Health-related quality of life in patients with myocardial infarction: trends and predictors

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CERTIFICATE OF ORIGINAL AUTHORSHIP

I, Kyoungrim Kang declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Faculty of Health at the University of Technology Sydney.

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ABBREVIATIONS

Abbreviation	**Full term**
ACS	Acute Coronary Syndrome
AMI	Acute Myocardial Infarction
B-IPQ	Brief Illness Perception Questionnaire
BMI	Body Mass Index
CABG	Coronary Artery Bypass Grafting
CHD	Coronary heart disease
CHF	Chronic Heart Failure
CK-MB	Myocardial Band fraction of Creatine Kinase
COPD	Chronic Obstructive Pulmonary Disease
CVA	CerebroVascular Accident
CVD	CardioVascular Disease
DASI	Duke Activity Status Index
DS-14	14-item type D Scale (DS-14)
EF	Ejection Fraction
ESSI	ENRICHD Social Support Instrument
GSE	General Self-efficacy
HADS	Hospital Anxiety and Depression Scale
HCS	Health Complaints Scale
HRQoL	Health-Related Quality of Life
IPQ	Illness Perception Questionnaire
ISI	Insomnia Severity Index
LVEF	Left Ventricular Ejection Fraction
MacNew	MacNew Heart Disease Health-Related Quality of Life Questionnaire
MCS	Mental Component Summary
MeSH	Medical Subject Headings Descriptor Data
MFI-20	Multidimensional Fatigue Inventory
MHI-5	Mental Health Inventory
MI	Myocardial Infarction
MIDAS	Myocardial Infarction Dimensional Assessment Scale
MLHFQ	Minnesota Living with Heart Failure Questionnaire
MOS-20	Medical Outcomes Study 20-item Short-Form General Health Survey
MQ	Shortened Maastricht Vital Exhaustion Questionnaire
MSQ-H	Multidimensional Support Questionnaire for Heart Patients
NHP	Nottingham Health Profile
NSTEMI	Non-ST Segment Elevation Myocardial Infarction
NYHA	New York Heart Association
PCI	Percutaneous Coronary Intervention
PCS	Physical Component Score
POMS	Profile of Mood States
PSP	Preferred Support Profile

PSS	PTSD Symptom Scale
PTSD	Posttraumatic Stress Dsorder
QLI-C	Quality of Life Index-Cardiac Version
QLMI	Quality of Life after MI questionnaire
QoL	Quality of Life
SAQ	Seattle Angina Questionnaire
SASRQ	Stanford Acute Stress Reaction Questionnaire
SD	Standard deviation
SF-12	Short Form-12
SF-36	36-item Short Form Health Survey
SHC	Somatic Health Complaints
SOC	Sense of Coherence Scale
STAI	Spielberger State-Trait Anxiety Inventory
STEMI	ST Segment Elevation Myocardial Infarction
TIA	Transient Ischaemic Attack
TIMI	Thrombolysis In Myocardial Infarction
WHO	World Health Organisation
WHOQOL-BREF	World Health Organization Quality of Life Instrument Abbreviated

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ABSTRACT

Helping people to “live longer and live better” is the principal goal of healthcare systems, that is, to enhance both survival and health status. As the survival of patients with myocardial infarction (MI) increases with effective and timely therapy, attentions turn to improving patients’ health status, recovery and quality of life. Health-related quality of life (HRQoL) consists of broad constructs that cover various aspects of patient life. Cardiac events, including MI often have negative effects on HRQoL, which is an important measure, independently predicting mortality and future cardiac events in patients with MI. It is also used as an indicator of therapeutic response in these patients. Assessment and monitoring of cardiac patients’ health status including their HRQoL has been highly recommended as a key measure of cardiovascular health.

The aim of this study was to examine the changes in HRQoL scores of patients over the acute phase of MI and determine significant predictors of HRQoL immediately after experience of MI (within a few days) and at three months after discharge from hospital. A longitudinal survey design was used. Participants were recruited from two tertiary hospitals in South Korea. A total of 150 study participants completed self-report questionnaires at baseline (within a few days after the experience of MI) and at the three-month follow-up (n=136). A Korean version of the MacNew Heart Disease Health-related Quality of Life Questionnaire (MacNew) was prepared, evaluated for construct validity and internal consistency, and used for assessing HRQoL.

Health-related quality of life scores improved significantly at three months follow-up, compared to baseline. Using the backward elimination stepwise regression analysis, six variables—financial status, physical activity, diabetes, a history of stroke, history of heart disease, and the DASS score—were significantly correlated with HRQoL of the patients at baseline. The significant predictors of HRQoL at the three-month follow-up, included age, gender, education level, self-assessed financial situation, diagnosis, left ventricular ejection fraction (LVEF), depression, anxiety, stress, illness perception, and social support. The findings of this study can help identify patients who are likely to experience diminished HRQoL after MI. Early psychological and social

support may reduce the influence of MI on patients' function and health status outcomes. While some factors cannot be modified or are difficult to amend, targeting the modifiable factors through psychosocial support, financial support, and improving patients' understanding of their disease and recovery process may have the capacity to improve their HRQoL and enhance clinical care.

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1. Background of the study

1.1.1. Cardiovascular disease: a global challenge

Cardiovascular disease (CVD) remains the number one killer of both men and women worldwide. The personal and economic burden of the disease is considerable, with approximately 31% of all deaths being attributed to CVD globally (WHO 2017). Coronary heart disease (CHD) is the most common and serious form of CVD. In 2015, of the 17.7 million deaths from CVD, 7.4 million were attributed to CHD worldwide (WHO 2017). According to the American Heart Association, 31.9% of all deaths in 2010, that is, 1 of every 3 deaths in the United States, were caused by CHD (Go et al. 2014), and this ratio continued in 2014 (Benjamin et al. 2017). It is expected that deaths attributed to CHD will increase to more than 23.6 million by 2030 (Benjamin et al. 2017). Similarly, the percentage of mortality due to CHD in the UK was considerably high at 28 percent in 2012 (Bhatnagar et al. 2015) and it reduced slightly to 26 percent in 2015 (British Heart Foundation 2017). In line with the international trends, CHD remains the leading cause of death in South Korea, accounting for 58.2 deaths per 100,000 in 2016 (Korean National Statistical Office 2017).

Nevertheless, the survival rate from CVD including CHD, has significantly increased over the last a few decades in many high-income countries (Bhatnagar et al. 2015). This means that the number of patients who live with CHD including myocardial infarction (MI) is continuously increasing, which is a remarkable achievement; however, it is also important that the survivors live a productive and quality life through maintaining and promoting cardiovascular health (Rumsfeld et al. 2013).

1.1.2. Myocardial infarction (MI)

Coronary heart disease (CHD) is the most common manifestation of CVD encompassing a diverse array of diseases, including unstable angina, non-ST elevation MI (NSTEMI), and MI with ST elevation (STEMI) (Wilson & O'Donnell 2017). Angina is caused due to inadequate blood flow of nutrients to myocardial cells (Bowdish et al. 2010), while MI is a more serious condition (Australian Institute of Health and Welfare 2014), referred to as cardiac necrosis due to prolonged ischaemia usually caused by the sudden complete blockage of a coronary artery by a thrombus or plaque (Morrow & Braunwald 2016). Symptoms of MI may include feelings of pressure, tightness, or pain on the chest or arms that may spread to neck, jaw or back, nausea, indigestion, heartburn or abdominal pain, shortness of breath, cold sweat, fatigue, light-headedness or sudden dizziness (McFerran 2014; Morrow & Braunwald 2016). These symptoms are not differentiated among acute coronary syndrome (ACS) patients, but MI is differentiated from unstable angina by changes in biomarkers, which indicate presence of myocardial necrosis (Morrow & Braunwald 2016). Patients who show an increase in cardiac enzymes, particularly the myocardial band fraction of creatine kinase (CK-MB) and cardiac troponin, are diagnosed with MI (Morrow & Braunwald 2016). If there is ST-segment elevation at the 12-lead electrocardiogram, diagnosis will be STEMI, while absence of ST-segment elevation is diagnosed with NSTEMI, in case of presence of myocardial necrosis (Giugliano, Cannon & Braunwald 2015). Two thirds of ACS patients tend to be diagnosed with unstable angina or NSTEMI (Yang & Steinhubl 2010).

Patients after MI—both NSTEMI and STEMI—are at higher risk of subsequent physical consequences, such as malignant arrhythmias, reduced left ventricular function, angina pectoris and adverse psychological reactions, particularly anxiety and depression (Benyamini et al. 2013; Hawkes et al. 2013). Malignant ventricular arrhythmias and recurrent cardiac events increase the risk of sudden cardiac death, shown in 15 percent of patients with CHD (Wilson & O'Donnell 2017). Some patients continue to experience angina symptoms months after their cardiac event. The relatively poor disease prognosis, persistent disease symptoms, and associated psychological distress affect the overall health, well-being and health-related quality of life (HRQoL) of patients after MI (Pettersen et al. 2008).

Myocardial infarction may develop suddenly in patients without warning, disturbing many aspects of the patient’s life. The sudden and often profound physiological and psychological effects of the acute onset of MI along with the psychosocial impact of hospitalisation, has a negative impact on HRQoL (Wang et al. 2014). Therefore, patients have to adjust to changes in different aspects of their lives, such as lifestyle, employment, finances, and relationships. They also need to learn to live with a long-term medical condition and the associated treatment regimens (Fox 2016; Moser, Frey & Bode 2010). The Perspective Registry Evaluating Myocardial Infarction: Events and Recovery (PREMIER) study (2011) found that one month and six months after MI, 26.9 and 23.7 per cent of the patients experienced angina respectively (Longmore et al. 2011). Persistent disease symptoms, invasive medical interventions, including percutaneous coronary intervention (PCI) or coronary artery bypass graft surgery (CABG), and associated psychological distress often adversely affect the patient’s life and overall well-being and impact on their HRQoL. It is becoming increasingly important that the survivors of MI live fuller and higher quality lives and enjoy their health, defined as ‘a state of complete physical, mental and social well-being (WHO 1948)’.

1.1.3. Management of myocardial infarction

The survival rate of patients with MI has remarkably improved due to advances in medical science and technology, such as the introduction of new thrombolytic agents and primary coronary interventions that restore the flow of the culprit vessels in timely and effective manner (Yang & Steinhubl 2010). The critical time for effective managements of MI is known as reperfusion in 90 minutes from onset (Fox 2016). Thrombolytic therapy, PCI, and CABG are the most common interventions for patients with MI according to the American Heart Association (Thygesen et al. 2012).

Among these popular medical interventions, CABG is the most direct treatment, creating alternative blood-flow pathways (Yang & Steinhubl 2010), and can reduce fatality rate, impairment of myocardium, and additional anginal symptoms after MI (Pettersen et al. 2008). Urgent CABG is usually recommended to patients admitted with MI combined with cardiogenic shock, patients with persistent angina after infarction, those with ventricular septal defect, or free wall rupture (Yang & Steinhubl 2010). This surgical treatment can be applied when patients show continuous ischaemia or other severe symptoms even after non-surgical interventions (Rahman et al. 2017).

Percutaneous coronary intervention is usually more preferable to CABG due to lower risk of associated fatal complications (Rajamanickam & Sharma 2014). Percutaneous coronary intervention is the process of restoring blood flow to blocked coronary arteries through insertion of a small balloon tipped catheter. The balloon is then inflated to compress the plaque and open the artery (Brodie & Mann 2010). The advanced drug-eluting stents in the 2000s have reduced the need for repeated revascularisation, increasing the popularity of angioplasty as the treatment option and decreasing CABG surgery rate (Yang & Steinhubl 2010). For patients diagnosed with STEMI, PCI is the preferred treatment modality in many countries to minimise the risk of subsequent heart failure and to maximise the survival rate (Fox 2016).

On the other hand, thrombolytic therapy—anti-ischaemic therapy, antiplatelet therapy, and anticoagulant therapy—is preferred to invasive interventions for NSTEMI patients (Fox 2016). Anti-ischaemic agents include nitrates, beta-adrenergic receptor blocking agents, and calcium channel blockers. Antiplatelet agents, which influence activation of platelet, include aspirin, adenosine diphosphate inhibitors, and protease-activated receptor-1 antagonists. In addition, anticoagulants are commonly used as a treatment of MI, which include heparin, direct thrombin inhibitors, and warfarin (Giugliano, Cannon & Braunwald 2015). These treatment modalities tend to have different impacts on HRQoL of MI patients (Arnold et al. 2013; Chhatriwalla et al. 2015). The effects of different treatments and interventions of HRQoL are discussed in Section 2.6.

1.1.4. Quality of life (QoL)

Quality of life (QoL) is increasingly incorporated as an outcome measure in health research. In ancient Western culture, 'happiness' was almost the same concept as QoL in the philosophical context (Veenhoven 2001). For instance, Aristotle, the Greek philosopher, described happiness as “living well and doing well” (Aristotle 1999, p. 3). According to traditional Chinese philosophy, QoL meant harmoniously balanced Yin and Yang (Zhan 1992). The concept of QoL was first adopted in the literature of social science in 1992 (Sullivan 2003), and the term was first used in the field of medicine by Elkington in 1966 (Pennacchini et al. 2011). The concept of QoL emerged in a worldwide literature database, MEDLINE, in the 1970s, mainly in biomedical information and science articles (Walters 2009). They usually considered QoL as a subjective evaluation and experience of life (Theofilou 2013). In the Medical Subject Headings Descriptor Data (MeSH), the term QoL has been defined as “a generic concept reflecting concern with the modification and enhancement of life attributes, e.g., physical, political, moral and social environment; the overall condition of a human life” (U.S. National Library of Medicine 2018). Since the 1980s, the concept of QoL has broadened to include various aspects of life from economic to health status. The World Health Organization Quality of Life group described QoL as “individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns” (WHOQOL group 1995, p. 1405).

Ferrans (1990) defined five categories for QoL, which included ‘normal life’, ‘happiness/ satisfaction’, ‘achievement of personal goals’, ‘social utility’, and ‘natural capacity’. Additionally, the dimensions of QoL were scrutinised as ‘health and physical functioning’, ‘psychological/spiritual’, ‘social and economic’, and ‘family’. Correspondingly, the WHOQOL group was categorised into the six domains of QoL—physical domain, psychological domain, level of independence, social relationships, environment, and spirituality /religion /personal beliefs (WHOQOL group 1995). Other categories of QoL were shown as cognitive functioning, emotional functioning, psychological well-being, general health, physical functioning, physical symptoms and toxicity, role functioning, sexual functioning, social well-being and functioning, and spiritual/existential issues (Walters 2009).

1.1.5. Health-related quality of life (HRQoL)

The concepts of QoL and HRQoL have been frequently used interchangeably in the literature because of overlap of the meanings (Karimi & Brazier 2016). However, HRQoL should be distinguished from QoL by understanding its accommodation of personal health issues (Theofilou 2013). HRQoL employs more individual’s health status and reflects outcomes of illness and related treatments (Karimi & Brazier 2016). The most popular definition of HRQoL is “those attributes valued by patients, including: their resultant comfort or sense of well-being; the extent to which they are able to maintain reasonable physical, emotional, and intellectual function; and the degree to which they retain their ability to participate in valued activities within the family, in the workplace, and in the community” (Naughton & Shumaker 2010, p. 234).

Health-related quality of life is a complex and multidimensional concept embracing self-reported physical and mental health status, social functioning and overall satisfaction of one’s life (Lazarewicz, Wlodarczyk & Espnes 2016). In this context, despite the broader notion, QoL can be insufficient to describe self-perceived health status (Karimi & Brazier 2016). Thus, when the focus is on health status, HRQoL is a more relevant concept. Assessment and monitoring of patients’ health status that includes three domains: symptom burden, functional status, and HRQoL, has been highly recommended by the American Heart Association and the European Society of Cardiology as a key measure of cardiovascular health (Anker et al. 2014; Rumsfeld et al. 2013).

In the original conceptual model presented by Wilson & Cleary (1995), HRQoL includes ‘biological and physiological variables’, ‘symptom status’, ‘functional status’, ‘general health perceptions’, and ‘overall quality of life’. The first factor, ‘biological and physiological variables’, is usually referred to as conventionally measured disease outcomes, while ‘symptom status’ mainly takes into account symptoms perceived by patients. ‘Functional status’ is a broader concept, containing two previous factors. Functioning has four—physical, social, role, and psychological—aspects about whether patients are able to carry out specific tasks. The fourth factor of this conceptual model, ‘general health perceptions’, encompasses all three factors previously mentioned and is impacted by diverse factors, including sociodemographic and physiological factors. Health-related quality of life considers patient's perspective on satisfaction of their general life as well as outcomes deriving from all four previous factors.

The revised version of Wilson and Cleary's conceptual framework, developed by Ferrans et al. (2005) also accommodates five outcomes reported by individuals; however, the first two concepts have been modified to 'biological function' and 'symptoms'. In comparison with the original version, this conceptual framework has added causal relationships of 'biological function' with 'characteristics of the individual' and 'characteristics of the environment'. On the other hand, 'nonmedical factors' which influence 'overall quality of life', have been removed at the revision since Ferrans et al. (2005) pointed out that these factors could be included either in the individual features or in the environmental features. Furthermore, examples displayed in the original framework by Wilson & Cleary (1995), have been deleted in order not to limit the characteristics of the concepts (Ferrans et al. 2005).

1.2. Significance of the study

In recent years, interest in HRQoL has increased in health and medical research as well as in practice (Lazarewicz, Wlodarczyk & Espnes 2016). Health-related quality of life seems to recompense disease outcomes, which focus mainly on mortality and rehospitalisation rates, and provides more integral assessments of the patient's experiences of disease and treatment (Kawecka-Jaszcz et al. 2013). Interest in HRQoL has been paralleled by increasing recognition of patient-centred care and the significance of the patient's perspective on their health status after a disease experience and/or associated medical treatment. Health-related quality of life is an important patient-reported outcome emphasised by the new models of care that focus on high quality, patient-centred care (Rumsfeld et al. 2013).

This is particularly important in patients with cardiac disease who often experience significant disease burden and need to make lifelong lifestyle modification. The global rise in the prevalence of coronary heart disease including MI (Hardoon et al. 2011) demands a better understanding of the disease trajectory through inclusion of patient perspectives and patient-reported measures. HRQoL is an important indication not only for assessing disease outcomes, like death and recurrent cardiac events but also outcomes that are important to patients, such as daily functioning (Kawecka-Jaszcz et al. 2013). Patients with higher HRQoL are less likely to have recurrent cardiac events and more likely to return to work after the illness compared to those with lower HRQoL (Kawecka-Jaszcz et al. 2013). Some studies (Dal Boni, Martinez & da Silva Saccomann 2013; Sun, Buys & Jayasinghe 2014) also suggest HRQoL as an indicator of therapeutic response. Patients with MI and their health care providers often discuss HRQoL in order to develop a shared view of the disease and of treatment outcomes (Eriksson et al. 2013; Wingate 1995). This understanding is important to help optimise the management of MI and assist patients to return to a normal active life (Walters 2009).

Assessment and monitoring of HRQoL can be helpful in determining the burden of chronic diseases, injuries, and disabilities, and provide valuable insights into the relationships between patient-reported and disease-related outcomes. Health-related quality of life has been recommended for consideration as a primary outcome in the determination of therapeutic benefit (Centers for Disease Control and Prevention 2000). Information on HRQoL can play a significant role in the clinical management of patients with cardiac disease by providing an additional and complementary measure to the objective biomedical assessments (Hawkes et al. 2013). As such, the contemporary interventions for MI should focus not only on improving life expectancy, disease progression and treatment but also on symptom management, patient function, and HRQoL (Wang et al. 2014).

Therefore, monitoring the changes in HRQoL scores and identifying factors that are significantly associated with this important outcome should serve as a useful guide to inform health professionals in developing and providing effective interventions to improve patient recovery.

1.3. Conceptual framework

A few conceptual frameworks have been developed primarily to explain the theoretical underpinning of QoL. The two common conceptual frameworks are explained in the following section. Ferrans (1990) suggests that HRQoL encompasses five different domains, including the ability to live a normal life, happiness and contentment, goal achievement, ability to strive for a useful and meaningful social life and having physical and mental capacity. Later, Ferrans (2005) highlighted the multidimensionality of the concept of QoL, and suggested four interrelated dimensions including: physical well-being, psychological well-being, social well-being, and spiritual well-being. Although the underlying constructs are relatively similar in the existing conceptual frameworks, the framework developed by Zhan (1992) is based on the fact that human experiences are dynamic and complex. According to Zhan, this multi-dimensional and context-related concept is affected by personal background factors, health-related factors and social/cultural/environmental factors. The model takes into account many contributing factors; these and other factors that have been identified and discussed in the review of the literature chapter.

In order to improve patients' disease experiences and help patients to more fully recover from MI, health professionals should try to intervene in the factors that affect the HRQoL of these patients (Pettersen et al. 2008). The current study aimed to promote the management of patients with MI by understanding the factors that impact their HRQoL. This study was guided by the revised Wilson & Cleary model of HRQoL (Ferrans et al. 2005) and the relevant literature. The theoretical background knowledge played a significant role in informing the research questions and design of the study.

Figure 1 presents the conceptual formwork underpinning the study. The four groups of factors influencing HRQoL of patients with MI, were identified through a comprehensive review of the literature. These factors are discussed in Chapter 2. Although a number of studies have attempted to identify factors influencing HRQoL in patients with MI, studies that have examined the impact of all these factors in one single study using robust research methods are scarce.

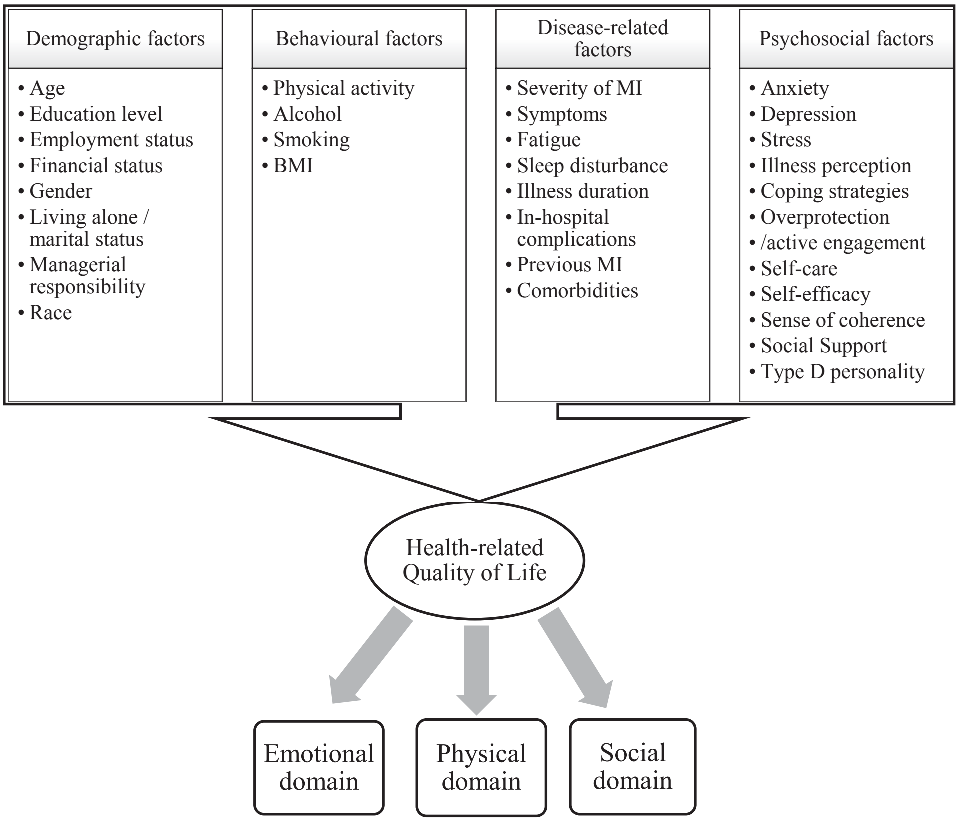

Figure 1. Conceptual framework developed from literature review for the current study

1.4. Study objectives

1.4.1. Study aims

Objectives of this study are to:

1) Assess the psychometric properties of the Korean version of the MacNew Quality of Life after Myocardial Infarction Questionnaire (MacNew) in patients with MI.
2) Assess HRQoL of patients immediately following MI (at hospital, baseline).
3) Examine the trends in changes in HRQoL of patients after the acute phase of MI (over three-month follow-up).
4) Identify the clinical, behavioural, and demographic predictors of HRQoL of patients immediately following MI (at hospital) and three months after discharge.
5) Examine other psychosocial factors that might affect HRQoL of patients with MI.

1.4.2. Research questions

The study aims were addressed by answering the following research questions:

1) Is the Korean version of the MacNew valid and reliable for assessing HRQoL of patients with MI?
2) How does HRQoL of South Korean patients with MI change over time, within three months after discharge from hospital?
3) What demographic, behavioural, and clinical factors predict HRQoL of patients immediately after MI?
4) What demographic, behavioural, and clinical factors predict HRQoL of patients with MI at the three-month follow-up?
5) What other psychosocial factors, comprising depression, anxiety, stress, insomnia, illness perception, social support, and self-efficacy predict HRQoL in this population?

1.5. Outline of the thesis

This thesis has been prepared as a series of publications. The thesis presents a series of studies to address the aforementioned research questions. It is composed of six chapters and further relevant information at appendices. Chapter One presents introduction and background to the study, providing justification for the research. Chapter Two presents reviews of the literature. Two articles have been published in peer-reviewed journals from the review of the relevant literature, therefore, part of the literature review chapter (Chapter 2) is presented in a preprint format. The methodology of the study is discussed in Chapter Three. This chapter mainly contains study setting, subjects, data collection process, measurements, data analysis and ethical consideration. Chapter Four presents results of the validation study on the Korean version of the MacNew heart disease health-related quality of life questionnaire, which is presented in a preprint format. Chapter Five presents the main results of this study. The article has been accepted to a peer-reviewed journal and is currently under the publishing process. As such, this chapter is also presented in a preprint format. All the papers in a journal article format are presented in Appendix E. Finally, Chapter Six discusses a comprehensive review of the major findings, suggestions for further studies, implications and limitations of the current research.

The first chapter introduced the background of this research project including information about major terms, significance of the study, and conceptual framework. Study objectives and research questions were also presented in this chapter, lastly describing an overview of the thesis structure with a figure. The review of the literature is presented in the following chapter.

1.6. Structure of this thesis

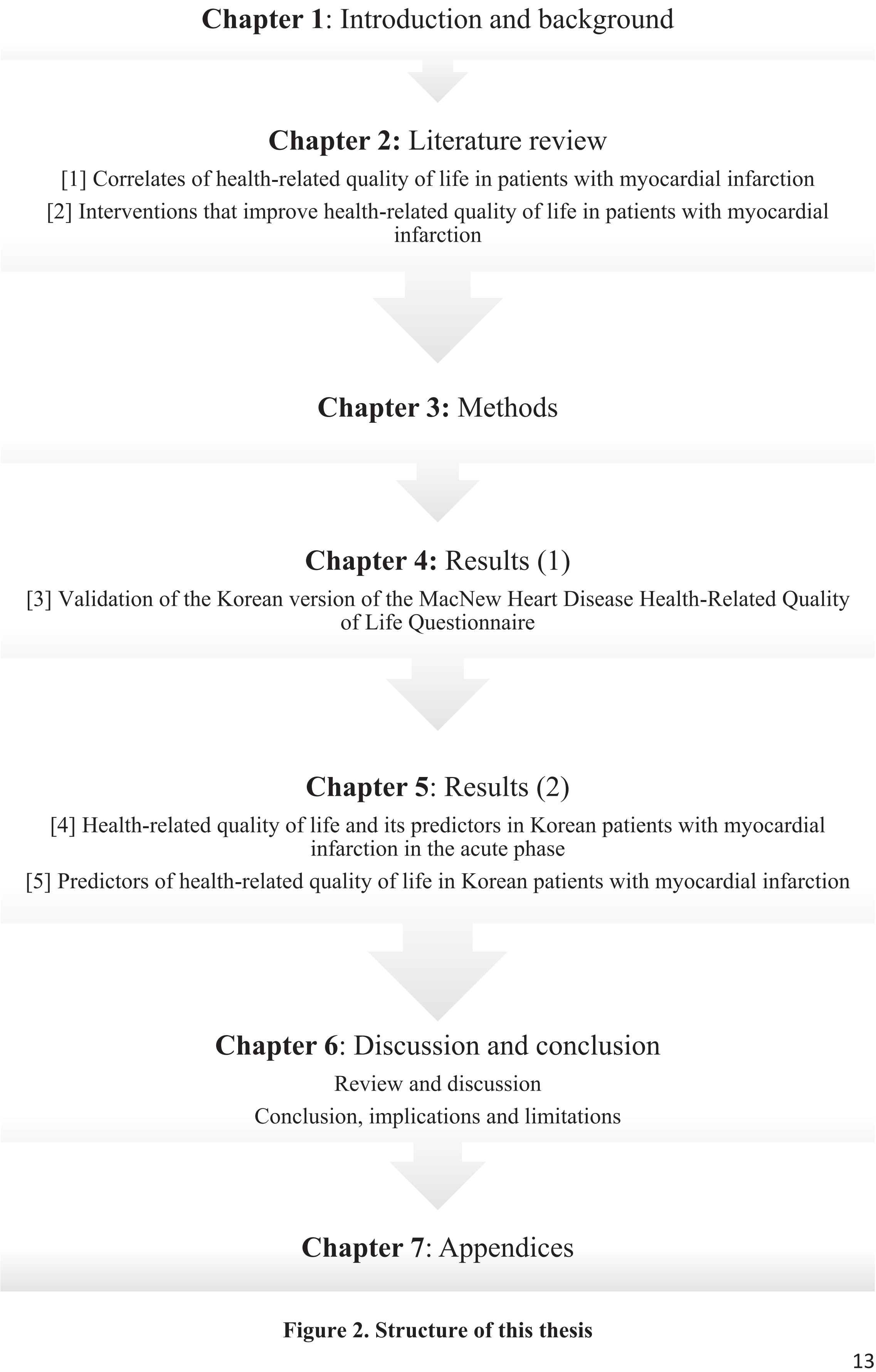

Figure 2. Structure of this thesis

1.7. Chapter references

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CHAPTER 2: LITERATURE REVIEW

2.1. Chapter preface

Chapter 1 provided information about the main concepts, the significance of the study, and the conceptual framework used for choosing factors. Moreover, it described the study's objectives, outlined the thesis and provided a figure of this thesis structure. In this second chapter, a literature review of HRQoL among patients with MI, in general and in South Korea, is presented in sections 2.2 and 2.3, respectively.

Section 2.4 provides a literature review of factors that have been found to be associated with HRQoL in patients with MI. The review was important in the development of the study questionnaires and helped identify potential factors to be assessed and included in regression analysis models in the current study. Section 2.4 presents an article in its preprint form, published in *International Journal of Nursing Studies* (2017) Volume 73 pages 1–16. The published format of this article is provided in Appendix E. *The International Journal of Nursing Studies* was chosen due to its scope, aims, and the peer-review process. In addition, the *journal's* international nature gives authors the opportunity to convey their work to a wide audience. *The International Journal of Nursing Studies* is highly ranked in nursing and its impact factor has been increasing constantly since 2012. The *journal's* impact factor reached 3.755 in 2016.

