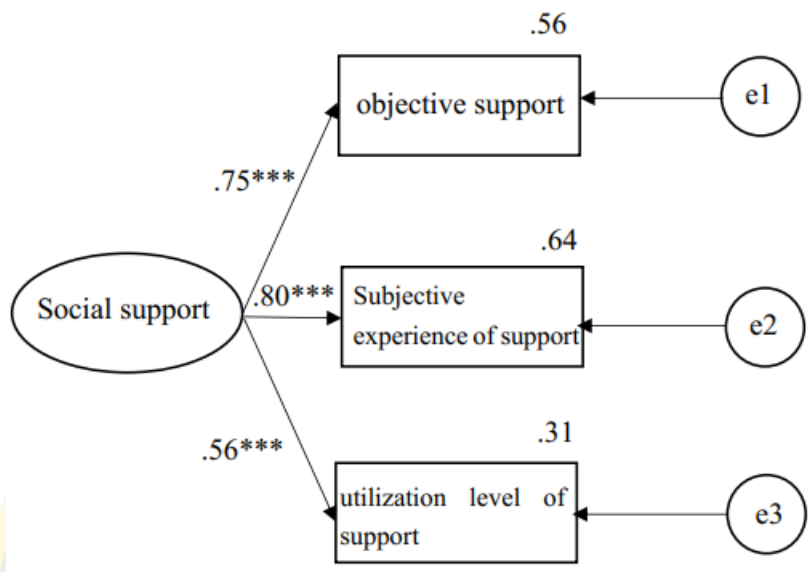
The measurement model of self-efficacy

$X^2=.000, df=0$

Figure Appendix F-3 Standardized factor loading and measurement errors for the measurement model of self-efficacy

Self-efficacy had two dimensions that include confidence in controlling symptom (CCS) and confidence in maintaining function (CMF). The model of self-efficacy had a construct validity and perfect fit to empirical data at $\chi^2 = .000$, $df = 0$. Two factors loading were statistical significance at $p < .001$, the value of standard factor loading from .41 to .85. Confidence in controlling symptom had maximum values of standard factor as .85 and confidence in maintaining function had minimum values of standard factor loading as .41. All indicators had positive values of standard factor loading and greater than .30 that acceptable level (Kim & Whitely, 1978). Consequently, confidence in controlling symptom and confidence in maintaining function dimensions were indicators of self-efficacy.

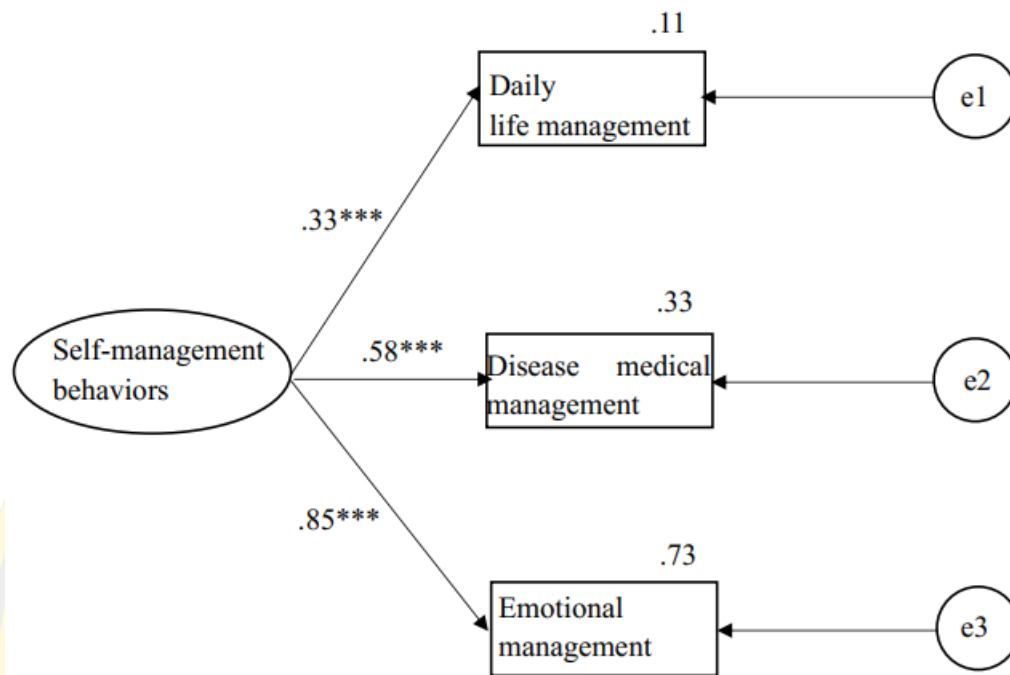**The measurement model of social support**

$X^2=.000$, *df=0*

Figure Appendix F-4 Standardized factor loading and measurement errors for the measurement model of social support

Social support had three indicators that comprise of objective support, subjective experience of support, and utilization level of support. The model of social support had a construct validity and perfect fit to empirical data at $\chi^2=.000$, *df* = 0. Three factors loading were statistical significance at p < .001, the value of standard factor loading from .56 to .80. Subjective experience of support had maximum values of standard factor as .80, and utilization level of support had minimum values of standard factor loading as .56. Those of all indicators had positive values of standard factor loading and greater than .30 that acceptable level (Kim & Whitely, 1978). Thus, three indicators were indicators of social support.

The measurement model of self-management behaviors

$X^2=.000, df=0$

Figure Appendix F-5 Standardized factor loading and measurement errors for the measurement model of self-management behaviors

 Self-management behaviors had three indicators that comprise of daily life management, disease medical management, and emotional management. The model of self-management behaviors had a construct validity and perfect fit to empirical data at $\chi^2=.000$, $df = 0$. Three factors loading were statistical significance at $p < .001$, the value of standard factor loading from .43 to .83. Daily life management had maximum values of standard factor as .83, and emotional management had minimum values of standard factor loading as .43. Those of all indicators had positive values of standard factor loading and greater than .30 that acceptable level (Kim & Whitely, 1978). Thus, three indicators were indicators of social support.