Section 2.5 presents another literature review, exploring non-medical interventions that have been found effective in improving HRQoL of patients with MI. The review helped the researcher identify interventional factors that could influence HRQoL of patients with MI. These factors were then assessed and controlled in the current study. The findings of this review were also useful for discussing the implications of the current study and formulating the study recommendations. Section 2.5 presents the article in its preprint form, published in *the Quality of Life Research* (2016) Volume 25, Issue 11, pages 2725–37. The published format of this article is also provided in Appendix E. *The Quality of Life Research* aims to publish a plethora of international and multidisciplinary research, specifically about QoL in various areas. Due to its international and multidisciplinary nature, the *Quality of Life Research* gives authors the opportunity to convey their work to a wide audience. The impact factor of this journal was also high at 2.344 in 2016.

Finally, Section 2.6 outlines medical interventions that have been found to positively affect HRQoL of patients with MI.

2.2. HRQoL in patients with MI

Health-related quality of life is an important measure in patients with MI, independently predicting mortality and future cardiac events in this patient group (Eriksson et al. 2013). In the acute phase of MI, the focus is often placed on physical health; however, after discharge from hospital or when considering the long-term effects, HRQoL becomes a significant factor reflecting the impact of MI on different aspects of the patient’s life (Eriksson et al. 2013). There is a wealth of evidence to show that overall well-being and HRQoL of patients reduce after experiencing MI (Foxwell, Morley & Frizelle 2013). This can be due to the fact that MI is a life threatening event, and patients after MI commonly experience adverse feelings, particularly uncertainty and despairing emotions towards reoccurrence of symptoms (Eriksson et al. 2013). In addition, patients are required to make lifelong lifestyle changes in order to reduce their risk of future cardiovascular events. These changes adversely affect different aspects of patients’ life, which are reflected in HRQoL measures. In a cohort study, Rawles, Light & Watt (1992) found that there was a significant decrease in HRQoL scores of patients with MI 100 days after admission compared to baseline, whereas the scores of non-MI patients remained steady throughout the same period. Similarly, Brink, Karlson & Hallberg (2002) found that HRQoL was negatively affected in both Swedish women and men over the period of five months after initial MI. Although the management of patients with MI has advanced over the last a few decades, it seems that patients with MI continue to suffer from an impaired quality of life. A more recent study also reported that individuals diagnosed with acute MI perceived severely impaired HRQoL at one month from the event (Rančić et al. 2013).

The long-term impact of MI on HRQoL of patients has not been widely studied, and the findings of the available studies are inconclusive. Results of a study showed that patients who experienced MI had better HRQoL at six months and over than shortly after the event (Lazarewicz, Wlodarczyk & Espnes 2016). In a longitudinal study in Sweden, Eriksson et al. (2013) examined changes in QoL of 13 MI patients and their partners. Participants were aged 65 years or younger and lived within the hospital catchment area. The study found a significant improvement in QoL scores of couples over time, as measured by the SF-36 scores, at 1, 13, and 25 months after MI. Specifically, mental health improved over time in both patients and their partners and the scores of physical health among the patients were generally higher than their partners except at 1-month follow-up, when partners scored higher physical health (Eriksson et al. 2013). However, Arnold et al.'s study (2009) found that above 25% of MI patients continued experiencing a significant decline in physical functioning over one year, as measured by the Seattle Angina Questionnaire (SAQ). The decline in physical functioning was independent of age (Arnold et al. 2009). Yet, in a four-year follow-up study, patients aged less than 65 years showed impairment in all domains of QoL compared to community norms, with the largest impairments being observed in physical functioning, role functioning, and perception of general health. In patients over 65 years; however, mean domain scores were similar to community norms at four-year follow-up (Brown et al. 1999). These mixed and inconclusive findings in the literature indicate a need for further longitudinal studies to help better understand the changes in HRQoL of MI patients over time, and whether certain subgroups of patients experience more severe and longer term impaired HRQoL.

2.3. HRQoL of patients with MI in South Korea

In line with the international trends, heart disease is a leading cause of death in South Korea. Due to improvement in medical treatment (Kim, Jeong, et al. 2014), the mortality rate from all types of heart disease dropped. Specifically, the figures were changed from 110.2 in men and 80.1 in women in 1983 to approximately 60 per 100,000 in both men and women in 2012. However, the mortality rate related to ischaemic heart disease has been on the rise again since the early 2000s (Lee et al. 2015). For instance, compared to the mortality rate in 2004 (36.7 per 100,000), death from CVD increased to 52.4 per 100,000 in 2014 (Shin et al. 2016). This can be attributed to extended lifespan, economic growth, and Westernised lifestyles in South Korea over the last few decades (Kook et al. 2014).

The incidence rate of MI in South Korea doubled in the period between 1997 and 2007 (43.5 vs. 91.8 cases per 100,000 persons, respectively) (Hong et al. 2009). This incidence rate tended to rise approximately by 10% per year throughout the period, with the largest increase being observed in 2000-2002. Although the yearly incidence rate of MI has slowed since 2002, statistics show an overall 15% increase in the incidence rate from 2002 to 2007 (Hong et al. 2009). This increasing trend has continued up to the present time (Kim & Ahn 2015). The findings from the Korea Acute Myocardial Infarction Registry (KAMIR) suggested that the overall incidence rate of acute MI in South Korea decreased slightly from 2006 to 2013 due to reduction in the rate of STEMI, while the incidence rate of NSTEMI increased steadily over the same period (Kook et al. 2014). To sum up, MI continues to impose significant socioeconomic burdens on individuals, families and the health care system of South Korea (Kim & Ahn 2015).

In accordance with the American Heart Association guidelines (Thygesen et al. 2012), it is common in South Korea that NSTEMI patients undergo a routine invasive therapy while patients diagnosed with STEMI undertake early elective coronary angioplasty after successful thrombolytic therapy (Sim, Jeong & Kang 2010). Statistics show that 75% of patients with STEMI underwent primary coronary angioplasty from November 2005 to January 2008, which was carried out within 90 minutes from the arrival time at the hospital, and 48.5% of patients with NSTEMI received early invasive therapy (Lee et al. 2013). The rates of PCI performance increased further to 96.7% in STEMI and 82.7% in NSTEMI patients in 2015 with the success rate above 99% (Sim & Jeong 2017).

Typical pharmacological treatments of MI include antiplatelet therapy, such as clopidogrel and aspirin for at least one year. Statins are prescribed to reduce low density lipoprotein cholesterol (Lee et al. 2013). It is commonly reported that early statin therapy can decrease major adverse cardiac events and death. Recently, angiotensin receptor blockers are being administered more often to patients with both STEMI and NSTEMI than angiotensin converting enzyme inhibitors (ACE inhibitors) due to the troublesome side effect of cough seen in 5% to 35% of patients on ACE inhibitors (Kook et al. 2014).

In addition to the use of advanced medical and pharmacological interventions in the acute phase of MI, patients are now better prepared for discharge. In particular, increasingly more patients with a cardiac event or high-risk persons are referred to a comprehensive cardiac rehabilitation programs (CRP) in South Korea, similar to other developed countries. These advances in treatment and management of patients with MI can have a positive influence on their disease experience and HRQoL (Bryniarski & Klocek 2013). CRP was first introduced in South Korea in 1993 (Hong & Lee 1997), and actively evolved from 1995. However, the actual participation rate remains extremely low, mainly because the program is provided in very few tertiary hospitals, not actively recommended by cardiologists, and not covered by health insurance (Song et al. 2013). In addition, the program is offered only during early phase of recovery from MI. Patients may find discordance between their personal goals and what the program aims at, indicating the need for more integral and patient-centred CRPs, which take into account the patients' individual needs and circumstances (Kang & Kim 2014). Recent CRPs, offered by a few cardiovascular centres of some tertiary hospitals, integrate consultation regarding diet, education on a healthy lifestyle and exercise. However, the associated cost and access issues are some of the drawbacks of the program (Song et al. 2013). Thus, only 10% of patients who need cardiac rehabilitation participate in the program (Kim, Kim & Jeong 2009). Dropout rates are also high with more than 50% of patients who commenced a program, dropped out (Song et al. 2013). The intervention group received Tai Chi CRP twice a week for six months, while the control group only received routine care without other CRPs. Many participants in the intervention group found hard to attend to both sessions in a week due to personal reasons (Song et al. 2013).

In South Korea, patients with MI mostly receive education about their medications and diet, and they are provided with an educational leaflet at the time of discharge. The patients are advised to visit the outpatient department one or two weeks after discharge for a follow-up check. They then return for regular check-ups once every two or three months.

There is little known about the experiences of South Korean patients with MI during their recovery. A study that aimed to explore this phenomenon through a qualitative approach (Kang & Kim 2014) suggested the following six themes: getting to know about their illness, getting motivated for behaviour change, putting an effort into health behavioural change, having difficulties maintaining health behaviour, developing coping strategies to cope with the changes, and the need for a tailored education. The study concluded that as post-MI patients make efforts to return to their normal life after discharge from hospital, it is important that health professionals help the patients set realistic goals for their health (Kang & Kim 2014).

2.4. Correlates of health-related quality of life in patients with myocardial infarction: A literature review

Publication reference:

Kang, K., Gholizadeh, L., Inglis, S.C. & Han, H.-R. (2017), 'Correlates of health-related quality of life in patients with myocardial infarction: A literature review', *International Journal of Nursing Studies*, vol. 73, pp. 1-16. https://doi.org/10.1016/j.ijnurstu.2017.04.010

2.4.1. Abstract

Background: By the increasing emphasis on health-related quality of life in patients with myocardial infarction, it is necessary to explore factors that affect HRQoL in this population.

Objectives: This study aimed to identify correlates of HRQoL in patients with MI.

Design: A literature review of the factors that affect HRQoL in patients with MI (1995-2016).

Data Sources: Three main databases—CINAHL, MEDLINE and PsychINFO—were searched to retrieve relevant peer-reviewed articles published in English.

Review methods: In consultation with a medical librarian, we identified relevant MeSH terms and used them for searching the literature: health-related quality of life/quality of life/HRQoL/QoL, myocardial infarction/heart attack/MI and predict*/factor. Data elements were extracted and narratively described variables synthesised into four categories.

Results: A total of 48 studies met the inclusion criteria and were included in the review. Correlates of HRQoL in patients with MI were identified in the following categories: demographic, behavioural, disease-related, and psychosocial factors. Specific correlates included age and gender-identity for demographic factors; physical activity and smoking for behavioural factors; severity of MI, symptoms, and comorbidities for disease-related factors; anxiety and depression for psychosocial factors.

Conclusions: Identifying correlates of HRQoL can help identify patients who are at risk for poor HRQoL in the recovery or rehabilitation stage of post-MI. Future intervention should focus on adjustable correlates, such as behavioural and psychosocial factors to promote HRQoL among patients after experiencing MI.

2.4.2. Introduction

Myocardial infarction (MI) is the most frequent manifestation of coronary heart disease (CHD) and one of the leading causes of death worldwide (Saeed, Niazi & Almas 2011; Wang et al. 2016). The life-threatening nature of the disease, the need for long-term lifestyle changes and medical regimens after MI (Boersma et al. 2006) often result in reduced health-related quality of life (HRQoL) among patients (Kang et al. 2016; Wang et al. 2014).

Health-related quality of life is a multidimensional concept that examines the physical, emotional, and social impacts of a disease/ illness on the patients' life (Sertoz et al. 2013). One of the most popular patient-reported outcomes, HRQoL is used as a means of assessing the overall well-being of patients in the recovery stage of MI (Lidell et al. 2014; Wang et al. 2014). In particular, HRQoL provides a patient-centred assessment of one's health condition (Norris, Hegadoren & Pilote 2007), which in turn, can be used to evaluate an individual patient's experience and to predict the reoccurrence of cardiac events, rehospitalisation, and mortality (Rumsfeld et al. 2013). Thus, the

American Heart Association recommends that the assessment of HRQoL needs to be included as one of the routine evaluations of health status among patients with cardiovascular disease (Rumsfeld et al. 2013).

By the increasing emphasis on HRQoL in patients with CHD, in particular MI (Rumsfeld et al. 2013), it is necessary to explore factors that affect HRQoL in this population. Knowledge about these factors may help identify patients who are likely to experience poor HRQoL at the time of hospital admission and during recovery and hence, provide a window of opportunity to eventually improve clinical outcomes associated with MI (Hawkes et al. 2013).

To the best of our knowledge, there are no reviews integrating correlates of HRQoL in patients with MI. This study was designed to collect, review and critically synthesise the results of research on factors affecting HRQoL in patients with MI.

2.4.3. Methods

A comprehensive electronic search was performed for this narrative literature review, using CINAHL, MEDLINE and PsychINFO databases. In consultation with a medical librarian, we identified relevant MeSH terms and used them for searching the literature: health-related quality of life/quality of life/HRQoL/QoL, myocardial infarction/heart attack/MI and predict*/factor. Only peer-reviewed studies published in English were searched. To ensure relevancy of the studies, articles were restricted to those published in the last 20 years, from 1995 to July 2016. This was because the management of MI and assessment of HRQoL has drastically improved over the past two decades.

Study Selection

A total of 640 articles were identified from the database searches. Ninety articles were removed as duplicates. The title and abstract of the remaining 550 articles were reviewed. Articles were included: 1) if study subjects were patients with MI exclusively; 2) if a dependent variable was HRQoL; 3) if a study examined factors or predictors of HRQoL; and 4) they were peer-reviewed articles. Irrelevant articles, scientific letters, posters, studies of validation or reliability of measurements or qualitative studies and articles published in languages other than English were excluded. One author extracted articles according to the predetermined inclusion and exclusion criteria, and results were discussed with the other authors for accuracy of the extracted articles. The selection process led to inclusion of 48 articles for the review. One additional article was identified through manual searching of the reference lists of the included studies, increasing the number of the articles for full-text screening to 49. After excluding one irrelevant study of a medical intervention, the total number of the reviewed articles was 48 (Figure 3).

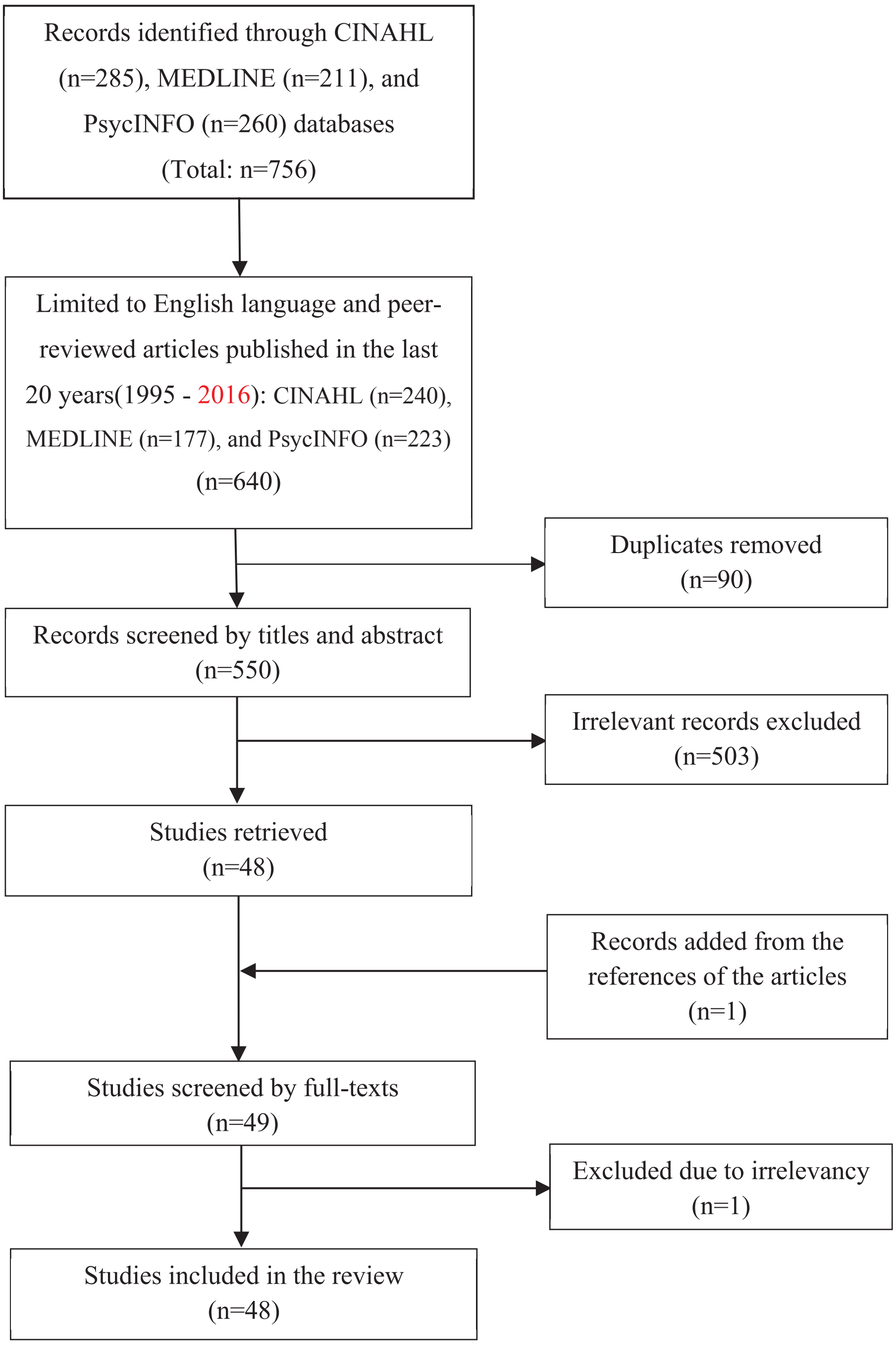

Figure 3. The process of article selection

Data extraction and quality assessment

A pre-developed table template (Table 1) was used for data extraction, and extracted data were examined, compared, discussed and agreed with the other authors. Data elements were extracted and narratively described variables synthesised into four categories. Data of study characteristics were countries where the studies were conducted, study designs, sample size, mean age, MI diagnostic criteria, tools that assessed HRQoL, instruments examined variables, follow-up periods and factors that affected HRQoL in patients with MI.

The quality of all included articles were evaluated and rated using the Quality Assessment Tool for Quantitative Studies of the Effective Public Health Practice Project (EPHPP) (National Collaborating Centre for Methods and Tools 2008). This tool comprises six criteria—selection bias, study design, confounders, blinding, data collection method, and withdrawals and dropouts. Each section rates ‘strong (1)’, ‘moderate (2)’ and ‘weak (3)’. Then, the global rating for the paper and the final decision of the reviewers can be determined as ‘strong (1)’, ‘moderate (2)’ and ‘weak (3)’ (National Collaborating Centre for Methods and Tools 2008). The final scores of the articles included in the current review are presented in Table 1. Using EPHPP, the articles were scored ‘weak’ if they did not use a randomisation method or if withdrawals and drop-outs, including percentages, were reported. However, these studies were not excluded, since observational studies were suitable to examine factors affecting HRQoL and randomisation was not needed.

2.4.4. Results

The studies were conducted mostly in European countries (n=33; 6 studies each in Sweden and the UK, 4 in the Netherlands, 3 in Poland, 2 in Norway, and 1 study each in France and Hungary) including one multinational study that included data from 18 European countries. In addition, there were 10 studies undertaken in the USA, 3 studies conducted in Canada, and one international study involving the USA and Spain. Of the 48 studies, 28 studies used cohort, longitudinal, prospective designs, or a combination of them, whereas 10 studies applied a cross-sectional design. Two studies did not report the study design explicitly; however, these studies were prospective in nature in that the participants of these two studies were followed for three months (Mayou et al. 2000; Williams et al. 2012) or up to a year (Mayou et al. 2000). Among the ten cross-sectional studies, the time since MI was not reported in two studies, whereas the other studies reported the time since an MI event. Apart from the cross-sectional studies, the follow-up period of 31 studies was less than 12 months, ranging from one month to one year; seven studies followed up with the study participants for longer than a year, including one with a follow-up period of 10 years. The sample size of the included studies varied from 27 to 3,432 participants, whose age ranged from 21 to 98 years of age. Four studies exclusively examined female patients, while one study included male patients only. Excluding these five studies, the proportion of male participants in the remaining 43 studies was 60% or more.

Correlates of HRQoL were studied in the following four main categories: demographic, behavioural, disease-related and psychosocial factors. As such, the following section describes each category of factors affecting HRQOL of MI patients. Table 1 summarises characteristics of the studies included in the review.

Table 1. Summary of the study characteristics

1st Author (year) /Country	Study design Study sites	Sample N (male %) Mean age (SD) MI diagnostic criteria	HRQoL Assessment	Variables examined (Instruments)	Follow-up period	Key findings	EPHPP score
Alsen et al. (2013) / Sweden	Longitudinal A single centre	N=155 (72.3%) 67.0 (9.0) Acute MI	SF-36	Fatigue (MFI-20)	2 years	The physical and mental dimensions of HRQoL two years after MI was predicted by experienced general fatigue at four months (p<0.01).	3
Arnold et al. (2014) / USA	Prospective cohort Multi-centre	N=2693 (67.0%) 59.9 (11.9) Biomarker evidence of myocardial necrosis and prolonged ischaemic signs/symptoms or electrocardiographic changes during the initial 24 hours of admission	SF-12, SAQ	Age, sex, race, depression (PHQ-9), financial difficulties, current smoking, Stress (PSS), angina	1 year	Older patients reported higher SAQ HRQoL scores one year after acute MI than younger patients (<50 years) (p<0.001). Patients with depressive symptoms, financial difficulties, female sex, current smoking (p<0.001 respectively), elevated chronic stress levels (p=0.001), more angina before their MI (p=0.004), and non-white race (p=0.017) reported lower follow-up HRQoL.	1
Baas (2004) / USA	Ex post facto and correlational Multi-centre	N=84 (69.0%) 61.0 (11.0) Not reported	The Index of Well-Being	Self-care resources (SCRI-Availability), self-care knowledge (SCRI-Needs), activity level (HAP)	3 to 6 months	The relationship between HRQoL and self-reported activity level was significant (r=0.24). Self-care knowledge and resources had a low relationship with HRQoL.	3
Beck et al. (2001) / Canada	Prospective cohort Multi-centre	N=554 (28.7%) 60.9 (12.0) Acute MI (Q or non-Q wave)	SF-36, EuroQol	Depression (BDI), age, in-hospital complications	6 months and 1 year	Older age and higher levels of depression predicting worse QoL. Shock in-hospital predicted improved physical QoL, at both six months and one year.	1

Bengtsson et al. (2001) / Sweden	Comparative A single centre	N=60 (80.0%) 58.0 (7.4) No previous history of MI and either 1) ECG with a pathological Q-wave in two parallel leads or 2) typical symptoms and a biochemical marker or 3) suspect ECG changes and a biochemical marker.	SF-36, Cardiac Health Profile	Age, angina (CCS score)	6 months	Patients below the age of 59 years improved in physical HRQoL (p=0.002) only, whereas patients over 59 years improved significantly in both the physical (p=0.030) and the mental HRQoL (p=0.006). Higher symptom scores predicted low physical HRQoL (p<0.001).	3
Benyamini et al. (2013) / Israel	Longitudinal, prospective cohort Multi-centre	N=540 (86.0%) 52.1 (8.4) First acute MI	SF-36	Depression (BDI), anxiety (the State Subscale of STAI), MI severity (infarct location and Killip class)	10 years	Depression (p<0.05) and anxiety (p=0.05) were directly related to poorer QoL 10 years later. Their QoL was found to be unrelated to the severity of the initial MI.	1
Boersma et al. (2006) / Netherlands	Longitudinal A single centre	N=46 (89.1%) 56.4 (8.2) Not reported	MacNew	Goal self-efficacy(a three-item questionnaire)	4 months	Greater self-efficacy was significantly related to the both physical and social HRQoL (p<0.05).	3
Boersma et al. (2005) / Netherlands	Longitudinal Two centres	N=113 (74.3%) 54.1 (10.3) Not reported	MacNew	Presence of anginal complaints (a self-report NYHA measure), social support (MSQ-H)	4 months	Significant predictors of a low HRQoL scores were presence of anginal complaints (p=0.05), low perceived adequacy of social support (p<0.01).	3
Brink et al. (2012) / Sweden	Longitudinal follow-up Two centres	N=145 (70.3%) 64.4 (9.4) Not reported	SF-36	General Self-efficacy (GSE)	2 years	General self-efficacy measured four months after MI was positively related to HRQoL after two years (physical: p<0.05, mental: p<0.01).	3

Brink et al. (2005) / Sweden	Longitudinal A single centre	N=98 (66.3%) Women=71.4 (8.7) Men=64.6 (9.8) First-time acute MI	SF-36	Depression (HAD), fatigue (SHC)	1 year	Depression at one week after an acute MI predicted women's physical HRQoL at one year (p<0.01) and depression at five months were correlated with both physical and mental HRQoL (p<0.01). Depression at five months and fatigue were predictors of men's physical HRQoL (p<0.01) and depression at 1 week was a predictor of men's mental HRQoL 1 year after MI (p<0.01).	3
Brink et al. (2002) / Sweden	Longitudinal A single centre	N=114 (67.5%) Women=72.2 (8.6) Men=65.4 (10.1) First-time acute MI	SF-36	Depression (HADS), health complaints, coping strategies (GCQ)	5 months	Depression (p<0.01) and the coping strategy (p<0.05) were found to be negatively and significantly associated with physical HRQoL, and the coping strategy (p<0.01) as well as the variable health complaints (p<0.001) with mental HRQoL.	2
Bucholz et al. (2011) / USA	Prospective Multi-centre	N=2264 (68.1%) Living alone=62.7 (13.5) Not living alone=59.3 (12.3) AMI confirmed by cardiac enzymes, and prolonged ischaemia or electrocardiographic ST-segment elevation changes.	SF-12, SAQ	Living alone	1 year	Living alone appears to be associated with poorer QoL at 1 year after MI (p<0.001).	3

Bucholz et al. (2014) / USA, Spain	Prospective, observational Multi-centre	N=3432 (32.9%) 48.0 Acute MI was confirmed by the presence of elevated cardiac enzymes (troponin or creatine kinase) and supporting evidence of myocardial ischaemia, including at least one of the following: symptoms of ischaemia; ECG changes suggestive of new ischaemia; or other evidence of myocardial necrosis on imaging.	SF-12, SAQ	Perceived social support (ESSI)	1 year	Patients with low social support continued to have lower QoL at 12 months (P<0.01).	3
Coyne et al. (2000) / USA	Cohort Multi-centre	N=1848 (79.0%) 59.5 The Global Utilisation of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries (GUSTO)-recorded MI	Combination of DASI, MLHFQ, and SF-36	Infarct artery patency (TIMI flow grade), LVEF (Left ventriculograms)	2 years	LVEF was significantly related to physical (P=0.021) and social (P=0.014) function, psychological well-being (P=0.042), and perceived health status (P=0.024). Infarct-related artery patency was not directly related to any HRQoL outcome.	3
De Jonge et al. (2006) / Netherlands	Longitudinal, prospective cohort Multi-centre	N=421 (79.6%) 61.0 (11.4) Chest pain for at least 20 minutes, creatine kinase concentration 100% higher than normal or creatine kinase MB fraction greater than 10%; or the presence of new pathological Q wave on the ECG in at least two leads.	RAND 36	Depression (CIDI-Auto)	1 year	Patients with post-MI depression had a significantly poorer HRQoL at 12 months after the MI than patients without a post-MI depression (p<0.001).	2

Dickens et al. (2006) / UK	Prospective cohort Multi-centre	N=314 (63.0%) 57.6 (11.2) First MI	SF-36 PCS	Depression and anxiety (HADS)	6 and 12 months	Depression and anxiety at 6 months continued to contribute significantly to physical HRQoL at 12 months (p<0.0005). Depression and anxiety right before the first MI did not predict the physical HRQoL 12 months later.	2
Doerfler et al. (2005) / USA	Cross-sectional A single centre	N=52 (69.2%) 57.7 (12.0) History consistent with ischaemic symptoms and electrocardiogram changes with ST elevation or depression of at least 1 mm in 2 contiguous leads with positive cardiac enzymes.	MOS-20	PTSD (PSS, IES)	3 to 6 months	Higher depression scores were associated with poorer QoL (p<0.05).	3
Ecochard et al. (2001) / France	Prospective Multi-centre	N=671 (84.5%) Women=63.6 (13.4) Men=57.9 (11.2) Acute MI	NHP	Myocardial dysfunction and coronary stenosis (Maximal Killip class)	1 year	Impaired QoL was not associated with the initial Killip class.	3
French et al. (2005) / UK	Prospective A single centre	N=194 (73.2%) 63.3 (10.6) Acute MI	QLMI	Illness perception (IPQ), Anxiety and depression (HADS), gender, smoking status, rehabilitation attendance, living alone, previous MI, employment status	6 months	For emotional HRQoL, anxiety and depression emerged as the only significant predictors. For both physical and social HRQoL, depression emerged as the only significant predictor. For all three HRQoL scales, illness perception was related to emotional (p=0.05), physical (p=0.051), and social HRQoL (p =0.044). Of the categorical variables, only employment status was related to any HRQoL scale (p=0.002).	3

Ginzburg et al. (2011) / Israel	Prospective Multi-centre	N=173 (84.0%) Recovered/resilient group=54.0 (8.2) Chronic group=54.7 (9.6) Typical clinical symptomatology, electrocardiographic evidence of MI and typically elevated serum levels of myocardial enzymes	SF-36	Acute stress disorder (SASRQ), PTSD (PTSD Inventory)	8 years	HRQoL at 8 years was inversely correlated with the severity of acute stress during their hospitalization (p<0.01), PTSD approximately 7 months after their admission (p<0.001), and PTSD approximately 8 years after their MI (p<0.001).	3
Hawkes et al. (2013) / Australia	Randomised controlled trial Two centres	N=294 (79.0%) 60.5 (10.7) Newly diagnosed MI	SF-36	Age, alcohol intake, health behaviours (the Active Australia Survey, a 5-item measure of physical activity intention), self-efficacy (a 10-point scale), smoking, depression and anxiety (HADS), social support (ESSI)	6 months	Older age (p<0.001), lower confidence levels (p<0.001), no intention to be physically active (p<0.001), and greater sedentary behaviour (p=0.001) were strong independent predictors of lower physical HRQoL. Younger age (p=0.01), depression (p<0.001), lower social support (p=0.001) and greater sedentary behaviour (p=0.01) were predictors of lower mental HRQoL.	1
Ho et al. (2008) / USA	Prospective cohort Multi-centre	N=2498 (67.0%) 60.9 (13.0) Biomarker evidence of myocardial necrosis and clinical evidence of an acute MI during the initial 24 hours of admission, prolonged (>20 minutes) ischaemic signs / symptoms or electrocardiographic ST changes.	SAQ	Age	12 months	Increasing age was associated with better HRQoL at 12 months (p<0.0001).	3

Hosseini et al. (2014) / Iran	Prospective cohort Two centres	N=196 (74.0%) 55.8 (11.1) Acute non-fatal MI, MI from the results of coronary bypass graft surgery or angiography was excluded	SF-12	Depression (BDI), Anxiety (STAI)	5 years	The association of depression and poor QoL survived in the model (p<0.0001). Only a trend of lower physical HRQoL score with anxiety was observed (p=0.004).	3
Joekes et al. (2007) / Netherlands	Longitudinal dyadic Two centres	N=73 MI patients (86.0%) and their partners Male=54.7 (9.8) Female=55.3 (8.8) Not reported	MacNew	Overprotection and active engagement (subscales from a questionnaire measuring support styles), chest pain, illness duration	3 and 9 months	When partners had been more overprotective, patients reported worsening physical HRQoL 9 months later (p<0.05). More active engagement perceived by the patient significantly predicted enhanced emotional, social and global HRQoL (p<0.05). Illness duration was associated with reduced social HRQoL (p=0.006). Patients who experienced chest pain reported lower emotional, physical, social and global HRQoL (p=0.000).	3
Kim et al. (2015) / S. Korea	Descriptive correlational A single centre	N=105 (79.0%) 65.0 (10.9) LVEF at less than 50%	MLHFQ	Gender, monthly income, NYHA class and symptoms (Friedman-Heart Failure Symptom Checklist)	12 months and over after the initial cardiac event	Patients who were female, with low income, and had greater functional limitation and more symptoms had worse HRQoL (p<0.001).	3
Kristofferzon et al. (2005) / Sweden	Cross-sectional and descriptive-comparative A single centre	N=171 (56.7%) Women=76.8 (11.6) Men=71.3 (12.1) Not reported	SF-36, QLI-C	Gender	1 month	Women reported significantly lower HRQoL than men in both the physical (p=0.01) and mental (p=0.007) components of the SF-36 and the QLI (p=0.04).	3

Lane et al. (2001) / UK	Cohort Two centres	N=257 (75.0%) 61.6 (11.4) Typical ischaemic chest pain lasting at least 20 minutes, presence of new pathological Q waves on the electrocardiogram, a peak creatinine phosphokinase level >1.5 times the normal limit, or a CK-MB (myocardial isoenzyme of creatinine phosphokinase) value ≥25 IU/litre or >5% of a simultaneous creatinine phosphokinase value exceeding the normal limit.	COOP chart system	Depression (BDI), anxiety (STAI), Living alone, severity of infarction (Peel Index score)	12 months	Symptoms of depression (p=0.001) and anxiety (p=0.008) predicted 12-month QoL among survivors, as did living alone (p=0.001), and indices of disease severity (p=0.001).	2
Lane et al. (2000) / UK	Cohort Two centres	N=263 (75.3%) 61.9 (11.4) Typical ischaemic chest pain lasting at least 20 min; presence of new pathological Q-waves on the electrocardiogram; a peak creatinine phosphokinase level greater than 1.5× the normal limit, or a CK-MB (the myocardial isoenzyme of CK) value ≥25 IU/l or > 5% of a simultaneous CK value exceeding the normal limit.	Dartmouth COOP charts	Depression (BDI), anxiety (STAI), severity of infarction (Peel Index score), previous exercise behaviour, demographic characteristics (gender, partner status, living alone, and employment status)	4 months	Baseline depression score (p=0.001), anxiety (p=0.001), and previous exercise behaviour (p=0.003) correlated significantly with QoL. QoL was also positively associated with being male, having a partner, not living alone, and being employed (p<0.05). The higher the Peel Index score, the poorer the QoL (p=0.001).	1
Leifheit-Limson et al. (2012) / USA	Prospective Multi-centre	N=1951 (67.0%) 60.9 (13.0) Acute MI with increased troponin or creatine kinase-	SF-12, SAQ (QoL subscale)	Social support (ESSI)	1, 6, and 12 months	Patients with persistently high support experienced higher disease-specific QoL (p<0.001) and general physical (p<0.001 at 1 month, p=0.049 at 6 months, and p=0.006 at 12 months) and mental functioning	3

		MB levels and (>20 min of ischaemic symptoms or electrocardiographic ST changes.				($p<0.001$) across time points.	
Lidell et al. (2015) / 18 European countries	International cross-sectional Multi-centre	N=452 (0.0%) 61.0 (11.8) Not reported	MacNew	Socio-demographic factors (marital status, BMI, managerial responsibility)	6 months	In the Northern Europe region, physical HRQoL was predicted by marital status ($p<0.02$), and social HRQoL by managerial responsibility ($p<0.01$) in the Eastern Europe region including Hungary, Poland, Russia, and Ukraine. Emotional HRQoL was predicted by marital status ($p=0.02$), and physical HRQoL by BMI ($p=0.02$) in the older age group.	3
Mayou et al. (2000) / UK	Not reported Two centres	N=344 (73.0%) 63.2 Daily screening of biochemistry records for requests for cardiac enzyme and electrocardiographic tests	SF-36	Depression and anxiety (HADS)	3 and 12 months	Patients who had been distressed at baseline had a significantly worse outcome at both 3 months and 1 year on all dimensions of the SF-36 than non-distressed patients ($p<0.05$).	2
McBurney et al. (2002) / USA	Cross-sectional A single centre	N=200 (68.0%) 63.4 (13.1) Acute MI (International Classification of Diseases-9 code 410)	SF-12	Patient and disease characteristics (age, personal history, comorbidities, and rehospitalisation)	7 months	History of chronic heart failure ($p=0.02$) and transient ischaemic attack ($p=0.04$), the total number of other illnesses ($p=0.001$), and rehospitalisation due to heart disease ($p<0.001$) were related to lower physical HRQoL. Age ($p=0.006$) was related to lower mental HRQoL.	3
Norekval et al. (2010) / Norway	Survey A single centre	N=145 (0.0%) 72.0 International Classification of Diseases-9 code 410	WHOQOL-BREF	Sense of coherence (SOC-29)	6 months	There was a significant difference between all sense of coherence groups on overall QoL ($p<0.001$). The significant positive relationships between SOC and all QoL domains at three months to five years after MI remained stable at a follow-up after six months ($p<0.001$).	3

Norris et al. (2007) / Canada	Prospective cohort Multi-centre	N=486 (79.0%) Women=66.0 Men=59.0 Q or non-Q wave acute MI	SF-36	Gender	1 year	Significant gender differences were found for worse HRQoL among women at both baseline and 1-year post-acute MI compared to men (p<0.05).	2
Oginska-Bulik (2014) / Poland	Cross-sectional Two centres	N=86 (72.1%) 60.5 (10.1) Not reported	Life Satisfaction Questionnaire	Personality type (DS-14 scale), age, gender	The mean time since MI was 2.81± 2.62 years.	Subjects with D type of personality showed lower QoL compared to non-type D subjects (p<0.05). Gender was also not related to HRQoL. Those younger than 58 years showed a slightly higher HRQoL compared to those older than 58 years (p<0.05).	3
Oldridge et al. (1998) / Canada	Randomised controlled trial Multi-centre	N=201 (89.0%) 53.2 (9.0) Acute MI	QLMI, Quality of Well-Being Scale, Time Trade-off	Baseline cardiovascular risk	8-week and 12-month follow-ups	More improvement in HRQoL was associated with the absence of a previous MI, absence of angina, less smoking, and higher exercise tolerance as well as the absence of shortness of breath at 8 weeks (p<0.05) and 12 months (p<0.04).	3
Pettersen et al. (2008) / Norway	Cohort Multi-centre	N=408 (71.0%) 66.0 (12.0) Acute MI, defined as codes I21 and I22 in the International Statistical Classification of Diseases and Related Health Problems, tenth revision	SF-36	Socio-demographic factors, medical records	2.5 (SD 0.2) years	Age, time since the index MI, COPD, previous MI, and stroke predicted physical HRQoL in women (p<0.02). Education, COPD, infarct localisation, and subsequent MI predicted physical HRQoL in men (p<0.02). Smoking status, education, and Q-wave MI were determinants for mental HRQoL in men (p<0.02).	3
Rafael et al. (2014) / Hungary	Descriptive correlational and cross-sectional survey A single centre	N=97 (69.1) 56.1 (10.1) The basis of the electrocardiogram and subsequent enzyme rise	WHO Well-Being Scale	Depression (BDI), anxiety (STAI-T), vital exhaustion (MQ), sleep disturbance (AIS)	8.5 days after MI on average (3–14 days)	Vital exhaustion (p<0.0001) and anxiety (p<0.05) were found to have a significant correlation with subjective QoL.	3

Rankin et al. (2003) / USA	Repeated measure descriptive Multi-centre	N=30 (0.0%) 65.0 (12.8) Not reported	SF-36, QLI-C	Social support (PSP), psychological distress (POMS), cardiac functional status (DASI)	1 year	Social support (p=0.014) and mood states (p=0.034) were the only predictors of QoL for women. Cardiac functional status did not explain a significant proportion of the variance.	3
Saeed et al. (2011) / Pakistan	Cross-sectional A single centre	N=80 (61.0%) Age group (years) 45-50=14.0% 50-55=47.0% 56-60=39.0% The first MI by a consultant cardiologist, excluding silent MI	WHOQOL-BREF	Type D personality (DS-14)	Not reported	Higher scores on type-D personality had a negative impact on QoL in MI patients (p<0.001).	3
Sakai et al. (2011) / Japan	Prospective cohort Multi-centre	N=215 (100.0%) No post-discharge depressive symptoms=62.0 (10.0) Post-discharge depressive symptoms=59.0 (11.0) Ischaemic chest discomfort lasting at least 30 min; electrocardiographic changes, such as elevation of ST segment, abnormal Q-wave, and inverted T-wave; and elevated serum creatine phosphokinase that was more than twice the normal upper limit.	SF-36	Post-discharge depressive symptoms (MHI-5)	6 months post-discharge	The presence of depressive symptoms at 1 month after discharge adversely affected the recovery of HRQoL at 6 months (p<0.05).	1
Sertoz et al. (2013) / Turkey	Cross-sectional Multi-centre	N=998 (79.2%) 57.4 (10.1) Chest pain or shortness of breath, ST segment elevation, loss of R waves, and/or new	WHOQOL-BREF	Depression (BDI), comorbid medical conditions, age	Not reported	Both depression and comorbid medical conditions were found to have a negative impact on QoL of post-MI patients (p<0.03). Increasing age had a negative effect on both the physical (p<0.01) and social (p<0.0001) domains of QoL.	3

		pathological Q waves, elevation of creatinine phosphokinase-MB exceeding the normal limit or elevation of creatinine phosphokinase, serum troponin T or I to > 2 times normal					
Uchmanowicz et al. (2013) / Poland	Prospective A single centre	N=120 (63.0%) 62.5 (9.8) a positive troponin blood test and electrocardiographic changes (ST-segment elevation, ST-segment depression, or T-wave inversion)	SF-36	Diabetes, demographic and clinical variables	6 months	The influence of diabetes, multi-vessel disease, hypertension, and the high triglyceride level have negative impact on life quality evaluation (p<0.05).	3
Wang et al. (2016) / Singapore	Cross-sectional correlational A single centre	N=128 (89.8%) 55.4 (9.5) At least two of the following three conditions, including typical ischaemia chest pain, elevated cardiac enzyme levels in the serum, usually creatine kinase-myocardial band, and typical ECG changes of the pathological Q-wave that are consistent with ischaemia	SF-12v2, MIDAS	Depression and anxiety (HADS), monthly household income, ex-smoker, alcohol user, hypertension	The length of diagnosis of MI ranged from 15 days to 30 months.	Monthly household income (p=0.002) was identified as a predictor of physical HRQoL. For mental HRQoL, four predictors were identified—hypertension (p=0.017), ex-smoker (p=0.034), alcohol user (p=0.007), and anxiety (p<0.001). For overall HRQoL, anxiety (p=0.030), and depression (p=0.004) were significant predictors.	3

Wang et al. (2014) / China	Cross-sectional Two centres	N=192 (76.6%) 59.8 (12.1) At least two of the following three criteria: typical ischaemic chest pain, elevated cardiac enzyme levels in the serum, usually creatine kinase-MB, and typical ECG changes consistent with ischaemia	SF-36, MIDAS	Depression and anxiety (HADS), socio-demographic and clinical variables (smoking status, hypertension, heart failure)	1 and 4 weeks (mean of 13 days) after the MI.	Six predictors were identified for poor physical HRQoL: increasing age, smoking status, heart failure, hypertension, anxiety, and depression ($p<0.05$). Heart failure, anxiety, and depression were identified for poor mental HRQoL ($p<0.05$). Four predictors were identified: age, heart failure, anxiety, and depression for overall HRQoL ($p<0.05$).	3
White et al. (2007) / USA	Descriptive Multi-centre	N=27 (0.0%) 60.7 (15.4) Not reported	SF-36	Depression (BDI)	Surveys were completed an average of 11 months after MI (SD = 9.88 months)	Depression had a significant negative correlation with mental HRQoL ($p=0.0005$), but not correlated with physical HRQoL ($p=0.360$).	3
Williams et al. (2012) / UK	Not reported A single centre	N=192 (71.9%) 66.0 (10.8) Not reported	MacNew	Type D personality (DS14)	3 months	Type D was significantly associated with poor QoL in MI patients ($p<0.001$).	3
Wrzesniewski et al. (2012) / Poland	Prospective A single centre	N=83 (59.0%) 50.2 (6.2) First uncomplicated MI	MacNew	Sense of coherence (SOC-13), level of education	1 year	Sense of coherence is a good predictor of HRQoL one year after MI both in men ($p<0.05$) and in women ($p<0.01$). Significant HRQoL predictors in the physical dimension included level of education ($p=0.03$).	3

AIS=Athens Insomnia Scale; BDI=Beck Depression Inventory; BMI=Body Mass Index; BMS=Bare-Metal Stents; CCS=Canadian Cardiovascular Society; CIDI-Auto=Composite International Agnostic Interview; COPD=Chronic Obstructive Pulmonary Disease; CVA=Cerebro Vascular Accident; DASI=Duke Activity Status Index; DES=Drug-Eluting Stents; DS-14=the 14-item type D Scale; EF=Ejection Fraction; EPHPP = Effective Public Health Practice Project (1=strong, 2=moderate, 3=weak); ESSI=ENRICHD Social Support Instrument; GCQ=General Coping Questionnaire; GSE=General Self-Efficacy; HADS=Hospital Anxiety and Depression Scale; HAP= Human Activity Profile; HCS=Health Complaints Scale; HRQoL=Health-Related Quality of Life; IES=Impact of Events Scale; IPQ=Illness Perception Questionnaire; LVEF=Left Ventricular Ejection Fraction; MacNew=the MacNew Heart Disease Health-Related Quality of Life Questionnaire; MFI-20=Multidimensional Fatigue Inventory; MHI-5=Mental Health Inventory; MI=Myocardial Infarction; MIDAS=Myocardial Infarction Dimensional Assessment Scale; MLHFQ=Minnesota Living with Heart Failure Questionnaire; MOS-20=Medical Outcomes Study 20-item short-form General Health Survey; MQ=Shortened Maastricht Vital Exhaustion Questionnaire; MSQ-H=Multidimensional Support Questionnaire for Heart Patients; NHP=Nottingham Health Profile; NYHA=New York Heart Association; PCI=Percutaneous Coronary Intervention; POMS=Profile of Mood States; PSP=Preferred Support Profile; PSS=PTSD Symptom Scale; PTSD=Post Traumatic Stress Disorder; QLI-C=Quality of Life Index-Cardiac Version; QLMI=Quality of Life after MI questionnaire; QoL=Quality of Life; SAQ=Seattle Angina Questionnaire; SASRQ=Stanford Acute Stress Reaction Questionnaire; SCRI=Self-care Resource Inventory; SD=Standard Deviation; SF-12=Short Form-12; SF-36=the 36-item Short Form Health Survey; SHC=Somatic Health Complaints; SOC=Sense of Coherence Scale; STAI=Spielberger State-Trait Anxiety Inventory; TIMI=Thrombolysis In Myocardial Infarction; WHOQOL-BREF= World Health Organization Quality of Life Instrument Abbreviated.

Table 2. Summary of factors that affect HRQoL of patients with MI

Demographic factors	
Age	(Arnold et al. 2014; Beck et al. 2001; Bengtsson, Hagman & Wedel 2001; Hawkes et al. 2013; Ho et al. 2008; McBurney et al. 2002; Oginska-Bulik 2014; Sertoz et al. 2013; Wang et al. 2014)
Education level	(Pettersen et al. 2008; Wrzesniewski & Wlodarczyk 2012)
Employment status	(French et al. 2005; Lane et al. 2000)
Financial status	(Arnold et al. 2014; Kim, Kim & Hwang 2015; Wang et al. 2016)
Gender	(Arnold et al. 2014; French et al. 2005; Kim, Kim & Hwang 2015; Kristofferzon, Löfmark & Carlsson 2005a; Lane et al. 2001; Lane et al. 2000; Norris, Hegadoren & Pilote 2007; Oginska-Bulik 2014; Pettersen et al. 2008; Uchmanowicz et al. 2013; Wang et al. 2014)
Living alone	(Bucholz et al. 2011; French et al. 2005; Lane et al. 2001; Lane et al. 2000)
/ marital status	(Lane et al. 2000; Lidell et al. 2014)
Managerial responsibility	(Lidell et al. 2014)
Race	(Arnold et al. 2014)
Behavioural factors	
Physical activity	(Baas 2004; Hawkes et al. 2013; Lane et al. 2000; Oldridge et al. 1998)
Alcohol	(Hawkes et al. 2013; Wang et al. 2016)
Smoking	(Arnold et al. 2014; French et al. 2005; Hawkes et al. 2013; Oldridge et al. 1998; Pettersen et al. 2008; Wang et al. 2016; Wang et al. 2014)
BMI	(Lidell et al. 2014)
Disease-related factors	
Severity of MI	(Benyamini et al. 2013; Coyne et al. 2000; Ecochard et al. 2001; Kim, Kim & Hwang 2015; Lane et al. 2001; Lane et al. 2000; Pettersen et al. 2008; Rankin & Fukuoka 2003; Uchmanowicz et al. 2013)
Symptoms	
Health complaints	(Brink, Karlson & Hallberg 2002)
Chest pain	(Joekes, Maes & Warrens 2007)

Shortness of breath	(Oldridge et al. 1998)
Symptoms	(Kim, Kim & Hwang 2015)
Angina	(Arnold et al. 2014; Bengtsson, Hagman & Wedel 2001; Boersma, Maes & van Elderen 2005; Oldridge et al. 1998)
Fatigue	(Alsén & Brink 2013; Brink et al. 2005)
Vital exhaustion	(Rafael et al. 2014)
Sleep disturbance	(Rafael et al. 2014)
Illness duration	(Joekes, Maes & Warrens 2007)
In-hospital complications	(Beck et al. 2001)
Previous MI	(French et al. 2005; Oldridge et al. 1998; Pettersen et al. 2008)
Comorbidities	(Joekes, Maes & Warrens 2007; McBurney et al. 2002; Pettersen et al. 2008; Sertoz et al. 2013; Uchmanowicz et al. 2013; Wang et al. 2016; Wang et al. 2014)
Psychosocial factors	
Anxiety	(Benyamini et al. 2013; Dickens et al. 2006; French et al. 2005; Hawkes et al. 2013; Hosseini et al. 2014; Lane et al. 2001; Lane et al. 2000; Mayou et al. 2000; Rafael et al. 2014; Wang et al. 2016; Wang et al. 2014)
Depression	(Arnold et al. 2014; Beck et al. 2001; Benyamini et al. 2013; Brink et al. 2005; Brink, Karlson & Hallberg 2002; de Jonge et al. 2006; Dickens et al. 2006; French et al. 2005; Hawkes et al. 2013; Hosseini et al. 2014; Lane et al. 2001; Lane et al. 2000; Mayou et al. 2000; Rafael et al. 2014; Sakai et al. 2011; Sertoz et al. 2013; Wang et al. 2016; Wang et al. 2014; White & Groh 2007)
Psychologic distress	(Rankin & Fukuoka 2003)
Stress	(Arnold et al. 2014; Doerfler, Paraskos & Piniarski 2005; Ginzburg & Ein-Dor 2011)
Illness perception	(French et al. 2005)
Coping strategies	(Brink, Karlson & Hallberg 2002)
Overprotection / active engagement	(Joekes, Maes & Warrens 2007)
Self-care	(Baas 2004)

Self-efficacy	(Boersma et al. 2006; Brink et al. 2012; Hawkes et al. 2013)
Sense of coherence	(Norekvål et al. 2010; Wrzesniewski & Wlodarczyk 2012)
Social support	(Boersma, Maes & van Elderen 2005; Bucholz et al. 2014; Hawkes et al. 2013; Leifheit-Limson et al. 2012; Rankin & Fukuoka 2003)
Type D personality	(Oginska-Bulik 2014; Saeed, Niazi & Almas 2011; Williams et al. 2012)

Demographic factors

Several demographic factors were closely associated with HRQoL in patients with MI. Those factors include: age, gender-identity, living alone or marital status, education level, employment status, managerial responsibility, race, and financial status. Specifically, older age, higher education, being employed, having more managerial responsibility, Caucasian, higher income or not having financial difficulties, being male, and not living alone or having a partner were associated with higher HRQoL than the comparators.

Age

Nine studies reported that age was closely associated with HRQoL in patients with MI (Arnold et al. 2014; Beck et al. 2001; Bengtsson, Hagman & Wedel 2001; Hawkes et al. 2013; Ho et al. 2008; McBurney et al. 2002; Oginska-Bulik 2014; Sertoz et al. 2013; Wang et al. 2014). While the majority of studies revealed that older age was associated with better HRQoL in patients with MI (Arnold et al. 2014; Bengtsson, Hagman & Wedel 2001; Ho et al. 2008; McBurney et al. 2002), there were two studies in which the finding was the opposite. For example, the studies conducted by Oginska-Bulik (2014) and Beck et al. (2001) found that older age predicted lower HRQoL, particularly in the physical domains at six-month and 12-month follow-ups (Beck et al. 2001). However, the results of three studies suggest that except for the physical dimension of the HRQoL, which was more adversely affected in older patients, younger patients with MI experienced poorer HRQoL life than older patients did (Hawkes et al. 2013; Sertoz et al. 2013; Wang et al. 2014).

Gender-identity

Eleven studies examined the association between gender-identity and HRQoL (Arnold et al. 2014; French et al. 2005; Kim, Kim & Hwang 2015; Kristofferzon, Löfmark & Carlsson 2005a; Lane et al. 2001; Lane et al. 2000; Norris, Hegadoren & Pilote 2007; Oginska-Bulik 2014; Pettersen et al. 2008; Uchmanowicz et al. 2013; Wang et al. 2014). Except for three studies, all the other eight studies showed a consistent result, suggesting that women after MI report lower HRQoL than their male comparators. In Wang et al.'s study (2014), women, immediately after MI, reported lower HRQoL than men, particularly in physical-related subscales of the 36-item Short Form Health Survey (SF-36) and the Myocardial Infarction Dimensional Assessment Scale (MIDAS) (Wang et al. 2014). Similarly, the short-term studies found that female patients showed significantly poorer HRQoL than male patients one month after MI, measured by the SF-36 and the Quality of Life Index-Cardiac Version (QLI-C) (Kristofferzon, Löfmark & Carlsson 2005a), at four months, as measured by the Dartmouth COOP Charts (Lane et al. 2000), and at the six-month follow-up when HRQoL was measured using the SF-36 (Uchmanowicz et al. 2013). Likewise, following patients up to one year, female patients with MI showed poorer HRQoL than male patients, as measured by different instruments including the SF-36 of a moderate study (Norris, Hegadoren & Pilote 2007), the Short Form-12 (SF-12), the Seattle Angina Questionnaire (SAQ) of a strong study (Arnold et al. 2014), the Minnesota Living with Heart Failure Questionnaire (MLHFQ) (Kim, Kim & Hwang 2015), and the COOP Chart System (Lane et al. 2001). However, the two studies found that gender-identity was not related to the Quality of Life after MI questionnaire (QLMI) scores at six months after MI (French et al. 2005), and to the SF-36 scores at an average of 2.5 years since MI (Pettersen et al. 2008). In contrast to the other studies, only one study reported that women had a higher HRQoL than men, as scored by the Life Satisfaction Questionnaire, at the mean time of 2.81 years since MI (Oginska-Bulik 2014).

Living alone / marital status

The effect of either living alone or marital status on HRQoL was examined in five articles reviewed in the current study (Bucholz et al. 2011; French et al. 2005; Lane et al. 2001; Lane et al. 2000; Lidell et al. 2014). Two articles, which used the COOP Chart System for measuring HRQoL in patients with MI, identified the positive association of HRQoL with having a partner or not living alone at four months (Lane et al. 2000) and the association remained significant at the 12-month follow-up (Lane et al. 2001). Consistently, a better HRQoL was observed in patients who did not live alone at one year after MI, as scored using the SF-12 and the SAQ (Bucholz et al. 2011). Moreover, marital status was a predictor of higher physical and emotional HRQoL in scores of the MacNew in a cohort of patients from European countries (Lidell et al. 2014). However, the QLMI scores of the British patients were not affected by their living status at six months (French et al. 2005).

Other demographic factors

Education level was one of the predictors of low physical HRQoL in men, as measured by the MacNew Heart Disease Health-Related Quality of Life Questionnaire (MacNew) at one year (Wrzesniewski & Wlodarczyk 2012) and by the SF-36 at 2.5-year follow-ups (Pettersen et al. 2008). Both studies reported that men with lower education level had significantly poorer physical HRQoL after MI. Being employed was strongly related to improved HRQoL at four months using the Dartmouth COOP charts (Lane et al. 2000) and at the six-month follow-up measured by the QIMI (French et al. 2005). Additionally, there was only one study that identified that women from Eastern European countries including Hungary, Poland, Russia, and Ukraine had better HRQoL in the social dimension if they had managerial responsibilities (Lidell et al. 2014). Of the 48 studies reviewed, there was also only one study which found that non-Caucasian was associated with poor HRQoL one year after first MI (Arnold et al. 2014). The financial status of participants was one of the predictors of HRQoL in the three papers reviewed. The results of these studies consistently suggested that patients who had lower monthly income or financial difficulties reported lower HRQoL than patients who had higher income or no financial difficulties (Arnold et al. 2014; Kim, Kim & Hwang 2015; Wang et al. 2016).

Behavioural factors

Some behavioural factors including physical activity, alcohol consumption, smoking, and body mass index (BMI) were significantly associated with HRQoL in patients after experiencing MI. In particular, patients who had a more active lifestyle, showed lower alcohol consumption, were non-smokers, and who had normal BMI presented higher HRQoL scores than their comparators.

Four studies examined the relationship between physical activity and HRQoL (Baas 2004; Hawkes et al. 2013; Lane et al. 2000; Oldridge et al. 1998). Patients who were physically active right before MI showed better HRQoL at four months after MI (Lane et al. 2000). Also, patients who participated in physical activities after discharge from hospital and who had an more intention to be involved in physical activity reported significantly higher HRQoL at the six-month follow-ups (Baas 2004; Hawkes et al. 2013). In addition, a higher exercise tolerance after the 8-week rehabilitation program also promised better HRQoL, as measured with the QLMI (Oldridge et al. 1998).

The association between alcohol use and HRQoL among patients with MI appears to be controversial. Alcohol users, referring to anyone who consumed alcohol, in Wang et al.'s study (2016) scored significantly lower in the mental dimension of the SF-12 than non-alcohol users, while another study did not find any associations between alcohol consumption and physical or mental dimensions of the SF-36 at six months after MI (Hawkes et al. 2013). Seven studies found that the smoking status of MI patients was associated with HRQoL (Arnold et al. 2014; French et al. 2005; Hawkes et al. 2013; Oldridge et al. 1998; Pettersen et al. 2008; Wang et al. 2016; Wang et al. 2014). Patients who had a history of smoking (Wang et al. 2016) or were smoking at the time of MI (Pettersen et al. 2008) scored low in the mental dimension of HRQOL. Patients who smoked at the time of MI also reported poorer physical functioning shortly after MI, as measured by the SF-36 immediately after MI (Wang et al. 2014), the SAQ (Arnold et al. 2014) and the QLMI (Oldridge et al. 1998) at one-year follow-up. Yet, two studies showed that smoking status had no relation with any dimensions of HRQoL, scored with the SF-36 (Hawkes et al. 2013) and the QLMI at six months (French et al. 2005). Only one study identified BMI as an indicator of low HRQoL in MI patients, particularly in the physical domain of the MacNew. This study recruited female patients aged over 65 years and examined the relationship between baseline BMI of MI patients and HRQoL at the six-month follow-up (Lidell et al. 2014).

Disease-related factors

Disease-related factors including severity of MI, symptoms, illness duration, in-hospital complications, previous MI, and comorbidities had a strong prediction to some aspects of HRQoL, measured using different instruments.

Severity of MI

The reviewed studies used several indicators to assess the severity of patient MI and examine the relationship between disease severity and HRQoL. These indicators included infarct location, left ventricular ejection fraction (LVEF), infarct-related artery patency, the Killip class, the Peel index scores, the New York Heart Association (NYHA) class, the Duke Activity Status Index (DASI), and Q-wave. Poor HRQoL was strongly associated with the higher Peel index score at four months (Lane et al. 2000) and 12 months from MI (Lane et al. 2001) as well as the higher NYHA class at longer than 12-month follow-ups (Kim, Kim & Hwang 2015). Baseline LVEF was also related with decreased HRQoL (Coyne et al. 2000; Kim, Kim & Hwang 2015) and Q-wave MI limitedly predicted the mental component of HRQoL in men at the 2.5-year follow-up (Pettersen et al. 2008). However, infarct-related artery patency (Coyne et al. 2000) or cardiac functional status measured using the DASI scores (Rankin & Fukuoka 2003) was unrelated to HRQoL outcomes. The location of infarction and the Killip class showed mixed results. A strong study conducted by Benyamini et al. (2013) did not find any association between infarct location and the Killip class with MI patients' HRQoL at the 10-year follow-up (Benyamini et al. 2013). Likewise, Ecochard et al. (2001) claimed that HRQoL was not affected by the Killip class of MI patients one year after MI (Ecochard et al. 2001). While, in another study, the location of infarction could predict men's physical HRQoL measured by the SF-36 at 2.5 years from MI (Pettersen et al. 2008), and the worse Killip class indicated more impaired HRQoL of the

Dartmouth COOP Charts 12 months after MI (Lane et al. 2001).

Symptoms

The reviewed studies consistently reported a negative association between angina symptoms and HRQoL scores (Arnold et al. 2014; Bengtsson, Hagman & Wedel 2001; Boersma, Maes & van Elderen 2005; Oldridge et al. 1998). Baseline cardiac-specific symptoms, such as chest pain and dyspnoea, fatigue, weakness, lack of energy and sleep disturbance showed strong associations with the mental component of the SF-36 at the five-month follow-up (Brink, Karlson & Hallberg 2002). Likewise, higher symptom scores on the Friedman-Heart Failure Symptom Checklist was associated with worse HRQoL measured by the MLHFQ at one year or longer follow-ups (Kim, Kim & Hwang 2015).

Among the cardiac symptoms, chest pain seemed to have an obvious and negative effect on the MacNew scores at three months and nine months of the follow-ups (Joekes, Maes & Warrens 2007). Additionally, patients with dyspnoea at baseline scored lower than those who did not experience shortness of breath in the QLMI measured HRQoL at the 8-week and 12-month follow-ups (Oldridge et al. 1998). Moreover, patients with higher scores on the Multidimensional Fatigue Inventory-20 at four months after MI reported poorer HRQoL at the two-year follow-up, as measured by the SF-36 (Alsén & Brink 2013). The Somatic Health Complaints Scale at one week after MI also had a prediction of the SF-36 scores at five months, particularly in men's physical HRQoL (Brink et al. 2005). Excessive fatigue shortly after MI, measured with the Shortened Maastricht Vital Exhaustion Questionnaire, and sleep disturbance, measured by the Athens Insomnia Scale and WHO Well-Being Scale, were also negatively associated with HRQoL scores at the acute phase of MI (Rafael et al. 2014).

Illness duration / in-hospital complications

There was only one study each which identified the impact of illness duration (Joekes, Maes & Warrens 2007) and in-hospital complications, which included reinfarction, shock, congestive heart failure, recurrent ischaemia, any arrhythmia, acute mitral regurgitation or acute ventriculoseptal defect or tamponade in a strong study (Beck et al. 2001). It was found that illness duration had a negative relationship with the social dimension of HRQoL measured using MacNew at three and nine months from a diagnosis of MI (Joekes, Maes & Warrens 2007). Among the in-hospital complications, shock predicted more improved physical HRQoL of the SF-36 at both six months and one year (Beck et al. 2001).

History of MI

Patients with a history of MI experienced greater impaired HRQoL than those with first-time MI at both eight weeks and 12 months, measured using the Quality of Well-Being Questionnaire (Oldridge et al. 1998). Likewise, women in Pettersen et al.'s study (2008) scored lower in the physical domain of the SF-36 if they had a previous experience of MI (Pettersen et al. 2008). However, in another study, no association was found between MI and HRQoL, measured by the QLMI at six months (French et al. 2005).

Comorbidities

The presence of comorbidities seems to affect HRQoL of patients with MI negatively. Several studies found patients with hypertension reported impaired HRQoL in the total score of the SF-36 at six months (Uchmanowicz et al. 2013), low mental HRQoL of the SF-12 after being diagnosed from 15 days to 30 months (Wang et al. 2016), poor physical HRQoL of the SF-36 at the acute phase of MI (Wang et al. 2014), and decreased physical and social dimensions of the World Health Organization Quality of Life Instrument Abbreviated (WHOQOL-BREF) in a cross-sectional study (Sertoz et al. 2013).

In addition to hypertension, HRQoL was also adversely affected by the total number of comorbidities, history of heart failure, transient ischaemic attack (McBurney et al. 2002), diabetes, multi-vessel disease, or high triglyceride level (Uchmanowicz et al. 2013). In particular, comorbid heart failure was identified as a predictor of worse scores in both physical and mental domains of the SF-36 and the total score of the MIDAS at the acute phase of MI (Wang et al. 2014). Moreover, the comorbidity of chronic obstructive pulmonary disease in both genders and stroke in women had a negative effect on the physical domain of the SF-36 of MI patients at longer follow-ups (Pettersen et al. 2008). In one study conducted by Joekes, Maes and Warrens (2007), the presence of other chronic illnesses, which were not specified, was negatively associated with physical and global HRQoL scores (Joekes, Maes & Warrens 2007).

Psychosocial factors

Psychosocial factors are one of the most frequently studied variables in the HRQoL literature targeting MI patients. Anxiety and depression were measured more frequently than other studies, appearing in 11 and 19 of 48 studies, respectively. Other psychosocial factors examined in the literature include: stress, social support, illness perception, coping strategies, overprotection, active engagement, self-care, self-efficacy, sense of coherence, and type D personality. Patients scored lower HRQoL when they had higher anxiety, depression and stress, lower social support, illness perception, coping strategies, self-efficacy and sense of coherence, were overprotected, had a partner less actively engaged, and had type D personality. Yet, there was an insufficient relation between self-care resources of patients and their HRQoL.

Anxiety

The impact of anxiety on HRQoL of patients with MI has been widely studied. A higher anxiety level at baseline was associated with poorer HRQoL at six-month follow-up, as measured by different generic and disease-specific quality of life tools including the SF-36 (Hawkes et al. 2013; Mayou et al. 2000; Wang et al. 2014), the SF-12 (Wang et al. 2016), the Dartmouth Coop Chart (Lane et al. 2000), WHO Well-Being Scale (Rafael et al. 2014), the MIDAS (Wang et al. 2016; Wang et al. 2014), and the QLMI (French et al. 2005). Anxiety also predicted HRQoL of MI patients in longer follow-ups (one year), using the SF-36 (Dickens et al. 2006; Mayou et al. 2000) and the Dartmouth COOP Chart (Lane et al. 2001). Baseline anxiety was significantly and negatively associated with impaired HRQoL one year after MI (Lane et al. 2001; Mayou et al. 2000). This was not supported by Dickens et al. (2006) who found baseline anxiety did not have a significant association with HRQoL at one year.

Depression

The impact of depression on HRQoL of MI patients has also been widely studied and revealed mainly consistent results. A cross-sectional study found that depression negatively affected physical and social dimensions as well as the total score of the WHOQOL-BREF (Sertoz et al. 2013). The total scores of the MIDAS (Wang et al. 2016) and the WHO Well-Being Scale (Rafael et al. 2014) were also affected by the experience of depression immediately after MI. These results are consistent in a study that used a shorter follow-up. Patients who experienced depression after MI scored lower in the SF-36 and the MIDAS (Wang et al. 2014) at the one-month follow-up. At the six-month follow-up, depression at baseline (Beck et al. 2001; French et al. 2005) and depression at one month in a strong study (Sakai et al. 2011) had also a significant prediction to all the dimensions including emotional, physical, and social of the QLMI scores (French et al. 2005) as well as physical and mental domains of the SF-36 (Beck et al. 2001; Sakai et al. 2011) and overall HRQoL of the EuroQol (Beck et al. 2001). The results are in line with the result of a four-month follow-up study, which found an independent and strong correlation between depression and HRQoL, as measured by the Dartmouth COOP Charts in a study rated strong (Lane et al. 2000).

On the other hand, a study claimed that depression immediately after MI was significantly associated with the physical component of HRQoL but not the mental dimension at the five-month follow-up (Brink, Karlson & Hallberg 2002), while results of two other studies showed a significant association between baseline depression and mental HRQoL, but not physical HRQoL, at six months (Hawkes et al. 2013), and at an average of 11 months after MI (White & Groh 2007). Additionally, higher depression one week after MI predicted lower physical HRQoL in women and mental HRQoL in men at one year (Brink et al. 2005). Three other long-term studies also identified that patients who reported higher depression scores had lower HRQoL one year after MI, as measured by the SAQ in a strong study (Arnold et al. 2014), the SF-36 in two moderate studies (de Jonge et al. 2006; Mayou et al. 2000), and the COOP Charts (Lane et al. 2001). Similarly, psychologic distress, measured using the short form Profile of Mood States in women who experienced MI one year prior, was adversely associated with HRQoL measured by the QLI-C (Rankin & Fukuoka 2003). This association was consistently observed at the five-year follow-up (Hosseini et al. 2014) and at the ten-year follow-up (Benyamini et al. 2013). On the contrary, one study found that depression immediately after MI did not predict impaired HRQoL in the physical aspect at one year; however, depression assessed at six months predicted physical HRQoL of patients 12 months after MI (Dickens et al. 2006).

Social support

Lower social support, assessed with the ENRICHD Social Support Instrument (ESSI) in a strong study, could predict worse physical and mental HRQoL scores on the SF-36 at six months (Hawkes et al. 2013). Also, in the other two studies, scores of the ESSI were significantly related to HRQoL scores in both physical and mental domains of the SF-12 and the overall scores of the SAQ at 12 months post-MI (Bucholz et al. 2014; Leifheit-Limson et al. 2012). Likewise, social support, measured by the Preferred Support Profile, showed a significant prediction for HRQoL in female patients at the 12-month follow-up (Rankin & Fukuoka 2003). A lower level of perceived social support, measured with the Multidimensional Support Questionnaire for Heart Patients, also predicted lower scores in the MacNew at four months (Boersma, Maes & van Elderen 2005).

Other psychosocial factors

The impact of stress on HRQoL of patients after MI was consistent across the studies. The level of stress immediately after MI (Arnold et al. 2014; Ginzburg & Ein-Dor 2011), three to six months after MI (Doerfler, Paraskos & Piniarski 2005) and approximately seven months after discharge from hospital (Ginzburg & Ein-Dor 2011) negatively affected HRQoL of MI survivors at the three to six-month follow-up (Doerfler, Paraskos & Piniarski 2005), at the one-year follow-up (Arnold et al. 2014), and at the eight-year follow-up (Ginzburg & Ein-Dor 2011).

The relationship between illness perception and HRQoL among patients with MI has not been widely studied, yet one study found that the scores of the Illness Perception Questionnaire were positively associated with HRQoL of the patients at the six-month follow-up, assessed using the QLMI (French et al. 2005). In addition, only one study examined the association between applied coping strategies, including adaptation, management of illness and stress, and HRQoL of patients with MI. This study found that coping strategies were positively associated with both physical and mental dimensions of HRQoL, measured by the SF-36 at five months after discharge from hospital (Brink, Karlson & Hallberg 2002). Patients' HRQoL was also influenced by patients' perception of their partner's overprotection and active engagement. The more patients perceived their partners overprotecting them, the worse physical HRQoL they showed after nine months, while active engagement, which presented patients' perception towards partner's support in patient's emotion and solving problems, was positively linked to enhanced emotional, social and overall HRQoL, as measured by the MacNew (Joekes, Maes & Warrens 2007). In one study, self-care factors including self-care knowledge and resources, assessed by the Self-care Resource Inventory (SCRI), showed a low association with HRQoL scores in patients with MI (Baas 2004). Three studies included in this review examined self-efficacy in general (Brink et al. 2012), with respect to the achievement of goals (Boersma et al. 2006), and in regards to physical activity (Hawkes et al. 2013). This concept reflected MI patients' beliefs that their behaviours were responsible for the outcomes (Brink et al. 2012). Higher general self-efficacy, measured with the General Self-Efficacy Scale at four months after MI, was able to predict better HRQoL after two years (Brink et al. 2012). Additionally, higher self-efficacy on goal attainment predicted better physical and social dimensions of HRQoL, assessed by the MacNew at four months (Boersma et al. 2006), while low level of confidence in undertaking physical activities was a predictor of low physical HRQoL, measured with the SF-36 at six months (Hawkes et al. 2013). The association between HRQoL and sense of coherence was examined in two studies. Sense of coherence refers to the extent to which one has a pervasive, enduring though dynamic feeling of confidence (Wrzesniewski & Wlodarczyk 2012). This concept was found to be significantly and positively associated with HRQoL in patients with MI at six months (Norekvål et al. 2010) and one year after MI (Wrzesniewski & Wlodarczyk 2012). The current review revealed that the Type D personality, assessed by the 14-item Type D Personality Scale, was strongly related to the low level of HRQoL in patients with MI (Oginska-Bulik 2014; Saeed, Niazi & Almas 2011; Williams et al. 2012), as was assessed using the MacNew (Williams et al. 2012), the WHOQOL-BREF (Saeed, Niazi & Almas 2011), and the Life Satisfaction Questionnaire (Oginska-Bulik 2014).

2.4.5. Discussion

Our comprehensive review reveals that patients who have particular factors listed above at the early stage after MI could show lower HRQoL than their comparators during the recovery phase. Among nine demographic factors examined in the literature, the effect of age was found to be a predictor of HRQoL among patients with MI. In particular, older patients had better HRQoL except for the physical domain, which was negatively affected by older age. The fact that older people tend to have more sedentary behaviours and limitations related to physical activities may cause decreased physical HRQoL (Longmore et al. 2011). Thus, increasing physical activity in this patient group can be vital to optimising HRQoL (Sun, Buys & Jayasinghe 2014). For instance, the Tai Chi program can be apt to encourage older patients to exercise after MI (Song et al. 2009). Gender-identity was another widely studied demographic factor. Most studies of the association between gender-identity and HRQoL reviewed in this study suggested that MI could impose a greater adverse impact on HRQoL of women than that of men. However, considering the fact that women in the general population also score lower on the SF-36 than men in the general population, similar effects to both female and male patients can be assumed (Pettersen et al. 2008). Regarding the other demographic factors, a higher level of education, being employed, higher income, involvement in more managerial responsibility, and being Caucasian were associated with higher HRQoL in MI patients. Yet, there was an insufficient number of studies to draw a clear conclusion.

In cases where patients were more involved in physical activity, consumed less alcohol, were non-smokers, and had a BMI in the normal range, their HRQoL scores tended to be higher. A previous review found that the cardiac rehabilitation programs with exercise were helpful for recovering HRQoL after MI (Kang et al. 2016). Promoting patient participation in a cardiac rehabilitation program, which is a comprehensive intervention including exercise, education or counselling and monitoring by health professionals (Kang et al. 2016), can be one of the ways to enhance patients' physical activities, and risk-reducing behaviours in the form of smoking cessation and reducing alcohol consumption in the recovery phase of MI. On the other hand, the disease-related factors are unlikely to be modified despite the fact that having more disease-related factors tend to cause decreased HRQoL after MI. Thus, it seems that altering or preventing modifiable factors will be more effective strategies for the recovery of HRQoL in patients with MI (Yusuf et al. 2004).

It was consistent throughout the previous literature that anxiety, depression, and stress had a significantly negative impact on MI patients' HRQoL. Early identification and interventions for depression, anxiety, and stress may help improve HRQoL in the early stage of recovery from MI (Arnold et al. 2014; Rafael et al. 2014; Wang et al. 2016). Depression can increase the risk of developing CHD by 1.64 times, and patients with CHD who have the comorbidity of depression show poorer prognoses (Wulsin & Singal 2003). These patients have 69% and 78% greater risks of cardiac death and all-cause deaths, respectively (Barefoot et al. 1996). It is also known that patients with MI have three times higher probability of depression than the general population (Lichtman et al. 2008). Likewise, anxiety can increase 26% of CHD risk and 48% of cardiac death (Holt et al. 2013) and the close relationship between anxiety and CHD cannot be overlooked (Davies & Allgulander 2013). Therefore, in accordance with the recommendations of the American Heart Association for depression and CHD, depression should be routinely considered in the treatment of CHD based on the fact that depressive symptoms of patients with heart disease may reflect their medical condition (Lichtman et al. 2008).

Social support had a strong influence on HRQoL. It is important to consider perceived social support as a part of the treatment for MI patients since social support is closely associated with outcomes of heart disease including morbidity and mortality (Lett et al. 2005; Uchino 2006). Social support can be relatively easily modified by giving education programs for patients' caregivers or expanding social service within the community so that patients can be supported and encouraged to cope with the aftermath of MI (Kristofferzon, Löfmark & Carlsson 2005b). It was found throughout the literature review that having higher scores of illness perception, coping strategies, self-efficacy and sense of coherence, having partners or caregivers being involved in appropriate protection and actively engaged in the process of the treatment, and not having a type D personality were associated with increased HRQoL after MI. As the psychosocial factors except the type D personality are considered as modifiable factors, it can be more effective and efficient to pay attention to these factors for recovering HRQoL among patients with MI when patients undergo the process of treatments.

Our review revealed several areas where the evidence is not sufficient hence further research is warranted. For example, an age-adjusted and/or sex-adjusted study of comparing HRQoL in female and male patients in comparison with the general female and male population may be needed to explore correlations between age, gender-identity and HRQoL. Similarly, in the majority of studies included in this review, the ratio of female to male subjects was observed to be unbalanced with significantly fewer females. Therefore, it is suggested that recruitment targeted female patients with MI will be needed for future studies in order to make these adjustments. Although the behavioural factors are mostly modifiable through cardiac rehabilitation programs or counselling, studies of these factors and HRQoL are sparse. Despite the fact that sleep disturbance was closely associated with cardiovascular disease including MI, and had a strong association with HRQoL, the relationship between sleep disturbance and HRQoL has been scarcely studied (Rafael et al. 2014). A study conducted by Redeker and Hilkert (2005) examined the relationships of subjective and objective sleep problems, including sleep quality, duration and continuity, with physical and mental health, measured by the SF-36, among heart failure patients whose LVEF was less than 35%. Given the importance of sleep quality and continuity for physical and mental HRQoL, further studies on sleep disturbance of MI patients are also recommended for developing effective clinical evaluation and interventions (Redeker & Hilkert 2005). Likewise, the relationship between illness perception and HRQoL among patients with MI has not been widely studied, yet there is evidence that the scores of the Illness Perception Questionnaire had an association with HRQoL in patients with MI after six months assessed using the QLMI (French et al. 2005). Studies of the relationship between HRQoL and these factors need to be identified due to the importance of improvement in health outcomes of MI patients. Moreover, each study in this review has focused on a few variables. Therefore, one single study examining these variables together can be recommended in order to determine correlations of various factors affecting HRQoL in patients with MI.

Although the current review covered broad facets, there are some limitations in this review. First, despite rigorous search and study selection, there may have been some potentially relevant studies omitted due to our limitation to studies in English, the search duration of 20 years, and the exclusion of grey literature. Second, due to the heterogeneity among the studies included in the review, only a descriptive review was possible. Despite these limitations, the current review addressed critical factors, which were significantly associated with HRQoL among patients with MI throughout the previous literature.

2.4.6. Conclusion

There seem to be various types of factors including modifiable and non-modifiable ones that affect different dimensions of HRQoL in patients with MI. Identifying these factors can provide early detection of patients who tend to have worse HRQoL in the recovery or rehabilitation stage of post-MI, focusing on adjustable factors, such as behavioural and psychosocial ones which would be more effective in helping them recover HRQoL to the normative level after experiencing MI.

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2.5. Interventions that improve health-related quality of life in patients with myocardial infarction

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2.5.1. Abstract

Purpose: Patients with myocardial infarction (MI) often report lower health-related quality of life (HRQoL) than those without MI. Interventions can affect HRQoL of these patients.

Methods: Three electronic databases were searched and limited to articles peer-reviewed and published in English between 1995 and 2015. We screened titles and abstracts of the retrieved articles for studies that examined effectiveness of interventions to improve HRQoL in patients with MI.

Results: Twenty-three studies were found that examined the effects of behavioural interventions—cardiac rehabilitation programs (CRP), education and counselling programs, and other psychological and cognitive interventions—to improve HRQoL in patients with MI. A supervised exercise-based CRP at the hospital was found more effective in improving HRQoL of MI patients compared to a home-based unsupervised exercise program. The education and counselling interventions showed positive effects for better HRQoL in the shorter terms. In addition, psychological and cognitive interventions were also reported as having the potential to improve HRQoL of patients with MI.

Conclusions: Most CRPs and other interventions were beneficial to MI patients. Therefore, patients with MI should be encouraged to participate in programs that can help promote their HRQoL.

2.5.2. Introduction

Cardiovascular disease (CVD) is the leading cause of death globally (World Health Organisation 2015); mortality from all types of heart disease increased worldwide between 2000 and 2012 (WHO 2014). In particular, myocardial infarction (MI) is a life-threatening event caused by a complete blockage in a blood vessel that supplies blood, oxygen and nutrients to the heart muscle (Thygesen et al. 2012). The survival of patients with MI has remarkably improved in developed countries as the result of timely use of thrombolysis and primary percutaneous coronary intervention (PCI) that help restore the flow of the culprit vessels (Runge, Stouffer & Patterson 2010). Yet, these patients frequently experience negative physiological effects, particularly depression and uncertainty, as well as other adverse effects, such as a disrupted daily life associated with persistent and/or reoccurring disease symptoms (Eriksson et al. 2013). As a result of MI, patients often report reduced health-related quality of life (HRQoL), which is increasingly recognised as a critical outcome measure in health care (Foxwell, Morley & Frizelle 2013).

HRQoL is a multidimensional concept that encompasses self-reported measures of physical and mental health (Centres for Disease Control and Prevention 2012). The American Heart Association recommends assessment of HRQoL as an integral part of patient-reported health status assessment in patients with cardiovascular disease (Rumsfeld et al. 2013). HRQoL has been found to be an independent predictor of death and future cardiac events in patients with MI (Eriksson et al. 2013). In the acute phase of MI, the focus is often placed on physical health; however, after discharge from hospital or considering the long-term effects, HRQoL becomes a significant factor reflecting the impact of the disease on diverse aspects of the patient's life (Eriksson et al. 2013). Patients with MI and their health care providers often discuss HRQoL to develop a shared view of the disease and treatment outcomes (Eriksson et al. 2013; Wingate 1995). Some studies suggest HRQoL as an indicator of therapeutic response (Dal Boni, Martinez & da Silva Saccomann 2013; Sun, Buys & Jayasinghe 2014). This understanding is important to help optimise the management of MI and assist patients to return to a normal active life and to obtain required lifestyle changes.

Health professionals are in a unique position to intervene and support patients as they recover from MI. While medical interventions, thrombolytic therapy and coronary angioplasty have important roles in survival of patients with MI (Pettersen 2008), interventions that improve patients' recovery after discharge also need to be developed and used to help promote patients' overall health status, wellbeing and HRQoL. Currently, there is no comprehensive literature review to examine the evidence on HRQoL interventions for patients with MI. This study aims to review the effectiveness of behavioural interventions to improve the HRQoL of patients with MI.

2.5.3. Methods

Literature Search

The review was conducted as a narrative literature review. Relevant studies were identified by searching the electronic databases including MEDLINE, CINAHL and PsycINFO. Key search terms included: health-related quality of life/quality of life/HRQoL/QoL and myocardial infarction/heart attack/MI. At the stage of screening, only studies that focused on behavioural interventions were included. Search was limited to English language and peer-reviewed articles published from 1995 to October 2015. Management of patients with MI has significantly improved over the last couple of decades. Thus, the search was limited to the last 20 years to ensure that the interventions were still relevant.

Table 3. Inclusion/exclusion criteria

Inclusion criteria	Exclusion criteria
• Subjects exclusively with MI • English language • Peer-reviewed	• Scientific letters or posters • Validation studies of measurements • Qualitative studies • Studies about medical interventions

Study Selection

A total of 2523 articles were found from the search and 1996 were retained after duplicates were removed. Firstly, 1996 articles were screened by titles and abstracts if they reported original data on HRQoL in patients exclusively with MI. 1879 studies were excluded due to irrelevant study subjects, irrelevant dependent variables, and validation studies of measurements. Scientific letters or posters as well as studies of applied qualitative methods were excluded. Table 3 described the inclusion and exclusion criteria of the study. Following the screening of the titles and abstracts, 116 potential articles were selected for further screening. A hand search of the reference lists of relevant published articles was done and resulted in 16 additional articles. These articles were missed in the initial search due to their titles not appropriately reflecting the studies. Among 132 studies screened by full-texts, 109 studies were excluded due to non-interventional studies or studies on medical procedures, such as PCI. Finally, 23 studies on HRQoL of MI patients combined with the effects of a particular intervention were included in the present review (Figure 4).

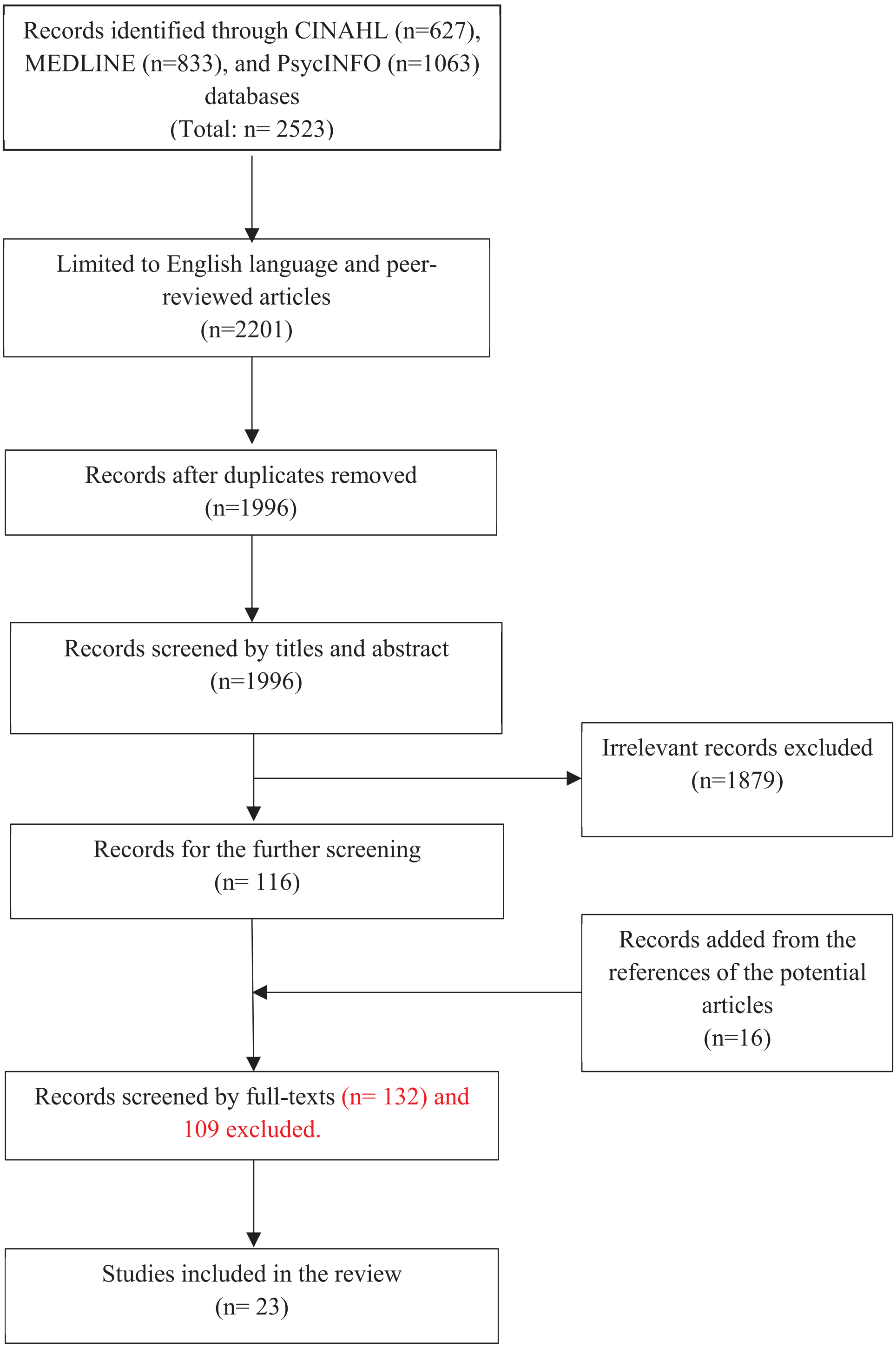

Figure 4. The process of article selection

2.5.4. Results

Participants and setting

Table 4 summarises the characteristics of each study included in the review. Out of 23 articles, 9 studies were conducted in Europe (the UK, Norway, and the Netherlands, 2 studies each, and Finland, Italy, and Ireland, 1 study each). The remaining studies were carried out in North and South America (2 studies in Brazil, and 1 study in the US), Asia (3 studies in Japan, 2 studies in Iran, and 1 study each in Hong Kong, South Korea, Turkey, and China), and Australia (2 studies). The included studies were mainly randomised controlled trials (RCT; 14 studies), followed by prospective studies. Two of the reviewed studies also considered cost-effectiveness as an outcome measure (Marchionni et al. 2003; Yu et al. 2004) and one study analysed the cost-effectiveness of the program in an additional separate article (Hawkes, Patrao, Atherton, et al. 2013). The reviewed studies included a wide age range of participants (18-80 years), with a mean age group of 50-70 years. More male participants were recruited in most of the studies, and one study targeted male patients exclusively (Benetti, Araujo & Santos 2010). The reviewed studies recruited between 46 and 2481 participants. A few studies seemed to have smaller sample sizes because not all the eligible patients were able or willing to participate in the intervention (Boersma et al. 2006), or the sample size was calculated as smaller in randomised controlled trials of a specific intervention (Varnfield et al. 2014). In a controlled clinical trial, 45 patients each group were found to be enough based on 80% power analysis (Uysal & Özcan 2012).

Assessment of HRQoL

A range of tools were used to assess HRQoL in the reviewed studies. These included the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36), the Sickness Impact Profile (SIP), EuroQol-5D (EQ-5D), the World Health Organization Quality of Life Questionnaire Brief Version (WHOQOL-BREF), the 8-item Life Satisfaction Scale (LSS), a 1-10 ladder technique (Ladder of Life, LOL), the Time Trade-off instrument, and Quality of life, which is a short 10 item visual analogue scale (Dugmore et al. 1999), as a generic measurement. The SF-36 was one of the most widely used generic tools to measure HRQoL in this patient population (Wang et al. 2012), used in 11 reviewed studies (Hanssen et al. 2007, 2009; Hawkes et al. 2013; Izawa, Hirano, et al. 2004; Izawa, Yamada, et al. 2004; Mendes de Leon et al. 2006; Uysal & Özcan 2012; Wang et al. 2012; West, Jones & Henderson 2012; Yonezawa et al. 2009; Yu et al. 2004). It was a global

QoL tool addressing eight domains, including physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional and mental health, which were also classified with two psychometrical dimensions—physical component summary (PCS) and mental component summary (MCS) (Hawkes, Patrao, Atherton, et al. 2013). The measurement was scored from 0 to 100 with lower scores indicating lower HRQoL and higher scores representing better HRQoL (Izawa, Yamada, et al. 2004).

Other studies used disease-specific tools, such as the MacNew Heart Disease HRQoL Instrument (MacNew), the Myocardial Infarction Dimensional Assessment Scale (MIDAS), or the Quality of Life Index (QLI)–Cardiac Version III. Among these specific tools, the MacNew questionnaire was the most commonly used tool to assess HRQoL. MacNew was an improved version of Quality of Life after Myocardial Infarction (QLMI) Questionnaire, consisting of 27 items including physical, emotional, social function domains and five items about symptoms. Each item was scored within a range of 1 to 7, with higher total scores indicating better HRQoL (Höfer et al. 2004). In three retrieved studies (Uysal & Özcan 2012; Wang et al. 2012; Yousefy et al. 2009), researchers used both generic and disease-specific QoL instruments.

Interventions to improve the HRQoL of patients with MI

The effectiveness of behavioural interventions was examined in 23 studies. The interventions implemented were cardiac rehabilitation programs (CRP), education and counselling programs, along with other psychological and cognitive interventions. Heterogeneity of the interventions was observed across the reviewed studies, as the result, the studies were grouped and discussed according to the type of intervention. The assessment points of HRQoL of MI patients were mostly comparison between the intervention group and the control group by asking with various patient-reported QoL questionnaires as well as dimensions of HRQoL that were improved after the interventions.

Table 4. Summary of the studies that examined the effectiveness of an intervention on HRQoL of patients with MI

1st Author (year) /Country	Study design	Participants / Male %	HRQoL Assessment	Intervention	Comparison	Follow-ups	Key findings
Bagheri et al. (2007) / Iran	RCT	62 patients with MI who were referred to hospitals / Male=NR	MacNew	A 4-week group counselling program (2 one-hour sessions/week)	No counselling	1 month (post-intervention)	Improved a total score in the IG ($p<0.001$) compared to the CG.
Benetti et al. (2010) / Brazil	Prospective study	87 patients (57.7 ± 6.1 years old) IGⅠ=29, IGⅡ=29, CG=29 / Male=100%	MacNew	Ⅰ: a 12-week high-intensity physical training (85% maximum heart rate) Ⅱ: a 12-week moderate-intensity training (75% maximum heart rate)	No exercise	After 12 weeks (post-intervention)	QoL improved significantly ($p<0.05$) in the IGⅠ (from 5.66 to 6.80) and in the IGⅡ (from 5.38 to 6.72), compared to the CG (from 5.30 to 5.15).
Boersma et al. (2006) / The Netherlands	Longitudinal study	46 outpatients excluded older than 70 years of age; CABG or angioplasty following their MI/ Male=NR	MacNew	The 4-month attainment of three midlevel goals shortly after discharge from hospital	None	4 months after MI (post-intervention)	Positive effects on social component of HRQoL ($p=0.05$).

Choo et al. (2007) / South Korea	A quasi-experimental design study with a non-randomized, pre-test–post-test control group	60 subjects admitted for a first MI, ≤75 years/ Male=81.7%	QLI–Cardiac Version III	A 8-week supervised exercise-based CRP (3 sessions/week) at the hospital	A self-administered home-based exercise program	8 weeks (post-intervention)	IG showed significant improvements in health/functioning (p<0.0001) and psycho/spiritual (p=0.016) subscales.
Dugmore et al. (1999) / UK	RCT	124 patients, IG=62, CG=62/ Male=98.4%	Quality of life—a short 10 item visual analogue scale	12-month regular weekly aerobic training program (3 times/week)	No formal exercise	12 months (post-intervention)	Improved QoL scores. Good prognosis group: IG= 85.9 vs CG= 66.7 (p<0.001) / poor prognosis group: IG = 80.8 vs CG= 59.4 (p<0.001)
Hanssen et al. (2007) / Norway	A prospective RCT	288 patients (IG=156, CG=132) and aged less than 80/ Male=80.9%	SF-36	A 6-month telephone follow-up intervention about common problems or queries and risk factor modification	One visit to a physician 6-8 weeks after discharge and subsequent visits to their general practitioner	6 months (post-intervention)	Significantly improved the HRQoL in the PCS score (p=0.039) in the IG compared to the CG, but no effects on the MCS score (p=0.447).

Hanssen et al. (2009) / Norway	A prospective RCT	288 patients admitted to the hospital with a diagnosis of AMI, excluded CABG/ Male=80.9%	SF-36	A 6-month telephone follow-up intervention about common problems or queries and risk factor modification	One visit to a physician 6-8 weeks after discharge and subsequent visits to their general practitioner	18 months after discharge (after a year of the intervention)	No long-term effects in the overall physical domain (p=0.250) and the overall mental domain (p=0.280).
Hawkes et al. (2013) / Australia	A parallel group, prospective RCT	430 adult MI patients/ Male=74.6%	SF-36	Telephone-delivered secondary prevention program including ten health coaching sessions over 6 months	Usual care	6-month follow-up (post-intervention)	Significant improvement in mental component (p=0.02), social functioning (p=0.04) and role-emotional (p=0.03) subscales.
Hevey et al. (2014) / Ireland	Not reported	89 patients (expressive writing=43; control=46) / Male=76%	MacNew	Expressive writing for 20 minutes per day for 3 consecutive days	Objective writing	After 3 months (post-intervention)	Higher total HRQOL (p<0.05).
Izawa et al. (2004) / Japan	Prospective observational study	124 AMI patients; outpatient CR group (n=82) and a non-CR group (n=42) / Male=77.4%	SF-36	8-week CRP covered individual education and exercise therapy(2/week)	No CRP	3-month follow-up (after a month of the intervention)	Significant improvements in the physical functioning (p=0.000), role-physical (p=0.000), general health (p=0.03), and vitality (p=0.03) subscales.

Izawa et al. (2004) / Japan	Observational study	109 AMI patients (89 men, 20 women; mean age, 63.5 ± 10.1 yrs) / Male=81.6%	SF-36	A supervised 5-month recovery-phase CRP including exercise therapy based on cardiopulmonary exercise testing and muscle strength testing	No CRP, no exercise	6-month follow-up (after a month of the intervention)	Physical functioning, role-physical, bodily pain, general health, vitality, role-emotional, and mental health subscales were significantly higher in the IG compared with the CG (p<0.001).
Marchionni et al. (2003) / Italy	RCT	270 outpatients older than 45 years/ Male=67.8%	Italian- SIP	2-month Hosp-CR; 40 exercise sessions (3/ week), 2-month Home-CR; overall 4-8 supervised exercise sessions at home.	No CRP	8-month and 14-month follow-ups (after 6 and 12 months of the intervention)	Hosp-CR and Home-CR were similarly effective. SIP total score: age 45-65 group: p=0.029/ age 66–75 group: p=0.318/ >75 group: p=0.017
Mendes de Leon et al. (2006) / USA	RCT	2,481 patients with AMI / 1296 completed at 6 months/ Male=56.3%	SF-36, the 8-item LSS, a 1-10 ladder technique (LOL)	Psychosocial intervention included 11 individual sessions delivered over 6 months	Usual care	After 6-month (post-intervention)	Significant differences in the SF-12-MCS, the LSS, and the LOL scores, but not in the SF-12-PCS.
Oranta et al. (2011) / Finland	RCT	103 MI patients <75 age/ Male=70.9%	EQ-5D	Interpersonal counselling consisting of starting (sessions 1–2), encouragement (3–4) and ending phase (5–6) (not reported about the time of the intervention)	Usual care	6 and 18 months after discharge	No significant improvement in the IG in any of dimensions compared to the CG. Only improved in patients under 60 years (p<0.001 at 6 months, p=0.004 at 18 months).

Peixoto et al. (2015) / Brazil	RCT	88 patients ranged between 18 and 70 years of age/ Male=70.5%	MacNew	Stage 1: an educational program to both groups. Stage 2: IG-an unsupervised progressive exercise program (4 sessions/ week) for a month.	Usual care	30 days after discharge (post-intervention)	Physical (p<0.0001) and emotional domains (p<0.001) improved in the IG.
Roncella et al. (2013) / The Netherlands	RCT	94 patients admitted patients aged ≤70 years/ Male=89.4%	MacNew	STP including 3 to 10 individual sessions and 5 group sessions over 6 months	No STP	1-year follow-up (after 6 months of the intervention)	Improved physical domain (p=0.03), and trended toward enhanced QoL in the social domain (p= 0.06) and global QoL (p=0.07).
Uysal et al. (2012) / Turkey	Controlled clinical trial	90 patients/ Male=77.8%	SF-36, MIDAS	Individual training for an hour before discharge and counselling program in the fourth and eighth weeks following discharge	No telephone counselling and training	3- month follow-up (after a month of the intervention)	Improvement in all dimensions of MIDAS (p=0.000~0.04) and SF-36 (p=0.000~0.02) except bodily pain (p=0.15).
Varnfield et al. (2014) / Australia	RCT	60 post-MI patients recruited to each group/ Male=83.5%	EQ-5D	A 6-week smartphone-based home service delivery (CAP-CR)	A 6-week traditional centre-based CRP	After 6 weeks (post-intervention) , 6 months (after 18 months of the intervention)	The median scores of HRQoL improved significantly in the IG (p<0.001) at 6 weeks, but not at 6 months.

Wang et al. (2012) / China	RCT	133 outpatients with MI/ Male=83.5%	SF-36, Chinese MIDAS	A 6-week home-based CRP.	Usual care	3- and 6-month follow-ups (after 6 weeks and 18 months of the intervention)	Significantly improved in physical functioning ($p<0.01$), role functioning ($p<0.05$), vitality ($p<0.05$), and mental health ($p<0.05$) subscales.
West et al. (2012) / UK	Prospective RCT	1813 patients following AMI/ Male=73.5%	SF-36	CRP-exercise training, health education about heart, heart disease, risk factors and treatment, counselling for recovery and advice for long-term secondary prevention over 6-8 weeks	Usual care	1 year (after about 10 months of the intervention)	No significant differences between IG and CG in any of eight domains of SF-36.
Yonezawa et al. (2009) / Japan	Not reported	109 outpatients (57±7 years) who completed a phase Ⅰ CR program after AMI/ Male=82.6%	SF-36	Phase II CRP-supervised exercise training and counselling for an hour once a week. (5 months)	No CRP	6 months after the AMI (after a month of the intervention)	The bodily pain ($p<0.05$) and social functioning ($p<0.05$) subscale scores improved in the IG.
Yousefy et al. (2009) / Iran	Experimental study	121 patients with AMI in past 6-12 months, ≥30 years old/ Male=68.8%	MacNew, WHOQOL-BREF	The hospital-based CRP consisted of 40 exercise sessions over 2-3 months (3 sessions/week)	No CRP	3-month follow-up (post-intervention	Improved physical functioning; MacNew physical: IG=73.10 vs CG=59.13 ($p<0.05$) WHOQOL physical: IG=3.51 vs CG=2.94 ($p<0.05$)

Yu et al. (2004) / Hong Kong	RCT	269 patients with recent AMI or after elective PCI at a CR centre/ Male=76%	SF-36	A 8-week cardiac rehabilitation and prevention program including exercise	Standard care without exercise	8 weeks (phase 2; post-intervention), 6 months (phase 3), 2 years (phase 4)	Significant improvement in QoL; physical functioning, physical role, bodily pain, and emotional role and vitality ($p<0.005$).

AMI= acute myocardial infarction; CABG= Coronary Artery Bypass Graft Surgery; CAP-CR= Care Assessment Platform of Cardiac Rehabilitation; CG= control group; CRP= cardiac rehabilitation program; EQ-5D= EuroQol-5D; Home-CR= home-based cardiac rehabilitation; Hosp-CR= hospital-based cardiac rehabilitation; HRQoL= health-related quality of life; IG= intervention group; LOL= Ladder of Life; LSS= Life Satisfaction Scale; MacNew QLMI= MacNew Quality of Life after Myocardial Infarction Questionnaire; MCS= mental component summary; MI= myocardial infarction; MIDAS= Myocardial Infarction Dimensional Assessment Scale; NR= not reported; PCI= percutaneous coronary intervention; PCS= physical component summary; PI= Psychosocial Intervention; QLI= Quality of Life Index; QoL= quality of life; RCT= randomized-controlled trial; SF-12= The 12-Item Short Form Health Survey; SF-36= Medical Outcomes Study 36-Item Short-Form Health Survey; SIP= Sickness Impact Profile; STP= short-term humanistic–existential psychotherapy; WHOQOL-BREF= World Health Organization Quality of Life Questionnaire Brief Version.

Cardiac rehabilitation programs

Cardiac rehabilitation program (CRP) is a comprehensive intervention for improvement of HRQoL in patients who have heart disease. Among the studies reviewed, 11 studies applied CRP, including exercise, education or counselling and monitoring by health professionals and two studies applied exercise programs only.

In the present review, CRPs have shown promising results on HRQoL scores of patients with MI. Yu et al. (2004) examined the effects of a cardiac rehabilitation and prevention program on HRQoL of patients with MI, within an age range of 53-75 years. In this RCT, the control group was given standard care without an exercise component, while the intervention group took part in a cardiac rehabilitation and prevention program, including inpatient ambulation for one to two weeks, and exercise with education sessions for eight weeks. Compared to the control group, participants in the intervention group had significantly higher HRQoL in four domains at the phase 3, and in five domains: the same four domains at the phase 3 plus vitality, at the two-year follow-up ($p<0.005$). The control group reported increased physical pain and no improvement in any of the HRQoL dimensions by phase 2. Only four dimensions of SF-36 were slightly improved at the end of the study period (Yu et al. 2004).

A supervised exercise-based CRP at the hospital seemed to better improve the QoL of MI patients compared to a home-based unsupervised exercise program. Researchers from South Korea found that patients in the supervised hospital-based group showed greater improvements in overall QoL scores after eight weeks ($p<0.0001$) compared to the unsupervised home-based comparison group (Choo, Burke & Hong 2007). Likewise, participants who attended either the supervised hospital- or home-based CRP for eight weeks in another study showed better HRQoL than those who did not participate in any of the programs (Marchionni et al. 2003). These findings imply that the social support and formal structure offered by the supervised program played an important role in improving QoL.

Findings of a recent study, conducted by Peixoto et al. (2015), were also in line with past studies.

A significant improvement was observed particularly in the physical and emotional domains in the intervention group, which underwent a one-month exercise-based CRP ($p<0.001$), compared with the control group (Peixoto et al. 2015). Moreover, other three-month follow-up studies (Izawa, Hirano, et al. 2004; Yousefy et al. 2009) reported positive results in promoting HRQoL among MI patients. In one of these two studies, Japanese participants who completed a CRP had superior HRQoL in four of the eight subscales of the SF-36 ($p=0.000$, $p=0.03$) to the control group (Izawa, Hirano, et al. 2004). In the other study, Iranian patients also scored higher in the physical domain of the MacNew ($p<0.05$) and the WHOQOL ($p<0.05$) after completing a 40-session hospital-based CRP than participants who did not participate in the program (Yousefy et al. 2009).

A six-week home-based CRP using a self-help manual, which contained information about Tai Chi, Qi Gong and Chinese diet, was effective in improving the HRQoL of Chinese patients at six weeks and six months post-MI ($p<0.05$) compared to the control group who received only instructions on taking medications, information leaflets about cardiac risk factors, a healthy diet, and smoking cessation, and a follow-up appointment (Wang et al. 2012). Varnfield et al. (2014) compared the effectiveness of a six-week CRP using the Smartphone-based Care Assessment Platform Cardiac Rehabilitation (CAP-CR) program with traditional centre-based CRP. They found that patients in the CAP-CR had higher HRQoL median scores as measured by EQ-5D ($p<0.001$). In addition, the CAP-CR group had a low dropout rate with 80% of participants completing the program compared to 47% of the centre-based CRP group (Varnfield et al. 2014).

There were two studies that followed up participants, using the SF-36 over a six-month period (Izawa, Yamada, et al. 2004; Yonezawa et al. 2009). In Izawa et al. (2004)'s study, the CRP group had significantly higher QoL than the control group in seven domains of the SF-36 at six months ($p<0.001$); no improvement was observed in social functioning; however, in Yonezawa et al. (2009)'s study, the CRP led to significant differences only in bodily pain and social functioning (both $p<0.05$) at six months.

Studies that examined the effectiveness of an exercise program only have reported benefits of these programs on HRQoL of patients with MI. A regular weekly aerobic training program resulted in greater improvements in HRQoL (p<0.001) compared with the control group who received no formal exercise (Dugmore et al. 1999). The effects of moderate and high intensity physical training was examined in only one study. Benetti, Araujo & Santos (2010) conducted a prospective case-control study and assigned patients into either a 12-week high-intensity physical training, a 12-week moderate-intensity training, or control group. Patients in both groups showed significant improvement in HRQoL from baseline (p<0.05), yet the higher intensity training resulted in slightly superior HRQoL than the moderate-intensity training and the control group (Benetti, Araujo & Santos 2010).

It should, however, be noted the effectiveness of standard CRPs or exercise alone programs on HRQoL of patient with MI has been mainly proven in short term follow- ups. It seems that effects of these programs disappear in longer follow ups (West, Jones & Henderson 2012).

Patient education and counselling

Different from some education and counselling provided as part of CRPs, six studies, specifically, tested the effects of education and/or counselling sessions on HRQoL. Regardless of modes, the interventions which were examined at short-term follow-ups showed positive effects, while long-term effects have not been thoroughly confirmed.

Three studies examined the effectiveness of patient education and counselling in improving HRQoL of patients with MI (Hanssen et al. 2007, 2009; Hawkes, Patrao, Atherton, et al. 2013). The telephone follow-up programs showed only short-term benefits (Hanssen et al. 2007; Hawkes et al. 2013), but failed to show long-term effects at 18 months after MI (Hanssen et al. 2009). Specifically, Hawkes et al. (2013) examined the effects of a telephone-delivered secondary prevention program over six months including three weekly sessions, three fortnightly sessions and four monthly sessions. The program significantly improved the mental component (p=0.02), the social functioning (p=0.04) and role-emotional (p=0.03) subscales of the SF-36 at the 6-month follow-up.

To assess the long-term effects of an education and counselling intervention via telephone, Hanssen et al. (2009) applied weekly phone calls for the first four weeks and subsequent calls at 6, 8, 12 and 24 weeks after discharge from MI. The phone follow-ups aimed to help patients solve their common problems or queries after discharge from hospital and to assist patients with their risk factor modification. The results of this RCT showed that the telephone follow-up intervention was effective in increasing HRQoL of patients at a six-month follow-up compared to the control group (Hanssen et al. 2007). However, the positive effects of the telephone follow-up intervention on HRQoL disappeared at 18 months (Hanssen et al. 2009).

On the other hand, the effectiveness of face-to-face counselling programs on HRQoL in patients with MI remains debatable. The effects of a six-session face-to-face interpersonal counselling on HRQoL scores of MI patients were examined by a group of researchers in Finland (Oranta et al. 2011). The intervention included a brief introduction by a trained nurse to the framework of the interpersonal counselling, strategies about role transition, and management of therapeutic gains and depressive symptoms. This study found no significant difference in mean HRQoL scores between patients who received interpersonal counselling and the control group. The interpersonal counselling, however, had a moderate effect on HRQoL of a subgroup of patients aged less than 60 years at either follow-up point (Oranta et al. 2011). On the other hand, in the study by Uysal & Özcan (2012), individual patient education plus counselling positively affected HRQoL of patients after MI. Visual materials were used to provide one-hour individual training on healthy life after MI in the program, which was delivered before discharge from hospital. The intervention also included two sessions of telephone counselling on cardiovascular risk-reducing strategies and addressing the patients' queries in week 14th and 18th following discharge from hospital. The study found greater improvements in HRQoL of patients who participated in the program ($p \leq 0.000$) (Uysal & Özcan 2012). It is not; however, clear whether the authors had controlled for cardiac rehabilitation participation as a covariate factor. In line with other counselling interventions, group counselling has also shown promising effects on HRQoL scores. In a study, group counselling resulted in greater HRQoL scores ($p<0.001$) at a one-month follow-up compared to the control group (Bagheri, Memarian & Alhani 2007).

Other psychological and cognitive interventions

Additional intervention programs included goal attainment, expressive writing, psychosocial intervention, and short-term humanistic-existential psychotherapy. For example, Boersma et. al (2006) assessed the effect of the attainment of three self-selected mid-level goals on HRQoL of patients with MI. These goals were related to health promotion, social activities, and open domain for the coming year. The goal attainment intervention had a positive effect on the social dimension of HRQoL of MI patients ($p=0.05$) (Boersma et al. 2006). Furthermore, there was a unique study, which used language as a means of intervention. Over a period of the study, the intervention group were asked to express their thoughts and feelings about their MI in writing, while the control group were asked to write objectively about their daily events, as they occurred during the year before heart attack. Patients in the expressive writing group showed superior overall HRQoL scores to the control group ($p<0.05$). This intervention was cost-effective as it costed only for pens, paper and envelopes, and had 68% of response rate (Hevey & Wilczkiewicz 2014).

Psychological interventions were also applied to MI patients in the ENRICHD clinical trial (Mendes de Leon et al. 2006) and the STEP-IN-AMI trial (Roncella et al. 2013). The counselling programs are usually similar to education or questioning and answering; on the other hand, the psychosocial intervention of ENRICHD trial was composed of cognitive behavioural therapy for MI patients who had at least one previous episode of major depression, pharmacotherapy for patients with severe depression, and training of strategies to help with social skill deficits and automatic thoughts or self-talk. The study found significant differences in the mental components of the SF-36 between the intervention group and the control group (2.2; 95% confidence interval 1.2 to 3.2), however, no differences were found in the physical components (0.8; 95% confidence interval -0.5 to 2.0) (Mendes de Leon et al. 2006). In consistent with the above study, a short-term humanistic-existential psychotherapy (STP) used in the STEP-IN-AMI trial enhanced the physical dimension of the MacNew instrument ($p=0.03$). The intervention consisted of three to ten one-hour individual sessions, which focused on patient personal history, body language insights, and relaxation techniques, as well as five group sessions over three months. The group sessions included information about MI, cardiac risk factors, lifestyle changes, music-guided breathing and muscular relaxation, comprehension of body signals, elements of oneiric language, and attention to specific partner/relationship issues. The study found that the physical domain of HRQoL was significantly improved in the intervention group compared to the control group. Also, positive trends in the social domain and overall HRQoL in the favour of the intervention were found (Roncella et al. 2013).

2.5.5. Discussion

Overall, the studies included in this review showed promising results in improving HRQoL of MI patients. The studies included heterogeneous behavioural interventions, with cardiac rehabilitation programs being the most commonly reported (Choo, Burke & Hong 2007; Yousefy et al. 2009). Patients who participated in either hospital-based or home-based CRP showed higher HRQoL than those who did not participate in any CRP (Marchionni et al. 2003; Yousefy et al. 2009). This finding is in line with other studies which demonstrated positive effects from CRP on HRQoL of patients with coronary heart disease (Heran et al. 2011; Kim, Lee, et al. 2014). Supervised hospital-based CRPs were shown to be superior to unsupervised home-based programs. However, if supervised, home-based CRPs showed only little difference with hospital-based cardiac rehabilitations (Anderson & Taylor 2014; Marchionni et al. 2003). The positive effects CRPs on HRQoL of MI patients was found to be independent from the cost and duration of these programs (Oranta et al. 2011). Similarly, a systematic review that compared home- versus hospital-based CRPs suggested that home-based CRPs are safe and effective on many patient and disease outcomes of cardiac patients including quality of life (Blair et al. 2011). Moreover, a study that conduced cost analysis on CRPs found that hospital-based CRP costed an average US$21,298, while the cost for home-based CRP and no program were estimated to be US$13,246 and US$12,433 respectively (Marchionni et al. 2003). Therefore, home based CRPs may be a better option for some patients.

In addition, the available evidence suggests that exercise is an important element of CRPs, which positively affects HRQoL of patients with MI (Anderson & Taylor 2014; Benetti, Araujo & Santos 2010). Similarly, a systematic review revealed that most of the exercise-based cardiac rehabilitation programs promised improvements in QoL of patients with coronary heart disease including patients with MI (Heran et al. 2011). In particular, Tai Chi exercise had positive effects on post-menopausal female patients with coronary heart disease, as this exercise is designed similarly to walking exercises with low-moderate intensity (Song et al. 2009). Therefore, it is important that cardiac rehabilitation programs be based upon moderate intensity exercise. However, the effects of exercise intensity of HRQoL in patients with MI need further investigation. While Benetti et al. (2010) demonstrated a superior effect from high-intensity exercise, an earlier study conducted by Worcester et al. (1993) suggested no significant difference in HRQoL scores between patients who participated in low-intensity and high-intensity exercises. In their study, Worcester et al. (1993) described the high-intensity exercise program as consisting of three one-hour sessions per week delivered by a teacher of physical education and a doctor, while the low-intensity exercise program included two one-hour sessions per week of light calisthenics and intermittent exercise.

The studies reviewed mainly used a generic tool to assess HRQoL in the target patient population. This is in line with the overall fact that specific instruments are less likely to be used than generic tools (Choo, Burke & Hong 2007). Generic tools have the advantage of being applied to a wider range of individuals from full health to death. This feature enables comparison of QoL scores across diseases and the normal population. Nevertheless, disease-specific measurements are apt for assessing HRQoL in a specific population (Oldridge et al. 1998). These tools are more sensitive to treatment effects among a specific population group (Bengtsson, Hagman & Wedel 2001). Although, found that the SF-36 and the Mac New Quality of Life Questionnaire were found to be the most commonly used generic and disease-specific tools respectively for measuring HRQoL of patients with MI (Dempster, Donnelly & O'Loughlin 2004), the disease-specific instruments can better reflect the effects of interventions on HRQoL in this patient population. Thus, their use should be encouraged in studies that aim to follow the changes in HRQoL of MI over time or evaluate the effects of a particular intervention or treatment.

The findings of this review indicate that interventions usually improve some, but not all, dimensions of the HRQoL, suggesting that a combination of interventions may be necessary to improve multiple dimensions of HRQoL. Additionally, it should be considered that the overall uptake of CRPs is low, in particular, when conventional centre-based CRPs are delivered (Varnfield et al. 2014). It is important that the patients are routinely referred and encouraged to participate in CRPs, and alternative programs, such as home-based CRPs are offered, based on the patient's situation and preference, to increase participation. There is also a need for development of interventions that can result in a sustainable improvement in HRQoL of patients with MI. Long-term supportive programs, as opposed to one-off interventions, might lead to a superior and long-lasting improvement in HRQoL of MI patients.

In this review, the studies evaluated CRP and other interventions with a range of duration from one month to 18 months. Most interventions lasted a short-term up to six months and usually showed positive effects on HRQoL of participants with MI (Hanssen et al. 2007). Likewise, in a systematic review about QoL among CHD patients, most of the exercise-based cardiac rehabilitation programs promised improvements with duration of programs ranging from one to 12 months, where the frequency differed from one to seven sessions per week of 20 to 90 minutes length (Heran et al. 2011). The included studies mostly examined the short-term effects of behavioural interventions on HRQoL of patients with MI and found positives results. The long-term effects of these interventions are unclear, however. Future studies should focus on evaluating the long-term effects of the cardiac rehabilitation programs, counselling, and other behavioural interventions on HRQoL of patients with MI.

The effects of behavioural interventions on quality of life of MI patients were predominately studied on male participants. This is consistent with the fact that the incident rate of MI is higher in males than females (Brink, Karlson & Hallberg 2002). In line with wider research highlighting poorer quality of life scores in women than men in general (Hajian-Tilaki, Heidari & Hajian-

Tilaki 2017; Viira & Koka 2012), several studies reported that female patients showed more impaired HRQoL than their male counterparts within the first year after MI (Bogg, Thornton & Bundred 2000; Garavalia et al. 2007; Kristofferzon, Löfmark & Carlsson 2005b; Norris, Hegadoren & Pilote 2007). It is necessary to understand the reasons why women report poorer HRQoL than men and if particular dimensions of HRQoL are more affected in women. This understanding is required to develop and test targeted invitations aiming to reduce gender disparities in the experience of QoL in patients with MI.

Limitations

Several limitations should be noted in relation to the reviewed articles. Firstly, HRQoL is a subjective concept, therefore, studies that rely on self-report measurements need to be aware of potential bias based on self-assessment (Bucholz et al. 2011; Marchionni et al. 2003). In addition, some studies used small sample sizes, applied considerable exclusion criteria, and due to the nature of the interventions, using blinding techniques to reduce bias was possible. Further, despite our comprehensive methods, limiting our search strategy to English-language articles and excluding grey literature may have resulted in under-representation of research from regions outside English speaking countries.

This narrative review could not quantify the effect size of the interventions for patients with MI. Due to the existing heterogeneity in the reviewed interventions in terms of type, measures, and follow up meta-analysis was not appropriate.

2.5.6. Conclusion

Most CRPs and other behavioural interventions improved the HRQoL of patients with MI. Interventions that help increase patients' functional and psychosocial wellbeing should be introduced before long after discharge from hospital to promote patients' overall health and quality of life.

Implications

Patients with MI should be encouraged to participate in exercise-based cardiac rehabilitation programs to help improve their quality of life. Depending on the patient's situation and preference, these programs can be offered as home-based or hospital-based. Telephone follow-up programs and face-to-face education and counselling programs may also be used to help promote HRQoL of MI patients.

Compliance with Ethical Standards

Conflict of Interest: Kyoungrim Kang declares that she has no conflict of interest. Leila Gholizadeh declares that she has no conflict of interest. Sally C Inglis declares that she has no conflict of interest. Hae-Ra Han declares that she has no conflict of interest.

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

2.5.7. Paper references

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2.6. Medical interventions and HRQoL

There is ample evidence that medical interventions improve MI outcomes, including symptoms, recurrent cardiac events and mortality (Australian Institute of Health and Welfare 2017; Fox 2016; Rahman et al. 2017); however, the effects of these interventions on HRQoL of the patients has not been widely studied and the results of available studies are mixed (Soo Hoo, Gallagher & Elliott 2014; Yeng, Gallagher & Elliott 2016).

Studies that evaluated the impact of CABG on HRQoL measures reported that the patients often experienced impaired HRQoL following surgery. CABG was found to be a predictor of declined physical HRQoL in the SF-36, and the overall score in the EuroQol at the six-month and 12-month follow-ups (Beck et al. 2001), low scores in the SF-12 and the SAQ at one year follow up (Arnold et al. 2013), as well as low score in the Time Trade-Off tool at the 8-week and 12-month follow-ups (Oldridge et al. 1998). Only one study (McBurney et al. 2002) reported that patients with CABG had better mental HRQoL in the SF-12 after seven months from MI.

The impact of PCI on HRQoL was investigated in several studies. It was found that participants with drug-eluting stents showed better HRQoL in scores in the SAQ at six months, however, the difference between two groups disappeared at the 12-month follow-up (Chhatriwalla et al. 2015). In addition, MI patients with low self-reported drug therapy compliance and low self-reported compliance with angiotensin-converting enzyme inhibitor and lipid-lowering therapy reported lower mental HRQoL (McBurney et al. 2002). Also, patients with a greater number of indications for cardiac medications at discharge had lower physical component of the SF-36 approximately 2.5 years after MI (Pettersen, Reikvam, et al. 2008). It is important that new treatments for MI consider both disease and patient outcomes, and that the patients' HRQoL is improved using evidence-based effective approaches. However, it should be noted that the differences in the reported HRQoL among different medication interventions, such as CABG and PCI may be related to the type of patients who are receiving these interventions.

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CHAPTER 3: METHODOLOGY

3.1. Research method

This study adopted a longitudinal survey design. A longitudinal study is a correlational research study that involves repeated observations on a set of variables for the same sample units over time (Polit & Beck 2018). In order to develop the conceptual understanding of the HRQoL in patients with MI, two comprehensive literature reviews were performed (Kang et al. 2016, 2017) and the literature on the emergence of quality of life as a research outcome was reviewed. The researcher extended her knowledge of the pathophysiology of MI and contemporary management approaches. The insight and knowledge gained from these reviews were used in the development of the study design, including study questions and data collection tools.

3.2. Study setting

The study was conducted at Pusan National University Hospital (PNUH) and Pusan National University Yangsan Hospital (PNUYH) in South Korea. These hospitals are the major tertiary referral hospitals in the southern part of South Korea, with comprehensive cardiovascular centres. In 2016, the number of outpatients at PNUH was approximately 900,000 and that of inpatients was 400,000 (Pusan National University Hospital 2017). At PNUYH in the same year, the total number of inpatients was about 380,000 (Pusan National University Yangsan Hospital 2017a) and that of outpatients including new and return cases, was about 680,000 (Pusan National University Yangsan Hospital 2017b).

3.3. Study population

The target population of this study was South Korean patients with MI who met the inclusion criteria as follow:

1) Patients who were admitted to cardiac department with a diagnosis of MI (both STEMI and NSTEMI);
2) Patients who were able to understand and speak Korean language;

3) Patients who resided in South Korea; and
4) Patients who had the ability to understand the study and provide an informed consent to participate in the study.

The exclusion criteria included:

1) Patients who had cognitive impairment;
2) Patients who were participating in other interventional studies at the time when this study was being conducted;
3) Patients who were not willing to participate in the present study due to poor health conditions.

The patients' cognitive status and their ability to sign the consent and complete the research questionnaires were assessed using the following steps (Fan et al. 2008):

1) A nurse who was taking care of the patient confirmed that patient has the ability to provide an informed consent to the study.
2) All patients were asked to state their names at the time of screening.
3) Each patient was asked to state the colour of a paper shown.

3.4. Sample size

Pallant (2016) recommends that the formula of $N > 50 + 8 \times n$ for calculating required sample size for studies based on regression analysis, where N refers to number of required sample size, and n refers to the number of independent variables to be included in regression analysis. Based on this formula and with the consideration that 11 independent variables were to be included in the multiple linear regression analysis for current study, the study needed to recruit a minimum of 138 participants. Based on the results of previous similar studies, a dropout of 15–20% was expected (Brink et al. 2005; Dickens et al. 2006; French et al. 2005); therefore, 158–166 patients with MI were planned to be recruited to this study.

3.5. Data collection

After the ethics approval of each Institutional Review Board was obtained (Appendix A), patients were recruited from the two tertiary hospitals. Recruitment occurred under supervision of charge nurses at the participating hospitals. To assess the potential participant's capacity to participate in the research, their cognitive status was assessed by asking the patient to state their full name and their cognitive status assessed. Then, the researcher explained the purpose and protocol of the research, invited them to participate in the study, and provided the participant them with information statement. The participant information statement outlined the aim of the research and the description of the process the researcher followed to collect data. The participant information statement and the study consent form for both hospitals are presented in Appendix B. Patients admitted to the cardiovascular centres were recruited from the hospitals from August 2015 to February 2016 (the baseline) and followed up for three months. The follow-up was carried out once, three months after discharge. This time frame was chosen in consultation with two cardiologists from the participating hospitals, taking into account the transition of patients from an acute phase to more stable condition, and feasibility considerations.

In South Korea, almost 90 per cent of patients with MI undergo PCI which takes less than 90 minutes 'door-to-balloon time' with a success rate of 99.4% (Kim et al. 2016). Patients are often discharged from hospital within a week and visit an outpatient clinic once every one or two weeks in the first month, followed by two or three times in the next two to three months. Baseline data were collected within a few days after MI while participants were in hospital (baseline assessments). The three-month follow-up assessments were completed via telephone or face-to-face when the participants visited the outpatient clinics of the participating hospitals as part of their usual follow-up care. Nursing staff and cardiologists collaborated with the researcher in participant recruitment and collecting medical records and provided counselling during the process of obtaining ethics approvals.

Study participants who signed the consent form completed the self-report questionnaires at the time of enrolment (baseline) in a place that was comfortable, private, quiet and free from distractions. Only if the participants were comfortable and safe, were they moved to another room accompanied by the researcher, who closely monitored the participants' conditions while they were completing the questionnaires, also ensuring that participants' questions were addressed. Clinical data were obtained from medical records.

At three months after discharge from hospital, a follow-up interview was carried out with each participant by telephone (56 participants) or participants were asked to complete the follow-up questionnaires in a face-to-face session when they attended the outpatient department as part of their routine care. Privacy of the patients was maintained by providing patients with a private room, which was quiet and comfortable. The researcher monitored the participants while they were answering the questions and clarified their questions. Completion of the study questionnaires took less than one hour. Participants were asked to notify the researcher if completion of the questionnaires in one single session was a burden so that the researcher could arrange another time. All participants, however, completed the study questionnaires in a single session.

3.6. Sampling process

A total of 215 patients with MI were screened between August 2015 and February 2016. Of the 215 patients, 150 patients (69.8%), who provided informed consent, were recruited to the study and completed the baseline questionnaires. A total of 65 patients out of 215 patients screened were not recruited to the study due to being unconscious (n=1), refusal due to poor health condition (n=23), declined the study because of older age and the associate impaired hearing and visual abilities (n=17), declined without any reason (n=19), or discharged before enrolment (n=5). Patients who refused to participate in the study due to poor health condition mentioned reasons, including experiencing dyspnoea, pain, severe tremor, or tiredness. At the time of three-month follow-up from November 2015 to May 2016, four participants were deceased, and ten participants were lost to the follow-up. Consequently, 136 participants completed the follow-up survey. Details on the process of screening, enrolment, withdrawal, and completion are presented in Figure 5.

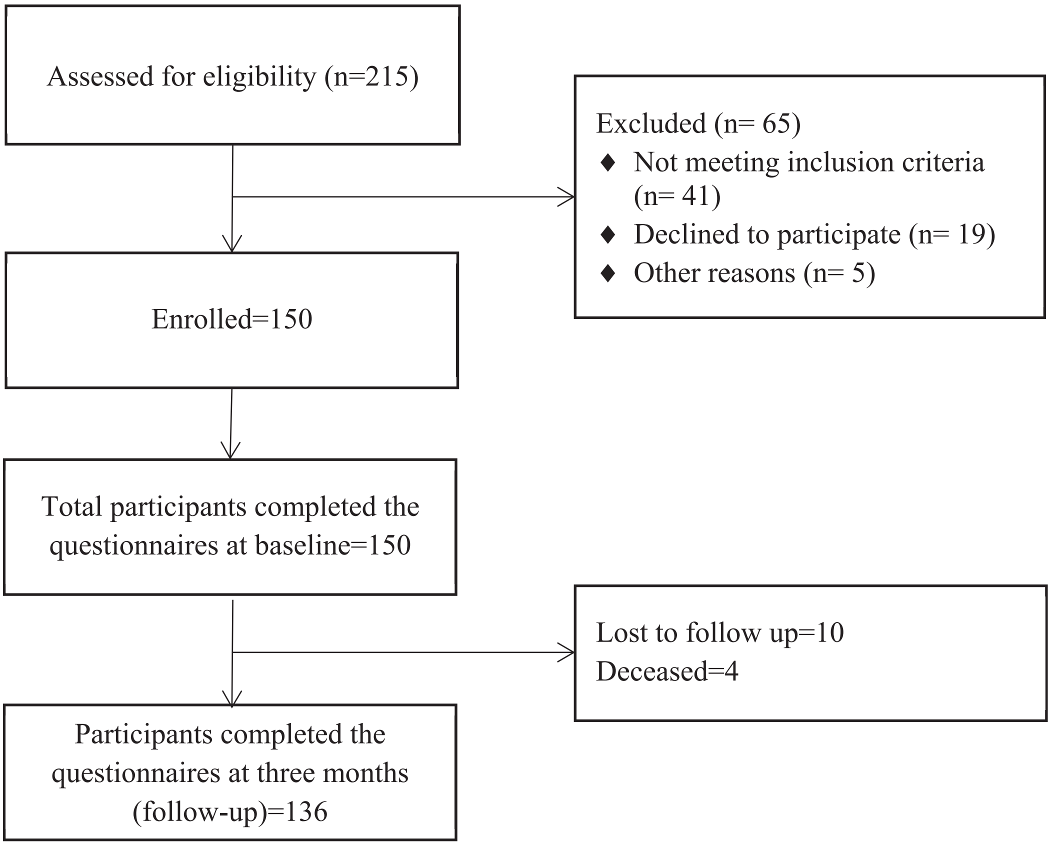

Figure 5. Flow diagram of participant recruitment

3.7. Measurements

3.7.1. Demographic profile

Demographical profile was requested from the participants by means of a researcher developed questionnaire. The information included: age, gender, marital status, the level of education, current employment status, and perceived financial situation. Information on health behaviour profile of the participants was also collected including physical activity, average sitting time per day, smoking and alcohol consumption. Most questions were derived from the national screening program of the National Health Insurance Service in South Korea to allow for the comparison of the study results with national data.

3.7.2. Clinical profile

The clinical profile included: height, weight, personal history of high blood pressure, diabetes, high blood cholesterol, cancer, stroke, mental problems, and other heart diseases, time since the first diagnosis of heart disease, previous MI, time since the last MI, and type of interventions for the recent MI. This clinical information was collected from the medical records of the participants after obtaining their consent.

3.7.3. Health related quality of life (HRQoL)

Following a thorough review of the available tools, the MacNew Quality of Life after Myocardial Infarction Questionnaire (MacNew) was used to assess HRQoL in the present study (Dixon, Lim & Oldridge 2002). The MacNew is one of the most popular disease-specific tools for the assessment of HRQoL in patients with MI. The tool is the modified version of the QLMI questionnaire (Höfer et al. 2004), optimising its suitability for assessing HRQoL in patients with MI. Compared to other HRQoL tools, the MacNew enables specific and more comprehensive experiences of patients with MI to be assessed (Höfer et al. 2012).

The MacNew consists of 27 items, which load into three dimensions of physical (13 items), emotional (14 items), and social functioning (13 items), with 12 items loading onto more than one subscale (Dixon, Lim & Oldridge 2002; Hevey & Wilczkiewicz 2014). Each item is scored on a seven-point Likert response format ranging from 1 to 7. A higher score on the scale indicates better HRQoL (Dixon, Lim & Oldridge 2002; Höfer et al. 2004). The total score of the MacNew is the mean score of the 27 items. Total scores for each physical, emotional and social HRQoL subscales can be calculated by averaging items included in each domain (Dixon, Lim & Oldridge 2002; Hevey & Wilczkiewicz 2014). According to the developers of the scale, the minimum important difference on each domain of the MacNew scale is 0.50 points (Dixon, Lim & Oldridge 2002).

The MacNew has proven to be highly valid and reliable. The reliability of this measure has been established in a number of studies with the Cronbach's alpha coefficients ranging from between 0.83 and 0.97 (Boersma et al. 2006; Boersma, Maes & van Elderen 2005; Joekes, Maes & Warrens 2007; Williams et al. 2012; Wrzesniewski & Wlodarczyk 2012). However, a Korean version of the MacNew was not available at the time of the study. Thus, the tool was translated into Korean for the purpose of this study following the guidelines suggested by Guillemin, Bombardier & Beaton (1993). First, the researcher, who has vast experience in translation of English texts to the Korean language, translated the instrument into the Korean language. Then, the back-translation was carried out by a bi-linguist, who had not seen the scale before. The translations were then reviewed and compared with the original version and revisions made as needed until consensus was reached. The face validity of the Korean MacNew was confirmed by three experts in the field and it was pilot tested by five patients with a history of cardiac disease. On the basis of pilot feedback, the wording of some questions was revised to improve understanding.

3.7.4. Depression, Anxiety, and Stress Scale (DASS 21)

Psychological distress including depression, anxiety and stress have been found to be important factors affecting HRQoL of patients with MI (Benyamini et al. 2013; Ginzburg & Ein-Dor 2011; Hosseini et al. 2014). Thus, the current study considered measuring and examining the impact of these variables on HRQoL of South Korean patients, using the DASS 21. The tool has several advantages: compared to DASS 42, DASS 21 is a short tool, which with less respondent burden it can enable concurrent assessment of three major psychological manifestations—depression, anxiety and stress; the validity of the tool on different population groups (Henry & Crawford 2005) and cultures have been widely confirmed (Oei et al. 2013). The original English version of DASS 21 showed high alpha coefficients at 0.91 for the depression subscale, 0.84 for anxiety and 0.90 for stress (Lovibond & Lovibond 1995). A Korean version of the tool is available (Cha 2014) and it has been validated on Korean population, demonstrating high internal consistency with alpha coefficients of 0.81, 0.72 and 0.80 for depression, anxiety, and stress subscales, respectively (Song & Lindquist 2015).

The DASS 21 comprises 21 items from the full version of the DASS 42. Each item is scored on a Likert scale from 0 (never) to 3 (almost always) and the 21 items can be summed as a total score, ranging from 0 to 63. The DASS 21 can be divided into three dimensions of depression, anxiety and stress and each dimension encompasses seven items. The total scores for the individual depression, anxiety, and stress subscales can be also calculated with these seven items each (Henry & Crawford 2005), indicating that the higher scores represent increased depression, anxiety and stress, with the total subscale ranging range from 0 to 21 (Henry & Crawford 2005). The severity of depression, anxiety, and stress can be classified into five categories comprising normal, mild, moderate, severe, and extremely severe (Lovibond, Lovibond & Psychology Foundation of Australia 1995).

3.7.5. Insomnia Severity Index (ISI)

Sleep disturbance is commonly experienced by patients after MI (Hoevenaar-Blom et al. 2011; Laugsand et al. 2011) and it has been shown to negatively affect HRQoL of these patients (Rafael et al. 2014). Disturbed sleep also seems to play an intermediary role between self-efficacy and HRQoL (Brink et al. 2012). Nevertheless, the effect of poor sleep itself on HRQoL of patients with MI has not widely been studied. Therefore, as a factor that could likely impact HRQoL of study participants, data on sleep quality were collected using the Insomnia Severity Index (ISI). The ISI is a brief self-report instrument measuring the patient's perception of their insomnia. It consists of seven items, addressing severity of sleep difficulties (three questions), satisfaction of sleep pattern, interference with daily functioning, noticeability of impairments, and worry about sleep (1 item each). The items are scored on a scale of 0 (not at all) to 4 (very much). Total score for the tool is the sum of the all 7 items, with the scores ranging from 0 to 28. A total score of 0–7 indicate no clinically significant insomnia, 8–14, sub-threshold insomnia, 15–21, moderate insomnia, and 22–28 severe insomnia (Cho, Song & Morin 2014). The ISI is a reliable tool for assessment of disturbed sleep in a clinical population with the reported Cronbach's α of 0.74 (Bastien, Vallières & Morin 2001). A validated Korean version of the tool is available with the reported Cronbach's α of 0.92 (Cho, Song & Morin 2014). The ISI also showed high reliability in the present study with the coefficient alpha of 0.95.

3.7.6. The Brief Illness Perception Questionnaire (B-IPQ)

The available evidence suggests that patients with more positive illness perceptions following MI show better quality of life (Petrie et al. 2002). Thus, this study examined the effect of illness perception, as a potential factor on HRQoL of South Korean patients with MI. Participants' perception of their MI was assessed by the Brief Illness Perception Questionnaire (B-IPQ), which consists of eight items, and one open question (Broadbent et al. 2006), assessing cognitive, illness and emotional representations, as well as illness comprehensibility. The first five items ask patients about the degree to which their illness affects the individual's life ('consequences'), how long the illness is expected to last ('timeline'), how much they feel 'personal control' over the illness, how much the treatment can help ('treatment control'), and patients' experiences of symptoms from the illness ('identity'). Items number six, seven and eight measure patients' 'concern' about their illness, comprehensive 'understanding' of the illness and the extent to which the illness affect them emotionally ('emotional response'). The items are scored on a Likert type scale ranging from 0 to 10, with higher scores indicating stronger congruence between a question statement and patient's perception. Interpretation of scores can be easily made by individual items. Answers to the last open question (item 9), which is about patient's perception of the casual factors, can be categorised into stress, lifestyle, or hereditary (Broadbent et al. 2006). This tool has shown good test-retest reliability, as measured at three weeks and six weeks ($p<0.01$), predictive validity in patients with MI ($p<0.05$), and discriminant validity ($p<0.001$) (Broadbent et al. 2006).

Permission for the use of the tool in the study was obtained from the developer of the tool (Appendix D), and the Korean version of the tool was prepared for the purpose of this study. It was translated into Korean using the same process as described for translation of MacNew, and reviewed by three health professionals and five laypersons. Following their advice, the wording of a couple of questions were amended so that they flowed better.

3.7.7. Fatigue

Fatigue seems to be a factor affecting HRQoL in patients with MI (Alsén & Brink 2013). The current study applied a single item measure of fatigue to assess patients' perception of daily fatigue following MI. Patients were asked to rate their current state of fatigue on a scale ranging from 0 (not at all) to 10 (extremely). The single-item fatigue scale has been examined for convergent validity and discriminant validity, and been found to be a valid tool to measure current fatigue (Van Hooff et al. 2007).

3.7.8. Self-efficacy

Self-efficacy is another factor that has been found to be associated with health behaviours and HRQoL of patients with MI. This concept takes into account patients' perception about their ability to manage the post-MI condition. In a longitudinal study, self-efficacy four months after MI was positively associated with HRQoL scores at two-year follow-up (Brink et al. 2012). For the current study, a single item self-efficacy measurement was used to assess participants' self-efficacy. This tool was modified from the Cardiac Self-Efficacy Scale, which consists of 13 items (Fors et al. 2014), and responses to the items are scored on a Likert type scale ranging from 0 (not all confident) to 5 (very confident). Single item self-efficacy measures have been shown to possess good discriminant validity and greater predictive validity compared to multi-item scales (Hoeppner et al. 2011).

3.7.9. The ENRICHD Social Support Inventory

Participants' perceived social support was measured by the ENRICHD Social Support Inventory (ESSI), developed to assess social support in patients with CHD. The ESSI is composed of seven items which are scored on a Likert type scale, ranging between 1 (none of the time) and 5 (all the time), excluding item 7. The seventh item is a question about the status of marriage, including living with a partner, which is answered either "yes" (scored 4) or "no" (scored 2) (Mitchell et al.

2003). The total score can be calculated by summing the seven items, with a higher total score indicating higher levels of perceived social support (Vaglio et al. 2004).

The psychometric properties of this scale were established on ischaemic heart disease patients after PCI, with the alpha coefficient of 0.88 (Vaglio et al. 2004). The original English version of this tool was translated into Korean using the same process as described for translation of MacNew.

3.7.10. Severity of MI

The severity of MI took into account the changes in ST-segment and left ventricular ejection fraction (LVEF) (Roger 2009). Classification by electrocardiographic manifestations—STEMI or NSTEMI—is commonly used for assessment of severity of MI and making decisions on in-hospital treatment strategies during the first 24 hours, as previous studies suggest that these two types of MI show different prognoses (Roger 2009; Thygesen et al. 2012). LVEF is also widely used for measuring cardiac function in clinical practice and has prognostic value in patients with MI. However, association between LVEF and HRQoL has not been adequately studied in patients with MI (Pettersen, Kvan, et al. 2008).

After obtaining informed consent from the participants in this study, information about diagnosis of MI and LVEF, recorded by a cardiologist, were extracted from the participants' electronic medical records.

3.8. Data analysis

All statistical analyses were implemented using SPSS version 24.0 (SPSS Inc., Chicago, IL, USA). A consultation was obtained from a statistician who was insightful about the instruments and the study design, but was not directly involved in the present study. Prior to the quantitative data analyses, data cleaning was conducted for detection and correction of inaccurate data coded. Categorical variables were summarised using frequencies and percentages, while continuous variables were compared using means and standard deviations (SD). Based on the normal distribution of the MacNew scores, bivariate and multivariate comparisons were performed using Chi-square analysis, paired-samples *t*-test, and Pearson correlation coefficients. The multivariate linear regression analysis was modelled to determine the significance and strength of associations between HRQoL and different variables (Hosseini et al. 2014; Wang, Thompson, et al. 2014). After verifying the absence of multicollinearity, the backward elimination stepwise regression analysis was performed. Statistical significance of all the analyses was set at the level of $p<0.05$ (two-tailed).

3.9. Ethical considerations

This study obtained ethics approvals from the Institutional Review Board of PNUH (IRB no. H-1505-008-029) and the Institutional Review Board of PNUYH (IRB no. 05-2015-072), the participating hospitals in South Korea. The study documents including the ethics approval letters from the participating hospitals were translated from Korean language into English for the purpose of obtaining ratification from the Human Research Ethics Committee of the University of Technology Sydney, the participating university (Appendix A).

The study adhered to the general ethical principles applied to research with human subjects. Potential participants were provided with verbal and written information about the study and its objectives in Korean language and provided an informed consent to participate in the study. They were assured that their participation was completely voluntary, there was no financial reward, direct benefits or risks for their participation in the study, and that they could withdraw from the study at any time without any consequences. Participant confidentiality and privacy were ensured and respected. The individual participation was not disclosed to other patients and data collection was undertaken individually in the room where the patients' privacy could be protected. Follow-up interviews were scheduled according to participants' preferences to minimise inconvenience. The participants were provided with the option to complete the questionnaires in more than one session. The study questionnaires were administered in Korean. A single researcher collected the data for the study, both baseline and follow up date, and dealt with the data collected from the participants. The researcher maintained the anonymity of the participants by not publishing any information by which one could identify a specific person. The information obtained was only considered for the purpose of the research. The researcher was the only person who knew the identity of the participants. All the completed questionnaires were kept in a secure, private location that was only available for the researcher.

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CHAPTER 4: Results (1)

4.1. Chapter preface

Chapter 3 provided the methodology of the current study including study population selection criteria, sampling and data collection processes, instruments for measuring variables, statistical analysis, and ethical considerations. In this fourth chapter, the study's results with regard to the validity and reliability of the Korean version of the MacNew Heart Disease Health-Related Quality of Life Questionnaire, are reported. This validation study was designed for verifying validity and reliability of the tool as well as for the process of translation into Korean. The article in this chapter is presented in its preprint form, being published in the Taiwan Nurses Association's *Journal of Nursing Research* (2018). The final submitted format of this article is provided in Appendix E. *The Journal of Nursing Research* was chosen since it well reflects the Association's international perspectives with an impact factor of 0.944. Moreover, this journal is highly ranked among Asian-based English-language journals, which will help to increase the accessibility and usability of the Korean version of the MacNew.

4.2. Validation of the Korean version of the MacNew heart disease health-related quality of life questionnaire

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Abstract

Background: Health-related quality of life (HRQoL) is an important measure in patients with cardiac disease including myocardial infarction (MI). The disease-specific tools can better reflect the impact of the disease on different aspects of the patient's life.

Purpose: The aim of the study was to assess the psychometric properties of the Korean version of the MacNew Heart Disease HRQoL Questionnaire

Methods: A total of 136 patients who had experienced MI about three months earlier were recruited from two tertiary hospitals in South Korea. The internal consistency and various types of validity of the Korean MacNew were assessed. Exploratory factor analysis (EFA) with varimax rotation was performed to identify a better structure for the Korean version of the MacNew.

Results: The internal consistency of the Korean MacNew was established as indicated by Cronbach's alpha coefficients, ranging from 0.88 to 0.93. Face validity and construct validity (both discriminant and concurrent) of the Korean MacNew were established. There were strong positive correlations between the total Korean MacNew and the single-item global QoL scale (r=0.73, *p*<.001). As expected, the total Korean MacNew also had strong negative correlations with the DASS 21 (r=-.81, *p*<.001), and the single-item fatigue scale (r=-.51, *p*<.001). The outcomes of EFA showed a better result with the five-factor structure in the Korean version of the MacNew.

Conclusion: The Korean version of the MacNew showed consistently acceptable psychometric properties of reliability and validity in patients with MI. Therefore, this instrument can be recommended for assessing HRQoL of MI patients among the South Korean population. However, caution should be taken in using the sub-scale scores.

4.3. Introduction

Health-related quality of life (HRQoL) is an important and relevant measure in patients with cardiac disease, allowing for a more comprehensive assessment of health status as perceived by the patient. HRQoL presents the patient's individual perspective of the burden and trajectory of their illness as well as their overall health (Rumsfeld et al. 2013). Thus, careful assessment of this concept can provide valuable information about the patient and help guide clinical decisions and treatment. Several generic and disease-specific measurements have been used to assess HRQoL in cardiac patients and they are useful; however, the disease-specific tools can better reflect the impact of the disease on various aspects of the patient's life (Pavy et al. 2015). Further, disease-specific tools are more sensitive to changes during recovery from cardiac events, such as myocardial infarction (MI) and treatments (Nakajima et al. 2009).

Despite significant improvements in intervention and treatment, MI remains one of the leading causes of mortality and morbidity in South Korea (Kook et al. 2014). Increasing attention is being paid to improving patients' experience with MI and the impact that such a life threatening event can have on the patients' wellbeing and quality of life (Rumsfeld et al. 2013). In South Korea, the 36-Item Short Form Health Survey is the most commonly used generic tool for assessing HRQoL in cardiac patients, followed by the Seattle Angina Questionnaire, the Quality of Life Index-Cardiac, and the Padilla and Grant's Quality of Life Index (Lee, Tak & Song 2005). However, the MacNew Heart Disease Health-related Quality of Life (MacNew) is more likely to comprehensively reflect the experiences of patients with cardiac diseases. This measurement requires patients to answer the items about their 'heart problem' and the impact of these experiences on different aspects of their life, while the Seattle Angina Questionnaire and the Minnesota Living with Heart Failure Questionnaire refer to 'chest pain, chest tightness or angina' and 'your heart failure', respectively, in the questions that may have difficulties in covering a wide range of cardiac events, such as heart attacks (Höfer et al. 2012; Pavy et al. 2015).

The MacNew is the modified version of the Quality of Life after Myocardial Infarction Questionnaire (QLMI), developed by Hiller et al. (1994), and the QLMI questionnaire (QLMI-2) developed by Valenti, Lim, Heller, & Knapp (1996). It is a valid and reliable questionnaire for assessing HRQoL in patients with a broad range of cardiac diseases including angina, heart failure and MI (Höfer et al. 2004). The MacNew has been translated into a wide range of languages and is available in more than 50 countries. The psychometric properties of the tool have been validated in patients with MI and other cardiac conditions in 20 languages (MacNew.org 2016). However, the Korean version of the MacNew had not yet been validated. The aim of the study was to translate the MacNew into Korean, and assess the reliability, validity, and factor structure of the tool to measure HRQoL in South Korean patients with MI.

4.4. Methods

4.4.1. Settings and subjects

The study was implemented as part of a larger observational longitudinal study, which aimed to examine changes in HRQoL after MI and to identify factors affecting HRQoL in this patient population. The study was conducted at the cardiovascular centres of two major tertiary referral hospitals in the southern part of South Korea. Patients admitted to these centres were consecutively recruited from August 2015 to February 2016 and were followed up for three months after discharge. Inclusion criteria of the study included patients: 1) admitted to a cardiac department with a diagnosis of MI (either STEMI or NSTEMI); 2) able to understand and speak Korean; 3) living in South Korea; and 4) able to understand the study and provide an informed consent.

A total of 215 patients were screened in accordance with the inclusion criteria. One hundred and fifty patients (69.8%) gave informed consent to participate and completed the study questionnaires at baseline. Of the screened patients, 65 patients were not recruited due to poor health condition (n=23), declined without any reason (n=19), inadequate hearing (n=17), discharged before enrolment (n=5) or being unconscious (n=1). Poor health condition was mentioned as experiencing dyspnoea, pain on the site of intervention, severe tremor, or tiredness. By the time of the follow-up, four out of 150 participants were deceased and ten were lost to the follow-up. As a result, 136 participants completed the study questionnaires at the three-month follow-up, including the Korean version of the MacNew.

4.4.2. Study procedure

Before recruitment of participants, the ethics approval of each Institutional Review Board was obtained. Once participants signed the consent form, they were asked to complete the self-report questionnaires in the Korean language. Clinical data of the participants were retrieved from medical records. Recruitment occurred under supervision of chare nurses and two cardiologists were consulted about the appropriate follow up period, study questionnaires, and in the process of obtaining the ethical approvals.

At three months after discharge from hospital, a follow-up interview was carried out with each participant by telephone, or participants were asked to complete the follow-up questionnaires in a face-to-face session when they attended the outpatient department as part of their routine care.

4.4.3. Measurements

The study questionnaires included key socio-demographic questions, such as age, gender, marital status, and self-evaluated income (excellent, good, only fair, and poor); and questions about clinical characteristics contained recurrent MI (yes/ no), physical activity (active/ relatively active/ not active), and fatigue (the 0–10 fatigue scale).

This study used the Korean version of the MacNew. The MacNew consists of 27 items, which assess cardiac patients' perceived emotional (14 items), physical (13 items), and social functioning (13 items) over the previous two weeks. A single item can be part of more than one subscale. Each item is scored on a seven-point Likert scale ranging from 1 to 7. A higher score on the scale indicates better HRQoL. The total score of the MacNew can be calculated as the average of the 27 items, and domain scores can be taken by the averages of the items in each subscale with a range between 1 and 7. The scores are not contributed by missing items, and the 27th item may be excluded in the physical domain (Dixon, Lim & Oldridge 2002).

For the purpose of this study, the tool was translated into Korean following the guidelines suggested by Guillemin et al. (1993). To obtain a quality translation, the principal researcher, who has vast experience in the translation of English texts into Korean, first translated the instrument into Korean. Then, the back-translation was carried out by two bilingual experts who had not seen the questionnaire previously. Differences in the translations were discussed and agreement was reached on the final version. The Korean version of the MacNew was next reviewed for face validity by three South Korean native health professionals in the field of cardiovascular disease and five persons with a history of cardiac disease.

We used the Depression Anxiety and Stress Scale (DASS 21), the single-item fatigue scale, and the single-item global quality of life scale to assess the concurrent construct validity of the Korean MacNew. We hypothesised that the MacNew total score would correlate significantly and closely with the DASS 21 (McDonnell et al. 2014). DASS 21 is the short form of the DASS 42, designed to measure the severity of the core symptoms of depression, anxiety and stress. It consists of 21 items and each item is scored from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time). Higher total scores on the DASS 21 represent greater emotional distress. Past research shows strong positive relationships between experience of depression and poorer HRQoL in patients with MI (McDonnell et al. 2014; Moryś et al. 2016). DASS 21 has been widely used in Asian countries and a Korean version is available (Cha 2014). We also hypothesised that the MacNew total score would correlate significantly and closely with the single-item fatigue scale (Alsén & Brink 2013; Casillas et al. 2006; Hwang, Liao & Huang 2014). The single-item fatigue scale is a valid tool with response options ranging from 0 (no fatigue) to 10 (greatest possible fatigue) (Kim & Abraham 2017).

Additionally, we expected to find a significant correlation between the MacNew global scale with the single-item quality of life scale (De Boer et al. 2004), as they both measure the same construct. The single-item quality of life scale has proved to be a valid tool with response options ranging from 0 (the worst it has ever been) to 10 (the best it has ever been) (De Boer et al. 2004). Based on past literature, we hypothesised that the MacNew scores would correlate negatively with the DASS (McDonnell et al. 2014; Moryś et al. 2016) and the fatigue scores (Alsén & Brink 2013; Casillas et al. 2006; Hwang, Liao & Huang 2014), but positively with the single-item quality of life score (Alsén & Brink 2013; De Boer et al. 2004; Wang, Thompson, et al. 2014).

4.4.4. Ethical considerations

Ethical approvals were obtained from the relevant research ethics committees prior to commencement of the study (PNUH-IRB No. H-1505-008-029, PNUYH IRB No. 05-2015-072, UTS HREC Approval Number: 2015000254). The researcher provided verbal and written information about the study and its objective to the participants and assured them of their voluntary participation, confidentiality and privacy. Informed consent was obtained from all participants.

4.4.5. Statistical analyses

The follow-up data of 136 participants were analysed for the present validation study, using IBM SPSS Statistics 24. Characteristics of the participants were described using frequencies, means, and standard deviations (SD) (Table 5). The psychometric properties of the Korean version of the MacNew were assessed in accordance with the recommendations of the Scientific Advisory Committee of Medical Outcomes Trust (2002). Specifically, two steps of factor analysis were conducted. First, partial confirmatory factor analysis (PCFA) with direct oblimin rotation (maximum likelihood) was performed to determine if the items loaded similarly to the theoretically clear structure in three factors of the original version (Valenti et al. 1996). Second, exploratory principle component factor analysis (EFA) with varimax rotation was carried out to identify a better structure for the Korean version of the MacNew. A total of 26 items were included; however, item 27 was excluded in the factor analysis based on the original report (Valenti et al. 1996). The suitability of data for factor analysis was assessed by 0.30 and higher in the correlation matrix, the recommended value of 0.60 in the Kaiser-Meyer-Oklin value, and the significance ($p<.001$) in the Bartlett’s Test of Sphericity. The values of evaluating the confirmatory factor analysis model fit require higher than 0.950 of normed fit index (NFI), comparative fit index (CFI), and Tucker-Lewis index (TLI) as well as <.06 or <.08 of root mean square error of approximation (RMSEA) and standardised root mean square residual (SRMR).

The Cronbach's α coefficient was used to examine the internal consistency of the overall tool and of each dimension. The emotional subscale included items 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 15, 18, and 23. The physical subscale included items 1, 6, 9, 12, 14, 16, 17, 19, 20, 21, 24, 25, and 26. The social subscale included items 2, 11, 12, 13, 15, 17, 20, 21, 22, 23, 24, 25, and 26. The concurrent construct validity of the Korean MacNew was assessed by calculating the Pearson correlation coefficients of the total score of the MacNew with the DASS, with the single-item fatigue scale, and with the single-item of global quality of life scale. The strength of the correlations was considered weak when r=0.10 to 0.29, medium when r=0.30 to 0.49, and strong when r=0.50 to 1.0 (Pallant 2016). Discriminant validity was determined via assessment of the ability of the Korean MacNew to discriminate between males and females, different age groups, and levels of physical activity. We hypothesised that HRQoL of the participants would be poorer if they were female, older age and less active. Gender (Lim et al. 1993; Valenti et al. 1996) and age (Kim, Kim & Hwang 2015; Oginska-Bulik 2014; Valenti et al. 1996) have been used in previous studies for assessment of discriminant construct validity of the MacNew.

4.5. Results

Socio-demographic and clinical characteristics of the study participants are demonstrated in Table 5. The mean (SD) age of the participants was 64.35 ± 11.61 years old, they were mainly male patients (73.5%), married (87.5%) and perceived their income as 'only fair' (60.3%). The majority of the participants had experienced MI for the first time (77.9%) and were physically not active or only relatively active (71.3%). Additionally, the mean score of fatigue was 2.97 ± 2.69.

Table 5. Socio-demographic and clinical characteristics of the study participants (N=136)

Participant characteristics	N (%)
Age	
Mean ± SD years	64.35 ± 11.61
Range	21- 86
≥65	69 (50.7)
Gender	
Female	36 (26.5)
Male	100 (73.5)
Marital Status	
Married	119 (87.5)
Never married, separated, divorced, widowed	17 (12.5)
Physical activity	
Active	39 (28.7)
Relatively active	29 (21.3)
Not active	68 (50.0)
Self-evaluated income	
Excellent	3 (2.2)
Good	15 (11.0)
Only fair	82 (60.3)
Poor	36 (26.5)
Recurrent MI	
Yes	30 (22.1)
No	106 (77.9)

The PCFA with direct oblimin rotation was applied to help interoperate factor loading of each of 26 items of the MacNew on the three factors in the original version (Valenti et al. 1996), explaining 50.2% of the total variance (see Table 6). The majority of the items loaded significantly (loadings ranged from 0.30 to 0.78) on the same factors reported in the original study. Specifically, four of the 26 items in the Korean MacNew loaded on unexpected factors. Item 16 (aching legs), which asked the participants how often they had been bothered 'by aching or tired legs', loaded on the social factor instead of the physical factor; item 21 (unsure about exercise; 'how often have you felt unsure as to how much exercise or physical activity you should be doing?'), item 22 (overprotective family; 'how often have you felt as if your family is being over-protective toward you?'), and item 24 (excluded; 'how often have you felt excluded from doing things with other people because of your heart problem?') loaded on the emotional factor rather than on the physical or social factor.

To examine the factor structure of the Korean MacNew Questionnaire, data on 26 items of the questionnaire were subjected to EFA. The inspection of the correlation matrix revealed the presence of many coefficients at higher than 0.30 and 0.89 of the Kaiser-Meyer-Oklin value, and that Bartlett's Test of Sphericity reached significance (p<.001), supporting factorability of the data. The results of rotation sums of squared loadings in the EFA presented the five-factor structure, explaining 64.9% of the total variance (Table 7). Half of the 26 items loaded on more than one factor and the first three factors explained about 50% of the variance.

The internal consistency of the global scale was high at Cronbach's alpha coefficients of 0.93. Additionally, coefficients of emotional, physical, and social subscales, allocated as the original study (Valenti et al. 1996), were examined as indicated by 0.92, 0.88, and 0.91 respectively.

Concurrent construct validity of the Korean MacNew was supported by demonstrating strong negative correlations between the global MacNew and DASS 21 (r=-.81, p<.001), and between the global score and the single-item fatigue scale (r=-.51, p<.001). There were significant positive correlations between the total MacNew score and the single-item global quality of life scale (r=0.73, p<.001).

The discriminant validity of the Korean MacNew was also supported by examining the discriminant function of the tool across different age groups, gender, and physical activity. Patients ≥65 years old showed lower HRQoL than those <65 years old (5.34 vs 5.74 respectively, p=.002). The Korean MacNew also discriminated well between female and male, with female patients showing poorer HRQoL than male patients (5.20 vs 5.66 respectively, p=.002). The difference in the MacNew scores among patients who had been more active, relatively active and who had not been active (5.82, 5.81 vs 5.19 respectively, p<.001) was statistically significant, indicating that the discriminant concurrent validity on the Korean MacNew was well confirmed.

Table 6. Partial Confirmatory Factor Analysis with direct oblimin rotation of the Korean MacNew (N=136)

		The MacNew domains					
		Emotional		**Physical**		**Social**	
	MacNew items	**Korean**	**Original**	**Korean**	**Original**	**Korean**	**Original**
1	Frustrated	0.78	**0.79**				
2	Worthless	0.49	**0.74**			0.47	**0.42**
3	Confident	0.43	**0.61**				
4	Down in the dumps	0.74	**0.86**				
5	Relaxed	0.57	**0.79**				
6	Worn out		**0.59**	0.31	**0.52**		
7	Happy with personal life	0.49	**0.73**				
8	Restless	0.69	**0.81**				
9	Short of breath			0.44	**0.73**		
10	Tearful	0.38	**0.72**			0.37	
11	More dependent					0.60	**0.62**
12	Social activities	0.30	**0.40**		**0.46**	0.40	**0.52**
13	Others/less confident in you	0.63	**0.45**				**0.66**
14	Chest pain			0.39	**0.72**		
15	Lack of self-confident		**0.67**			0.66	**0.47**
16	Aching legs				**0.44**	0.41	
17	Sports/exercise limited			0.78	**0.60**		**0.61**
18	Frightened	0.52	**0.63**				
19	Dizzy/ light-headed			0.44	**0.61**		
20	Restricted or limited			0.82	**0.64**		**0.62**
21	Unsure about exercise	0.43			**0.47**		**0.48**
22	Overprotective family	0.34					**0.69**
23	Burden on others		**0.44**	0.31		0.90	**0.66**
24	Excluded	0.37			**0.43**		**0.74**
25	Unable to socialize	0.36		0.39	**0.46**		**0.68**
26	Physically restricted	0.78		0.90	**0.60**		**0.65**
	Variance explained	39.1%	**28.1%**	6.7%	**17.2%**	4.4%	**21.4%**

Table 7. Exploratory principle component factor analysis of the Korean MacNew (N=136)

	MacNew items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
23	Burden on others	0.81				
15	Lack of self-confident	0.77				
2	Worthless	0.71				
11	More dependent	0.71				
10	Tearful	0.63		0.40		
4	Down in the dumps	0.62		0.58		
12	Social activities	0.62	0.40			
13	Others/less confident in you	0.55			0.46	
16	Aching legs	0.54				0.49
24	Excluded	0.53	0.45			
7	Happy with personal life	0.52		0.47		
26	Physically restricted		0.84			
20	Restricted or limited		0.82			
17	Sports/exercise limited		0.76			
9	Short of breath		0.59			
19	Dizzy/ light-headed		0.58			
14	Chest pain		0.52			
25	Unable to socialize		0.51			
1	Frustrated			0.69	0.42	
5	Relaxed			0.58		
18	Frightened		0.42	0.47		0.42
6	Worn out		0.40	0.46		
22	Overprotective family				0.81	
8	Restless			0.48	0.58	
3	Confident	0.50				0.59
21	Unsure about exercise				0.43	0.54
	Variance explained	20.9%	17.7%	11.6%	8.4%	6.3%

4.6. Discussion

Patients' evaluation of the impact of the disease on their daily functionality and quality of life is important to facilitate patient centred care and improve disease and patient outcomes. HRQoL has been an important patient-reported health outcome in consideration of its prediction of mortality, recurrence of cardiovascular events and re-hospitalisation among patients with cardiovascular disease, particularly in MI (Anker et al. 2014). The MacNew questionnaire is one of the most popular disease-specific questionnaires for assessing HRQoL in cardiac patients (MacNew.org 2016). The current study demonstrated that the Korean MacNew is also reliable and valid for measuring HRQoL in patients with MI.

The Cronbach's alpha coefficients of the Korean MacNew in the current study were high, with 0.93 for the overall score as well as 0.92, 0.88 and 0.91 for the emotional, physical and social subscales, respectively. The results were consistent with prior internal consistency reports, with the average internal consistency reliability coefficients for the total, emotional, physical and social domains being 0.93, 0.92, 0.86 and 0.88, respectively, throughout the 23 validation studies conducted in different languages (Höfer et al. 2004; Höfer et al. 2012; Pavy et al. 2015; Wang et al. 2015). The concurrent construct validity and discriminate construct validity of the Korean MacNew were also supported. Therefore, the Korean version of the MacNew demonstrated high reliability and validity for assessing HRQoL in patients with MI.

When we performed PCFA with the direct oblimin rotation solution to determine if the items loaded similarly to the theoretically clear structure in three factors in the original version (Valenti et al., 1996), all the 26 items on the Korean MacNew met the threshold standard for item retainment and most loaded on the expected factors in comparison to the original study. The physical and social factors explained only 6.7% and 4.4% of variance, respectively, while the emotional factor explained 39.1% of variance. A few items loaded on a different factor compared to the original validation study. For example, loading of item 16 (aching legs) was skewed to the social factor rather than the physical factor. A potential explanation for this finding may that aching legs affects patients' social health rather than physical health in Korean culture. Loadings of item 21 (unsure about exercise) and item 22 (overprotective family) were on the emotional dimension rather than the physical or social dimensions. Pogosova, Kursakov, and Boycharov (2015) and Seneviwickrama et al. (2016), who used the Russian and the Sinhalese versions respectively, also found that item 21 loaded on the emotional domain. Item 22 loading on the emotional domain was consistently found in a study of the German version of the MacNew, conducted by Stefan Höfer et al. (2008). These findings may suggest that the Korean patients who have recently experienced MI are affected emotionally regarding their uncertainty regarding exercise and being overprotected by the family.

In addition, except for SRMR (=0.055), other values of NFI (=0.784), CFI (=0.879), TLI (=0.843) and RMSEA (=0.082) did not meet the requirements in the three-factor structure. Thus, EFA was implemented to identify a better structure for the Korean MacNew, and the results revealed that the 26 items of the Korean version of the MacNew were likely to be grouped into five factors.

In general, the results of previous validation studies on both English (Dempster, Donnelly & O'Loughlin 2004) and non-English patients with cardiac disease fail to support the item loading pattern (Gramm, Farin & Jaeckel 2012) as reported in the original study. For example, Dempster et al. (2004) established a five-factor solution, including factors of emotion, restriction, symptoms, perception of others and social on a population of cardiac patients in Ireland (Dempster, Donnelly & O'Loughlin 2004). Therefore, these findings imply that the factor structure of the MacNew may need to be further reviewed.

Overall, the results of the current validation study suggest that the Korean MacNew is a valid and reliable tool for assessing HRQoL in patients with MI. However, we recommend that only the total score for the Korean MacNew be used at this stage, unless future studies with bigger sample sizes provide more consistent results on the pattern of item loadings on the individual subscales. Our study sample size of 136 may not be large enough to produce reliable results, considering the number of the MacNew items. Although some authors suggest that five cases for each item is adequate for factor analysis in most cases, the recommendation generally is that the larger sample size, the better (Tabachnick & Fidell 2013).

4.7. Conclusion

The Korean version of the MacNew showed consistently acceptable psychometric properties of reliability and validity in patients with MI. The instrument can therefore be used for assessing HRQoL of South Korean MI patients to develop a better understanding of patients' health conditions after MI and evaluation of interventions or related treatments from patients' experiences. However, caution should be taken in using the sub-scale scores.

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CHAPTER 5: Results (2)

5.1. Chapter preface

Chapter 4 provided the results of the study on the psychometric properties of the Korean MacNew Heart Disease Health-Related Quality of Life Questionnaire. This study demonstrated that the Korean MacNew is a valid and reliable tool to be used for the assessment of HRQoL in South Korean patients with MI.

Chapter 5 provides the major findings of this study as presented by a submitted manuscript and an accepted article. Section 5.2 provides HRQoL of South Korean patients during less than a week of hospitalisation and correlates of HRQoL immediately after MI. The baseline study findings are helpful for identifying patients who are likely to experience impaired HRQoL at the early stage of recovery from MI. Section 5.2 presents a manuscript, submitted to *the Applied Research in Quality of Life*, and the submitted format of this manuscript is provided in Appendix E. *The Applied Research in Quality of Life* was chosen because its nature as the official journal of the International Society for Quality-of-Life Studies, and as a journal which has shown positive influences on research of quality of life. The impact factor of t*he Applied Research in Quality of Life* in 2016 is 1.286.

Section 5.3 provides results of a study on the trends of HRQoL for three months and baseline predictors of HRQoL among patients with MI three months after discharge. Along with the baseline study, this longitudinal observational study focused on achieving the overall research aims and in answering the research questions, presented in section 1.4. Supported by the literature review, a total of 11 independent variables, comprising demographic, clinical and psychosocial factors, were put into the regression analysis model, identifying its influence and its prediction of HRQoL in this patient population. This fifth chapter presents an article in its preprint form, sent for publication by *Heart & Lung: The Journal of Acute and Critical Care*. The published format prior only to the final correction process is provided in Appendix E. The American Association of Heart Failure Nurses has been officially publishing this peer-review journal, whose impact factor in 2016 was 1.657. This journal specialises in 'acute and critical care' for cardiovascular and respiratory patients, and its general perspective thus seems to fit with my research findings.

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5.2. Health-related quality of life and its predictors in South Korean patients with myocardial infarction in the acute phase

Manuscript reference:

Kang, K., Gholizadeh, L. & Han, H.-R. (2018), 'Health-related quality of life and its predictors in Korean patients with myocardial infarction in the acute phase' (Manuscript reference: RCNJ-2018-0057), *Contemporary Nurse* (Submitted and under review).

5.2.1. Abstract

Background: Individual experience of myocardial infarction (MI) often results in low health-related quality of life (HRQoL). Investigating factors affecting post MI HRQoL can be helpful for identifying patients who may be at risk for developing low HRQoL at an early stage of recovery from MI. This study aims to investigate HRQoL of South Korean patients in the acute phase of MI and factors that correlate with this important patient outcome.

Methods: A total of 150 patients with recent MI were recruited. The Korean version of the MacNew Quality of Life after Myocardial Infarction Questionnaire was used to assess their HRQoL. Demographic, behavioural and disease-related factors were also assessed and the Depression, Anxiety and Stress Scale (DASS 21) was used for psychological well-being. Stepwise regression analysis was implemented to identify the correlates associated with patients' HRQoL.

Results: Financial status, physical activity, diabetes, history of stroke, history of other heart disease, and the DASS 21 score were significantly correlated with HRQoL of patients with recent MI. Participants who had a higher education level and better financial status had better HRQoL. Diabetes, history of stroke, other heart disease and a higher score of the DASS 21 were adversely associated with HRQoL.

Conclusion: The findings of this study help detect individual patients who possibly experience lower HRQoL after MI and early psychological and financial support may help reduce the impact of MI on patients' overall health and quality of life.

5.2.2. Introduction

Cardiovascular disease (CVD) remains the number one killer of both men and women worldwide (Go et al. 2014). Similar to the international trends, CVD is a serious health concern in South Korea. As the second leading cause of death in the country, CVD mortality has steadily increased since 2004 (Shin et al. 2016). Among CVD patients, those who experience myocardial infarction (MI) are at higher risk of subsequent physical consequences, such as malignant arrhythmias, reduced left ventricular function, and adverse psychological reactions (Hawkes et al. 2013). The physiological and psychological impact of MI, often with sudden onset and hospitalisation, negatively affect the overall health and health-related quality of life (HRQoL) of patients shortly after MI (Wang, Thompson, et al. 2014).

The American Heart Association recommends HRQoL to be routinely assessed as a part of health status evaluation among patients with CVD (Rumsfeld et al. 2013). HRQoL is a subjective patient reported outcome that presents comprehensive assessment of patients' health status and the impact of a life threatening event, such as MI on patients' overall health and well-being (Anker et al. 2014), leading to a better understanding of patients' experience and recovery from MI (Lidell et al. 2015). This multidimensional concept can be useful for predicting future cardiac events, rehospitalisation, mortality among MI patients and help inform treatment decisions (Rumsfeld et al. 2013). The impact of the illness on HRQoL may be particularly evident in the early stages of

MI, when patients are admitted to the cardiovascular centre shortly after MI. Those who are hospitalised less than a week following MI had significantly lower HRQoL than at the three-month follow-up (Uysal & Özcan 2012).

Many studies have been conducted to identify correlates or predictors of HRQoL in patients with MI from various countries, yet the results are inconsistent throughout the variables. For instance, in a study, older age and being male predicted higher HRQoL (Arnold et al. 2013), whereas another study showed younger age and being female were related to better HRQoL (Oginska-Bulik 2014). Moreover, depression more commonly appears in patients after MI than in the general population and worsens cardiovascular morbidity and mortality (Lichtman et al. 2008), while anxiety also negatively influences the prognosis, increasing mortality and cardiovascular risk (Rafael et al. 2014; Wang et al. 2016). However, the literature is scarce in relation to South Korean patients' HRQoL and its predictors, particularly at the early stage of recovery from MI. Identifying factors influencing HRQoL can be helpful in detecting vulnerable patients who may have lower HRQoL in the early stages and developing strategies to reduce the impact of MI on patient experience and health status (Hawkes et al. 2013). This study aims to investigate HRQoL of South Korean patients with MI in the acute phase and identify its predictors in this population.

5.2.3. Methods

Design

This study was conducted as part of a longitudinal survey design, and used questionnaires and medical records to assess participants' HRQoL and to identify its predictors among patients with MI in South Korea.

Participants and setting

The study was conducted at the cardiovascular centres of two major tertiary referral hospitals in the southern part of South Korea. Consecutive patients admitted to the cardiovascular centres were recruited from August 2015 to February 2016. They were asked to participate in the study if they: 1) were admitted to the cardiac department with a diagnosis of MI (either STEMI or

NSTEMI); 2) were able to understand and speak Korean; 3) resided in South Korea; and 4) had the ability to understand the study and provide an informed consent. The patients' competence to sign the consent and complete the research questionnaires as well as cognitive status were assessed using the following steps (Caruana 2016): 1) a nurse who was taking care of the patient confirmed that patient had the ability to provide an informed consent to the study; 2) all patients were asked to state their names at the time of screening; 3) each patient was asked to correctly state the colour when they were shown one of three coloured papers. Patients were excluded if they had cognitive impairment or were participating in other interventional studies, which could influence their HRQoL at the time this study was being conducted. However, no patients were involved in an interventional study.

The formula by Tabachnick and Fidell (the number of cases needed should be > 50+8 x the number of independent variables) was used for sample size calculation (Pallant 2016). Based on this formula 138 participants were needed for this study. A total of 215 patients were screened for the study inclusion and exclusion criteria, of which 150 patients (69.8%) were recruited. Participants completed the study questionnaires about one week after experience of MI. Sixty-five patients did not participate in the study due to being unconscious (n=1), refusal due to poor health condition (n=23), inadequate hearing (n=17), declined without any reason (n=19), or discharged before enrolment (n=5). Patients who refused to participate in the study due to poor health condition mentioned reasons, such as experiencing dyspnoea, pain at the site of intervention, severe tremor, or tiredness.

Study procedure

After the ethics approval of each Institutional Review Board was obtained, patients were recruited from two tertiary hospitals. Charge nurses in the participating hospitals supervised the recruitment of the participants. The cognitive status of potential participants was assessed to determine their capacity to participate in the research. For this purpose, they were asked to state their full name and determine the colour of a card. Two cardiologists gave advice in setting the follow up for study, provided feedback on the study questionnaires, and helped in the process of obtaining the ethical approvals.

The study invitation letters were distributed to potential participants hospitalised in the units and they were invited to participate. The information letter outlined the aim of the research and the description of the process that the researcher followed to collect data. Study participants who signed the consent form completed self-report questionnaires in a place that was comfortable, private, quiet and free from distractions. A student investigator monitored the condition or stress of the participants while they were answering questions. Clinical data of the participants were obtained from medical records.

Research instruments

Demographical, behavioural and disease-related profile

A questionnaire was developed for the purpose of the study to collect information on demographical, behavioural and disease-related characteristics of the participants. For the selection of independent variables, previous articles on factors or predictors of HRQoL exclusively in patients with MI were thoroughly reviewed (Kang et al. 2017) and the revised Wilson & Cleary model for HRQoL (Ferrans et al. 2005) was adopted as an additional guidance. The questionnaire included questions about age, gender, marital status, the level of education, current employment status, and perceived financial situation. Information on the health behaviour profile of the participants was also collected including physical activity level prior to MI, smoking, alcohol consumption, and medical history. Physical activity was measured as having ‘at least 30 minutes moderate physical activity most or all days of the week’, ‘less than 30 minutes moderate physical activity less than 5 days in a week’ or ‘not physically active’. Smoking status was assessed as being a current smoker, a previous smoker or non-smoker. Participants were asked if they were regularly consumed alcohol prior to their recent hospital admission. The disease-related profile was collected from the medical records of the participants after obtaining their consent and included: ST-elevation (NSTEMI/STEMI), personal history of high blood pressure, diabetes, stroke, other heart disease, previous MI and other comorbidities. These variables were selected based on the results of a thorough review of the literature on factors affecting HRQoL of MI patients (Kang et al. 2017).

Psychosocial profile: Depression, Anxiety, and Stress Scale (DASS 21)

Psychological distress including depression, anxiety and stress have been found to be important factors affecting HRQoL of patients with MI (Hosseini et al. 2014). Thus, the current study considered measuring and examining the impact of these variables on HRQoL of South Korean patients, using the Depression, Anxiety, and Stress Scale (DASS 21). The DASS 21 is the short form of the DASS 42, consisting of 21 items with each scoring from 0 (never) to 3 (almost always) and the total score for this scale ranging from 0 to 63. Higher scores on the scale reflect worse psychosocial status (Lovibond, Lovibond & Psychology Foundation of Australia 1995). DASS 21 has been well-validated (Lovibond & Lovibond 1995) and widely used in Western and Asian countries (Oei et al. 2013) including the Korean version of the tool (Cha 2014). The total DASS 21 score was used and the alpha coefficient of this scale was 0.87 in the current study.

Korean version of the MacNew

After a thorough review of the available assessment tools, the MacNew Quality of Life after Myocardial Infarction Questionnaire (MacNew) was used to assess HRQoL of MI patients in the present study (Dixon, Lim & Oldridge 2002). The MacNew is one of the most popular disease-specific tools used to measure HRQoL of MI patients (Kang et al. 2016). The MacNew consists of 27 items, which address HRQoL in three areas: physical (13 items), emotional (14 items), and social (13 items) subscales (Dixon, Lim & Oldridge 2002; Hevey & Wilczkiewicz 2014). Each item is scored on a seven-point Likert response format ranging from 1 to 7. In addition, the total score of the MacNew can be calculated as the mean scores of the 27 items with a range of 1 to 7. A higher score on the scale indicates better HRQoL (Dixon, Lim & Oldridge 2002).

The MacNew has proven to be a highly valid and reliable instrument. Its reliability has been established by a number of studies with Cronbach's alpha coefficients ranging from between 0.87 and 0.97 (Williams et al. 2012; Wrzesniewski & Wlodarczyk 2012). For the purpose of this study, the Korean version of the MacNew was prepared (Kang et al. 2018), following the translation procedure described by Guillemin, Bombardier & Beaton (1993). The psychometric properties and factors analysis of this Korean version were presented in a separate study (Kang et al. 2018). In line with several previous validation studies on the MacNew (Dempster, Donnelly & O'Loughlin 2004; Gramm, Farin & Jaeckel 2012), the findings of this validation analysis showed factor structures different from the original study by Valenti et al. (1996). Therefore, at this stage, it is recommended that only a global score of the Korean MacNew to be used. The alpha coefficient for the total Korean MacNew was 0.90.

Ethical considerations

Ethics approvals were obtained from the Institutional Review Boards of both study sites (IRB no. H-1505-008-029 and IRB no. 05-2015-072) and the Human Research Ethics Committees of the university (HREC Approval No. 2015000254) prior to recruitment. Participants were informed that participation was voluntary and that they could withdraw from the study anytime without penalty. All ethical considerations met the international ethical standards of privacy and confidentiality. All enrolled patients signed the informed consent form prior to participation.

Statistical analyses

SPSS for Windows 24.0 was used to analyse the data. We used descriptive statistics including means, standard deviations (SD), frequencies and percentages to summarise the sample characteristics. The normality of the MacNew score was assessed and found to have normal distribution. As a preliminary analysis, an independent t-test or one-way analysis of variance (ANOVA) was used to decide which variables had an association with HRQoL and which of them were put into the first step of the regression model. The presence of multicollinearity was checked by tolerance, by variance inflation factor (VIF) and by correlations between the independent variables. Values of tolerance were higher than 0.10 and values of VIF were less than 10, indicating the absence of multicollinearity. In addition, Pearson correlation coefficients showed values of lower than 0.90, indicating no violation of multicollinearity (Pallant 2016). Stepwise regression analysis was applied to identify predictors associated with HRQoL of patients with MI until the final model was figured. The variables were selected for putting into the first step of stepwise analysis based on a p value of 0.05 or less at the level of the bivariate analyses and were then subjected to stepwise regression analysis. The most insignificant variables were removed gradually at different steps. The level of significance of all statistical analyses implemented was set at $p<0.05$ and two-tailed.

5.2.4. Results

Participant characteristics

Table 8 shows the participants' demographic, behavioural, disease-related and psychosocial characteristics as well as the breakdown of the MacNew scores according to these characteristics. The mean age of the participants was 64.63 years (SD=11.48) ranging between 21 and 86 years. The majority of the participants were over 55 years old (n=120, 80.0%), male (n=107, 71.3%), and married (n=129, 86.0%). More than half of the participants (n=85, 56.6%) had an education level of high school or above, and 40 per cent (n=60) were currently employed. Participants mostly self-evaluated their financial situation as "only fair" or "poor" (n=129, 86.0%), and approximately half of them (n=77, 51.3%) were not physically active. One third of the participants (n=50, 33.3%) were current smokers and about 30% (n=43, 28.7%) consumed alcohol. Participants diagnosed with non-ST-elevation MI were 59.3% (n=89) and ST-elevation MI patients 40.7% (n=61). In terms of CHD risk factors, half of the participants (n=75, 50.0%) had hypertension and approximately one-third diabetes (n=47, 31.3%). Several patients had a history of stroke (n=8, 5.3%) and 25 patients (16.7%) had a history of other heart disease such as valve disease or heart failure. A history of previous heart attack was present in 24.7% of participants. More than a third (n=58, 38.7%) had other comorbidities, including kidney problems and thyroid illness. The average total score of the MacNew among the 150 participants was 120.29 (SD=22.53) or 4.46 (SD=0.83) calculated by taking mean scores over 27 items and the average total score on the DASS 21 was 17.05 (SD=9.26). Among the 17 factors presented in Table 1, two factors—ST-elevation and other comorbidities—were not related to HRQoL of this patient population. Thus, those were excluded from the regression model.

Table 8. Preliminary analyses of HRQoL scores by participants' characteristics (n=150)

Demographic factors		n	%	MacNew (Mean± SD)	*t* / F	p
Age (years)	<55	30	20.0	130.27 ± 23.49	-2.678	0.008**
	55-64	43	28.7	123.72 ± 21.00		
	65-74	43	28.7	119.00 ± 20.06		
	75 ≤	34	22.6	108.76 ± 22.09		
Gender	Female	43	28.7	112.67 ± 21.31	5.824	0.001**
	Male	107	71.3	123.35 ± 22.37		
Marital status	Married	129	86.0	122.57 ± 21.56	3.163	0.002**
	Never married/Separated/Divorced/ Widowed	21	14.0	106.29 ± 23.77		
Level of education	Primary or less	40	26.7	110.25 ± 19.93	6.403	0.000**
	Middle school	25	16.7	115.44 ± 21.64		
	High school	54	36.0	123.89 ± 21.61		
	Undergraduate or more	31	20.6	130.87 ± 22.60		
Employment status	Employed	60	40.0	128.18 ± 19.41	3.648	0.000**
	Unpaid family workers/Retired / Unemployed	90	60.0	115.02 ± 23.01		
Financial status (Subjective)	Excellent / Good	21	14.0	138.10 ± 22.87	4.110	0.000**
	Only fair / Poor	129	86.0	117.39 ± 21.18		
Behavioural factors						
Physical activity	At least 30 minutes moderate physical activity most or all days of the week	42	28.0	128.57 ± 19.25	5.141	0.007**
	Less 30 minutes moderate physical activity less than 5 days in a week	31	20.7	121.71 ± 21.91		
	Not physically active	77	51.3	115.19 ± 23.24		
Smoking	Non-smoker	85	56.7	116.35 ± 23.34	3.531	0.032*
	Previous smoker	15	10.0	120.73 ± 19.16		
	Current smoker	50	33.3	126.84 ± 20.82		
Alcohol consumption	No	107	71.3	116.90 ± 22.93	-2.983	0.003**

	Yes		43	28.7	128.72 ± 19.27		
Disease-related factors							
ST-elevation	NSTEMI		89	59.3	118.04 ± 22.47	-1.478	0.141
	STEMI		61	40.7	123.56 ± 22.38		
Medical Characteristics	Hypertension:	Yes	75	50.0	115.39 ± 22.63	-2.721	0.007**
		No	75	50.0	125.19 ± 21.47		
	Diabetes:	Yes	47	31.3	112.45 ± 20.30	-2.953	0.004**
		No	103	68.7	123.86 ± 22.68		
	Stroke:	Yes	8	5.3	100.88 ± 20.05	-2.551	0.012*
		No	142	94.7	121.38 ± 22.22		
	Other heart disease:	Yes	25	16.7	108.64 ± 21.87	-2.902	0.004**
		No	125	83.3	122.62 ± 22.01		
	Previous MI:	Yes	37	24.7	113.86 ± 22.74	-2.019	0.045*
		No	113	75.3	122.39 ± 22.15		
	Other comorbidities:	Yes	58	38.7	116.43 ± 22.187	-1.675	0.096
		No	92	61.3	122.72 ± 22.516		
Psychosocial factors					Total	Pearson correlation	
DASS 21					17.05 ± 9.26	-0.520**	

DASS = Depression Anxiety and Stress Scale; HRQoL = Health-Related Quality of Life; MacNew = the MacNew Heart Disease Health-Related Quality of Life Questionnaire; NSTEMI = Non-ST Segment Elevation Myocardial Infarction; STEMI = ST Segment Elevation Myocardial Infarction.

* Significant at the level of p<0.05.

**Significant at the level of p<0.01.

Table 9. Correlations between independent variables

	Age	Gender	Marital status	Level of education	Employment	Financial status	Activity	Smoking	Alcohol	ST-elevation	Hypertension	Diabetes	Stroke	Other heart disease	Previous MI	Other comorbidities	DASS total
Age	1																
Gender	-.404**	1															
Marital status	.177*	-.254**	1														
Level of education	-.592**	.469**	-.240**	1													
Employment	.602**	-.367**	0.133	-.430**	1												
Financial status	.244**	-0.043	0.107	-.217**	.220**	1											
Activity	0.067	-0.102	0.159	-.161*	-0.016	0.132	1										
Smoking	-.484**	.464**	-.232**	.316**	-.414**	0.044	0.01	1									
Alcohol	-.382**	.304**	-0.128	.232**	-.385**	-.169*	0.051	.305**	1								
ST-elevation	-0.129	.195*	-0.06	0.138	0.011	0.021	-0.067	0.092	.195*	1							
Hypertension	0.159	-0.133	0.058	-0.11	0.082	0.058	-0.054	-.167*	-0.133	-0.149	1						
Diabetes	.173*	-0.144	0.017	-0.05	.199*	0.065	0.101	-0.047	-.174*	-0.062	0.158	1					
Stroke	0.132	-0.046	.161*	-0.083	.194*	0.096	-0.03	-0.037	-0.15	-0.136	0.119	-0.096	1				
Other heart disease	0.145	-0.112	0.129	-0.06	0.073	-0.026	0.087	-0.159	-0.046	-0.115	0.125	0.006	0.053	1			
Previous MI	.192*	-0.048	.215**	-0.081	.246**	0.142	-0.011	-.208*	-0.158	-.222**	.170*	0.08	0.071	.367**	1		
Other comorbidities	.335**	-0.102	0.035	-0.13	.173*	0.084	0.119	-.275**	-.201*	-0.156	0.137	0.083	0.055	.233**	.181*	1	
DASS total	0.04	0.013	.187*	-0.092	0.074	.177*	0.13	-0.036	-0.05	-0.022	0.084	0.037	0.069	0.046	0.159	-0.024	1

DASS = Depression Anxiety and Stress Scale; MI = Myocardial Infarction.

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 10. Collinearity test and backward elimination stepwise regression analysis

	Collinearity		Step 1			Step 2			Step 3			Step 4			Step 5		
Demographic factors	**Tol.**	**VIF**	***β***	***t*-value**	***p***	***β***	***t*-value**	***p***	***β***	***t*-value**	***p***	***β***	***t*-value**	***p***	***β***	***t*-value**	***p***
Age	0.508	1.968	-0.019	-0.228	0.820	-	-	-	-	-	-	-	-	-	-	-	-
Gender	0.606	1.650	-0.007	-0.092	0.926	-	-	-	-	-	-	-	-	-	-	-	-
Marriage	0.809	1.237	-0.035	-0.528	0.598	-0.030	-0.465	0.643	-	-	-	-	-	-	-	-	-
Education level	0.548	1.826	0.142	1.770	0.079	0.158	2.395	0.018*	0.172	2.655	0.009**	0.213	3.454	0.001**	0.228	3.688	0.000**
Employment	0.562	1.780	-0.035	-0.444	0.658	-	-	-	-	-	-	-	-	-	-	-	-
Financial status	0.829	1.207	-0.163	-2.486	0.014*	-0.169	-2.664	0.009**	-0.169	-2.716	0.007**	-0.159	-2.557	0.012*	-0.169	-2.705	0.008**
Behavioural factors																	
Physical activity	0.886	1.128	-0.129	-2.032	0.044*	-0.126	-2.013	0.046*	-0.128	-2.088	0.039*	-0.113	-1.839	0.068	-	-	-
Smoking	0.594	1.685	0.076	0.987	0.325	0.089	1.321	0.189	0.100	1.565	0.120	-	-	-	-	-	-
Alcohol consumption	0.753	1.329	0.061	0.894	0.373	0.069	1.053	0.294	-	-	-	-	-	-	-	-	-
Disease-related factors																	
Hypertension	0.891	1.123	-0.086	-1.368	0.174	-0.083	-1.336	0.184	-0.078	-1.262	0.209	-	-	-	-	-	-
Diabetes	0.862	1.160	-0.170	-2.648	0.009**	-0.177	-2.870	0.005**	-0.184	-3.034	0.003**	-0.201	-3.348	0.001**	-0.210	-3.480	0.001**
Stroke	0.888	1.126	-0.128	-2.032	0.044*	-0.135	-2.189	0.030*	-0.146	-2.415	0.017*	-0.155	-2.573	0.011*	-0.150	-2.458	0.015*
Other heart disease	0.828	1.208	-0.187	-2.859	0.005**	-0.187	-2.890	0.004**	-0.161	-2.666	0.009**	-0.184	-3.074	0.003**	-0.193	-3.207	0.002**
Previous MI	0.742	1.348	0.089	1.283	0.202	0.082	1.223	0.224	-	-	-	-	-	-	-	-	-
Psychosocial factors																	
DASS total	0.905	1.105	-0.429	-6.842	0.000**	-0.428	-6.950	0.000**	-0.423	-6.985	0.000**	-0.431	-7.064	0.000**	-0.442	-7.224	0.000**
			$R^2 = 0.524$, adjusted $R^2 = 0.471$			$R^2 = 0.523$, adjusted $R^2 = 0.481$			$R^2 = 0.514$, adjusted $R^2 = 0.483$			$R^2 = 0.498$, adjusted $R^2 = 0.474$			$R^2 = 0.486$, adjusted $R^2 = 0.465$		
			$F = 9.845$ ($p = 0.000$)			$F = 12.525$ ($p = 0.000$)			$F = 16.464$ ($p = 0.000$)			$F = 20.151$ ($p = 0.000$)			$F = 22.570$ ($p = 0.000$)		

β = Standardised β; DASS = Depression Anxiety and Stress Scale; MacNew = the MacNew Heart Disease Health-Related Quality of Life Questionnaire; Tol = Tolerance; VIF = Variance Inflation Factor.

* Significant at the level of $p<0.05$.

**Significant at the level of $p<0.01$.

Predictors of HRQoL

Table 9 provides the bivariate relationships as intercorrelations among the independent variables, testing the multicollinearity of the variables used in the regression model. Initially, 15 variables were subjected to the stepwise regression analysis, including age, gender, marital status, the level of education, employment status and perceived financial status as demographic factors; physical activity, smoking and alcohol consumption as behavioural factors; hypertension, diabetes, stroke, other heart disease and previous MI as disease-related factors; and the DASS 21 total score as the psychosocial factor. Six variables—financial status, physical activity, diabetes, history of stroke, history of other heart disease, and the DASS score—were significantly correlated with HRQoL among patients with MI. At the second step, the three most insignificant variables—age, gender and employment status—were eliminated. Among the demographic factors, the level of education and financial status remained statistically significant and among the behavioural factors, only physical activity remained significant. Hypertension and previous MI were not significantly related to HRQoL among this patient group, while the DASS 21 score showed a significant association. At the third step, after removing the most insignificant factors, which included marital status, alcohol consumption and previous MI, seven of the nine factors were significantly related to HRQoL. At the fourth step, these two insignificant factors were eliminated. The results of this step showed that physical activity did not have statistically significant association with HRQoL among the participants. At the fifth step when physical activity was removed, the final model of the current study was attained and the R^2 was 0.486 (F=22.570, p=0.000), indicating that this model explained 48.6% of the variance in HRQoL. Of the six demographic factors, only the level of education and patient-perceived financial status had a prediction in HRQoL of patients in the early days after MI. Participants who had a higher education level (β=0.228, t=3.688, p=0.000) and who had perceived better financial status (β=-0.169, t=-2.705, p=0.008) had better HRQoL. None of the three behavioural factors could predict HRQoL in this patient population, whereas there were three significant factors among the disease-related factors. Diabetes (β=-0.210, t=-3.480, p=0.001), the personal history of stroke (β=-0.150, t=-2.458, p=0.015) and history of other heart disease (*β*=-0.193, *t*=-3.207, *p*=0.002) were adversely associated with HRQoL. The total score of the DASS 21 steadily showed a statistically significant prediction for HRQoL throughout the steps (*β*=-0.442, *t*=-7.224, *p*=0.000 in the final model). A higher score of the DASS 21 was closely related to worse HRQoL among the participants in the present study. The results of the stepwise regression analysis are shown in Table 10.

5.2.5. Discussion

This study aimed to investigate HRQoL of patients in the acute phase of MI and to identify the factors that influence this patient outcome. The average age of the participants in this study was 64.63±11.48 years, which was older than other studies recently conducted in other countries, such as the US (Arnold et al. 2013; Chhatriwalla et al. 2015), Iran (Hosseini et al. 2014), European countries (Lidell et al. 2015), Hungary (Rafael et al. 2014), and China (Wang et al. 2016; Wang, Thompson, et al. 2014); however, it was similar to the previous study among South Korean post-MI patients, which reported the mean age of 64.95±10.91 (Kim, Kim & Hwang 2015). The present study paid close attention to the acute phase of recovery (less than a week since MI), while other cross-sectional studies focused on longer periods, for example, 13 days after MI (Wang, Thompson, et al. 2014), up to six months (Lidell et al. 2015), more than a 12-month lapse from MI (Kim, Kim & Hwang 2015), 15 days to 30 months from diagnosis (Wang et al. 2016), and 2.81±2.62 years of the average time since MI (Oginska-Bulik 2014).

The results of stepwise regression analysis revealed that education level, self-evaluated financial status, diabetes, history of stroke, history of other heart disease and total DASS21 score were significant predictors related to HRQoL in the early days after MI. As shown in Table 3, the final model at the fifth step accounted for 48.6% of the variance explained. Among the variables significantly associated with HRQoL, the DASS showed the highest standardised coefficient (*β*=-0.442), indicating the strongest relationship with the patient's subjective health outcome. Next, the level of education (*β*=0.228) and diabetes (*β*=-0.210) had the second and third closest association, followed by other heart disease (*β*=-0.193), financial status (*β*=-0.169), and a history of stroke (*β*=-0.150).

Education and self-evaluated financial status remained the only independent correlates of HRQoL among the demographic variables. These results are in line with previous similar studies that assessed HRQoL in patients with MI (Pettersen, Reikvam, et al. 2008; Wrzesniewski & Wlodarczyk 2012). Education can be referred as a proxy of individual resources and social support. People who have a higher level of education tend to be more aware of risk factors in their health and to derive more from health-related education than those who have a relatively lower education level. Also, longer education periods can lead to wider social resources including financial and psychosocial support (Zimmerman & Woolf 2014). To elevate patients' education level, further studies on social support in this South Korean population would be needed to improve HRQoL among MI patients from a long-term viewpoint.

In addition, another demographic factor, financial status, showed a significantly positive relation among MI patients in this study. It has been consistently found that a higher income could predict higher HRQOL in previous literature (Arnold et al. 2013; Kim, Kim & Hwang 2015; Wang et al. 2016). Similarly, in a study conducted in the general population in South Korea, affluent participants reported better HRQoL (Hong 2011). These results confirm the important role of the financial factor in an individual's health and provide the evidence base for the social determinants of health, as declared by the World Health Organisation (2011). Health professionals can assess the financial capacity of patients with MI and provide information for accessing financial support if needed.

People with diabetes and those who had a history of stroke or other heart disease also showed worse HRQoL at the early stage of MI recovery. These are chronic conditions that can significantly affect various aspects of the patients' health and thus negatively affect the HRQoL outcome. Diabetes also can increase the risk of cardiac morbidity and mortality (Uchmanowicz et al. 2013). It was previously found that diabetic patients with either NSTEMI or STEMI tended to have worse HRQoL than non-diabetic patients at the early stage of recovery (Uchmanowicz et al. 2013). Supporting patients to effectively manage their chronic disease is thus important for improving their health outcomes and HRQoL following MI.

In accordance with the results of the current study, it can be assumed that HRQoL of patients with a history of other heart disease might be more seriously influenced by a recent MI. These patients persistently experience a life-threatening trajectory, increasing their risk of depression, anxiety, and fear (Son et al. 2012). Thus, patients with MI who are susceptible to impaired mental health may need further psychological support and more attention to reduce the risk of future cardiac events and other heart-related comorbidities. Regular follow-ups encouraging the patients to participate in cardiac rehabilitation programs are important to improve patient and disease outcomes (Kang et al. 2016).

Many previous studies have shown that depression, anxiety and stress are closely associated with HRQoL after MI (Arnold et al. 2013; Hawkes, Patrao, Ware, et al. 2013; Hosseini et al. 2014; Rafael et al. 2014). Consistent with the literature, the present study confirmed that the patient’s psychosocial profile including depression, anxiety and stress predicted lower HRQoL. These results suggest that health professionals should pay close attention to the psychosocial aspects of MI patients particularly at the early stage. Also, individual optimisation and cultural adjustment would be important aspects in consideration of depression intervention (Gholizadeh et al. 2014). South Korean people are generally reluctant to seek consultation from health professionals regarding their mental health concerns (Lee, Wachholtz & Choi 2014). Therefore, based on this South Korean culture, routine screening for mental health issues should be incorporated into the management plan of patients with MI. Future research should focus on exploring the impact of early HRQoL scores on patients’ recovery from MI, future cardiac events and mortality. It is also interesting to know whether early HRQoL scores could predict HRQoL scores later. Additionally, further studies on HRQoL among MI patients who have a history of stroke may be required to make up for the lack of studies in this population.

A limitation of this study was that the descriptive and cross-sectional study design could not explain the causal relationships, although the stepwise regression was able to explain the percentage of the variance and strength of the independent variables with the standardised coefficient values. Thus, more longitudinal or cohort studies may be required to develop better plans or transitional cares for recovery of HRQoL among patients with MI. Nevertheless, this study also has its own strengths. First, the focus was on the acute stage of recovery from MI. The research, which was focused on HRQoL in the early phase of the patients with MI, was inadequately done in the past. Second, considering the similarities between the current study and a previous study implemented in another city of South Korea (Kim, Kim & Hwang 2015), it can be assumed that the study participants are representative of the South Korean population.

5.2.6. Conclusions

The results of the study suggest that lower HRQoL was significantly associated with lower education level and poor perceived financial status, having diabetes, having a personal history of stroke and other heart diseases, and a higher level of depression, anxiety and stress. The findings of this study help to detect individual patients who possibly experience lower HRQoL after MI. While some factors are unlikely to be modified, early psychological and financial support may help reduce the impact of MI on patients' overall health and quality of life.

Implications for clinical practice

The results of the current study support the link between social determinants of health (education and financial status) and HRQoL. Patients admitted to hospital with MI should be monitored for symptoms of psychological distress. In addition, if necessary, timely counselling or psychological treatment should be provided to reduce the impact of physiological factors on patient's outcomes and recovery.

5.2.7. Paper references

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5.3. Predictors of health-related quality of life in Korean patients with myocardial infarction: A longitudinal observational study

Article reference:

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5.3.1. Abstract

Background: Experience of myocardial infarction (MI) negatively affects different aspects of health-related quality of life (HRQoL).

Objectives: This study aimed to examine trends in HRQoL of MI patients and to identify demographic, clinical and psychosocial predictors of HRQoL at three months.

Methods: A total of 150 patients in South Korea were completed the study questionnaires at baseline. After three months from discharge, 136 participants completed follow-up questionnaires, including the Korean version of the MacNew Quality of Life after Myocardial Infarction Questionnaire (MacNew).

Results: HRQoL significantly improved over three months. Younger age, ST-elevation MI, and higher LVEF, lower level of depression, better understanding of the illness and higher perceived social support at baseline were associated with better HRQoL at three months.

Conclusion: Providing adequate information about the illness and social support as well as reducing negative psychological experiences in early days after MI may improve HRQoL of MI patients.

5.3.2. Introduction

Experience of myocardial infarction (MI) poses a threat to health-related quality of life (HRQoL) (Foxwell, Morley & Frizelle 2013). Within the first year after MI (Jernberg et al. 2015), about

20% of patients experience persistent symptoms including fatigue, sleep disturbance and shortness of breath as well as reoccurrence of MI, stroke, or death (Kim, Kim & Hwang 2015). It is common that patients after MI report lower HRQoL scores than those without MI; however, HRQoL scores improve in most patients over time (Lazarewicz, Wlodarczyk & Espnes 2016). The results of a longitudinal study conducted by Eriksson et al. (2013) showed that patients' HRQoL, measured by the Short Form 36 Health Survey Questionnaire (SF-36), was lower than their partners and those without the experience of MI at a one-month follow-up. However, HRQoL of MI patients showed improvement with higher scores than their partners or those without MI over time, at seven months, 13 months, and 25 months from MI. Similarly, another study found that improvement of HRQoL in patients with MI was statistically significant from four weeks to six months, as measured with both the Medical Outcomes Short Form-12 (SF-12) and the Seattle Angina Questionnaire (SAQ) (Yeng, Gallagher & Elliott 2016).

Multiple factors were reported to affect HRQoL of patients after MI (Lazarewicz, Wlodarczyk & Espnes 2016). These factors included female gender, living alone and low education level and higher depression, anxiety and stress. Disease-related factors, such as severity of MI and the associated symptoms were also found to be negatively associated with HRQoL post-MI. In addition, MI affects different aspects of HRQoL, including the physical, emotional and social functioning of patients. Patients' psychological experiences including depression, anxiety, stress, level of social support, perception of the disease, and self-efficacy are also associated with HRQoL (Kang et al. 2017).

Assessment of HRQoL can supplement the traditional measures of health outcomes as this subjective report represents the patient-centred health status individually in broader aspects. It can also be assumed that diminished HRQoL negatively affects morbidity and mortality in cardiac patients as well as in those without heart disease (Lazarewicz, Wlodarczyk & Espnes 2016). Studying this multi-dimensional concept thus could lead to a broader understanding of patients' recovery status (Lidell et al. 2015). Understanding those factors that contribute to HRQoL post-MI, particularly modifiable factors, can open a window of opportunities to improve recovery experience and disease outcomes of patients post-MI. Although some studies have examined the relationships between different demographic, clinical and psychological factors and HRQoL after MI, few studies have investigated the predictors of HRQoL using robust statistics to enable development of reliable models. These studies are particularly scarce in Asian countries including South Korea.

The purposes of the current study were to examine the trends in HRQoL of patients and to identify the role of different demographic, clinical and psychosocial variables in predicting HRQoL of these patients at the three-month follow-up.

5.3.3. Methods

Overview of the design

This study used a longitudinal survey design to examine the trends in changes of HRQoL, from baseline to three months, in patients with MI in South Korea and to identify factors predicting HRQoL of the patients at three months post-MI. The majority of infarct healing occurs within 3–4 months of MI (Pokorney et al. 2012) and most patients can resume their pre-illness activities including returning to work within three to six months after MI, positively affecting their emotional well-being (Heart Foundation 2002). Therefore, as the patients' functioning status improves, improvement in HRQoL is also expected.

Treatment of myocardial infarction (MI) at the early stage in South Korea includes reperfusion strategies using pharmaceutical interventions, percutaneous coronary intervention (PCI) or coronary artery bypass graft. More than 90% of patients with acute MI undergo drug-eluting stenting and there is no gender difference in the initial treatment of MI. However, prescription of medical therapy for secondary prevention has been reported to be suboptimal (Kim, Jeong, et al. 2014). After discharge from hospital, patients visit an outpatient clinic two or three times within the first month and then once or twice a month for the next three months.

Human subjects

Participants were recruited from the comprehensive cardiovascular centres of two tertiary hospitals in the southern part of South Korea. They were asked to complete study questionnaires at baseline (within one week after MI) and at three-month follow up.

Inclusion/exclusion criteria

Inclusion criteria required admission with a diagnosis of either ST-elevation myocardial infarction (STEMI) or non-ST elevation myocardial infarction (NSTEMI), ability to understand and speak Korean, be a South Korean resident, ability to understand the study procedure and give an informed consent. Patients were excluded if they had cognitive impairment or if they were participating in other interventional studies that might have affected the results of the current study. Patients' cognitive status, capacity to provide consent, and to understand the study questionnaires were assessed prior to enrolment in accordance with the Fan et al. (2008)'s two step approach. A charge nurse in each study site firstly confirmed the patient's ability to participate in the study, and then each patient was asked to state their full name and answer which colour they had seen among one of three sheets of coloured paper. After the cognitive assessment, patients who signed the consent form were subsequently enrolled in the study.

Rationale for the sample size

The formula of $N > 50 + 8 \times n$ is recommended for calculating required sample size for studies based on regression analysis. In this formula, N refers to number of required sample size, and n refers to the number of independent variables to be included in regression analysis (Pallant 2016, p. 151). Based on this formula, 138 participants were needed for this study to allow for inclusion of 11 independent variables into the regression model.

Procedures

The Institutional Review Boards of the participating hospitals (PNUH IRB no. H-1505-008-029 and PNUYH IRB no. 05-2015-072) and the Human Research Ethics Committee of the affiliating university (UTS HREC Approval No. 2015000254) approved the conduct of the study. Potential participants were provided with information about the study verbally and in writing in Korean. Participations who were interested in the study gave consent and were enrolled in the study. The confidentiality privacy and volunteer participation were maintained throughout the study. Participants were assured that their participation was completely voluntary and that they could withdraw at any time they wished. The individual's participation was not disclosed to other patients and the data collection was held individually in a room where the patients' privacy could be protected. Follow-ups were scheduled according to participants' preferences to minimise inconvenience. Data collection was completed by the principal investigator whose first language is Korean (KK). Two cardiologists and several nurse managers were consulted to discuss strategies for participant recruitment, study questionnaires, and ethical considerations. Figure 6 describes the process of screening, enrolment and follow-up of the study participants. A total of two hundred and fifteen consecutive patients were screened for the study inclusion criteria from August 2015 to February 2016; of whom 17 patients were excluded due to poor hearing, five patients were discharged before enrolment, and one patient was unconscious. The remaining eligible patients were invited to participate in the study. Among those who were invited to the study, 23 patients declined to participate because of perceived poor health condition, including dyspnoea, pain and tremor and 19 patients declined the invitation without giving a specific reason. A total of 150 patients (69.8%), who provided informed consent were enrolled in the study and completed the study questionnaires at baseline (within one week after MI) and at the three-month follow-up. The participants were asked to complete the questionnaires by themselves or the researcher read out the questions to the participant, obtained, and recorded their responses. Of the 150 participants recruited at baseline, ten were lost to follow-up and four passed away. As a result, 136 participants completed the three-month follow-up questionnaires. The three-month follow-up questionnaires were completed in a face-to-face session at an outpatient department during a routine follow-up check-up. Fifty-six participants, who did not have enough time to complete the three-month follow-up questionnaires at the outpatient department or the researcher failed to meet them at their follow-up appointment, completed the follow-up questionnaires over the telephone.

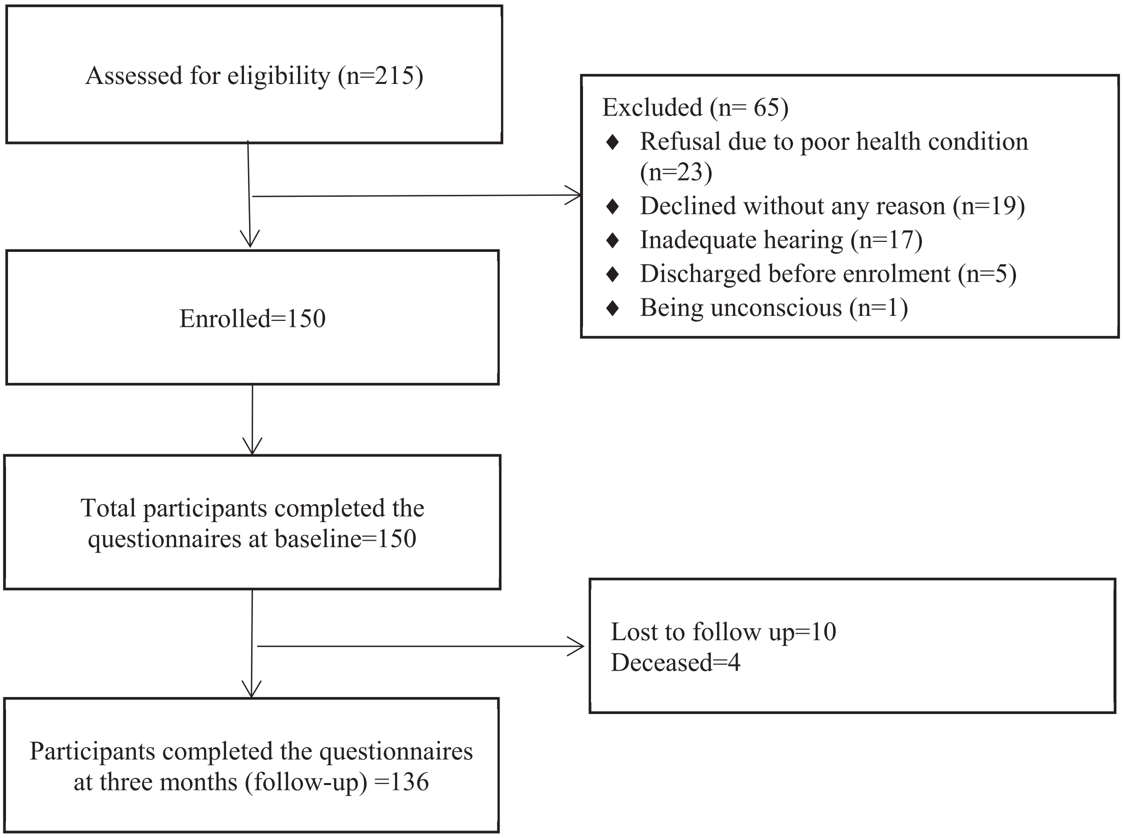

Figure 6. Flow diagram of participants with MI from screening, recruitment, withdrawal to completion

Variables and measures

Variables and conceptual framework

A thorough review of previous literature (Kang et al. 2017) and the revised Wilson & Cleary model for HRQoL (Ferrans et al. 2005) guided the selection of independent variables for the study. The participants' baseline psychosocial status (depression, anxiety, stress, illness perception, and social support), demographic factors (age, gender, education level and subjective financial status), and clinical factors (type of MI and LVEF) were examined for their contribution to HRQoL of the participants at the three-month follow-up.

Demographic and clinical profiles

Information on demographical profiles of the participants was collected, which included: age, gender, marital status, education level, employment status and self-assessed financial situation (categorised as excellent/good/only fair/poor). Information on participants' clinical profiles included: type of MI (STEMI/NSTEMI), smoking (non-smoker/previous smoker/current smoker), alcohol consumption (yes/no), LVEF, history of high blood pressure, diabetes, stroke, other heart diseases, previous MI and other comorbidities. This information was collected from the medical records of the participants after obtaining their consent.

Psychosocial profile

Depression, anxiety, and stress

Among psychosocial factors studied in previous literature, depression, anxiety and stress has been the most commonly examined factors negatively affecting HRQoL of patients with MI (Arnold et al. 2013; Hosseini et al. 2014; Rafael et al. 2014). We used the Korean version of the DASS 21 (Cha 2014) to assess the participant's physiological status. The DASS 21 is the short form of the DASS 42, consisting of 21 items with each item scoring from 0 (never) to 3 (almost always) and the total score for the scale ranging from 0 to 63, with higher scores indicating greater depression, anxiety and stress (Henry & Crawford 2005). The measurement can be divided into three dimensions of depression, anxiety and stress. Each dimension encompasses seven items with the total scores of the subscales ranging from 0 to 21 (Henry & Crawford 2005).

DASS 21 is a valid tool. In the original study, the internal consistencies of the subscales have been reported as 0.91 for depression, 0.84 for anxiety and 0.90 for stress (Lovibond & Lovibond 1995). In a Korean study using the Korean version of the DASS 21, the alpha coefficients were ranged from 0.72 to 0.81 for the subscales of depression, anxiety and stress (Song & Lindquist 2015). In the current study, the alpha coefficient for the total scale was 0.86, and for the subscales of depression 0.85, anxiety 0.52, and stress 0.80. We included the total scores of the DASS 21 in the regression analysis.

Illness perception

The available evidence suggested that patients with more positive illness perceptions following MI showed better quality of life (Petrie et al. 2002). Thus, this study examined participants' understanding of their MI, using a single item extracted from the Brief Illness Perception Questionnaire (B-IPQ). This item was scored on a Likert type scale ranging from 0 ("don't understand at all") to 10 ("understand very clearly") (Broadbent et al. 2006).

Social support

The ENRICHD Social Support Inventory (ESSI) has been developed to measure the social support of patients with coronary heart disease, in particular, patients with MI. This questionnaire consists of seven items addressing different types of social support including structural, instrumental, and emotional support. Response rate for all the items ranges from 1 (none of the time) to 5 (all the time), except for item 7, which is scored 4 for "yes" or 2 for "no" (Mitchell et al. 2003). The seven items can be summed as the total score ranging from 8 (no support) to 34 (maximum level of support) (Vaglio et al. 2004). The validation studies of the scale on the cardiac patient population have shown high internal consistencies, with alpha coefficients ranging from 0.88 to 0.94 (Vaglio et al. 2004). A Korean version of the scale was prepared for the purpose of this study and the alpha coefficient of the study sample was 0.93.

All study instruments were administered in Koran language, and a Korean version of these instruments were prepared if they were not available. The same process adopted in translation of MacNew (Kang et al. 2018) was used in translation of other instruments. All translated instruments were pilot tested by three health professionals and five laypersons. The wording of some questions/ items was modified to improve understanding, based on the received feedback.

Health-related quality of life

The MacNew Quality of Life after Myocardial Infarction Questionnaire (MacNew) is a disease specific valid tool to measure HRQoL of patients with MI. For the purpose of this study, the tool was translated into Korean language and validated on a sample of Korean patients with MI (Kang et al. 2018). The MacNew includes 27 items with responses ranging from 1 to 7 on a seven-point Likert scale. The items of this instrument fall into three physical (13 items), emotional (14 items) and social dimensions (13 items) (Dixon, Lim & Oldridge 2002; Höfer et al. 2004), although loadings of items onto each construct vary slightly across studies. The total mean score and each domain can be calculated as a mean score with a range between 1 and 7, with higher scores representing better HRQoL. The minimal important difference (MID) on the global MacNew and the three subscales is determined by 0.50 points as a significant change (Dixon, Lim & Oldridge 2002). The reliability of the total MacNew has been well established in a plethora of previous studies, with Cronbach's alpha coefficients ranging from 0.85 to 0.94 (Alphin et al. 2015; Fattirolli et al. 2015; Seneviwickrama et al. 2016). The Cronbach's alpha coefficient of the Korean MacNew in the current study was also high at 0.90 for the total scale, and 0.86, 0.85 and 0.88 for the emotional, physical and social subscales, respectively. Nevertheless, the results of factor analysis on the Korean MacNew indicated different factor structures (Kang et al. 2018) from the original study by Valenti et al. (1996). This finding is similar to the previous studies that aimed to study factor structure of the MacNew on other populations (Dempster, Donnelly & O'Loughlin 2004; Gramm, Farin & Jaeckel 2012). Thus, at this stage, it is recommended the sub scores of the Korean MacNew to be interpreted cautiously.

Statistical analysis

Data were analysed using SPSS version 24.0 (SPSS Inc., Chicago, IL, USA). A descriptive analysis of 150 participants at baseline was performed using means, standard deviations (SD), frequencies and percentages. In follow-up analyses, data from 136 participants who completed the whole study were included. The MacNew scores were normally distributed, thus paired-samples t-tests were used to examine changes between baseline MacNew and three-month follow-up scores. Tolerance, variance inflation factor (VIF) and correlations between the independent variables were analysed for multicollinearity. The results were indicated the absence of multicollinearity with a tolerance value of higher than 0.10, a VIF value of below 10 or Pearson correlation coefficients of lower than 0.90 (Pallant 2016). Thus, 11 independent variables were included in the backward stepwise regression model. At each elimination step, one or two most insignificant factors were removed from the model until only significant predictors remained. The level of statistical significance of analyses was set at $p<0.05$ (two-tailed).

5.3.4. Results

Participant characteristics

The mean age of participants at baseline was 64.63 (SD=11.48) years, with a range of 21 to 86 years. Most of the participants were aged 55 years or older (n=120, 80.0%), male (n=107, 71.3%), married (n=129, 86.0%) and educated at a middle school level or higher (n=110, 73.3%). Forty per cent of the participants (n=60) were employed at the time of enrolment, but only 14.0 % (n=21) perceived their financial situation as 'excellent' or 'good'. The mean value of LVEF was 50.86% (SD=10.80) with a range from 17% to 70%. One third of the patients in this study (n=50, 33.3%) were current smokers and 28.7% of them (n=43) answered 'yes' to the drinking question. The demographic and clinical characteristics of the participants at baseline are presented in Table 11.

Table 11. Participants' demographic and clinical characteristics at baseline (n=150)

Demographic factors			n	%
Age (years)	<55		30	20.0
	55-64		43	28.7
	65-74		43	28.7
	75 ≤		34	22.6
Gender	Female		43	28.7
	Male		107	71.3
Marital status	Married		129	86.0
	Never married/Separated/Divorced/ Widowed		21	14.0
Level of education	Primary or less		40	26.7
	Middle school		25	16.7
	High school		54	36.0
	Undergraduate or more		31	20.6
Employment status	Employed		60	40.0
	Unpaid family workers/Retired / Unemployed		90	60.0
Financial status (Subjective)	Excellent / Good		21	14.0
	Only fair / Poor		129	86.0
Clinical factors				
Type of MI	STEMI		61	40.7
	NSTEMI		89	59.3
Smoking	Non-smoker		85	56.7
	Previous smoker		15	10.0
	Current smoker		50	33.3
Alcohol consumption	Yes		43	28.7
	No		107	71.3
Medical Characteristics	Hypertension:	Yes	75	50.0
		No	75	50.0
	Diabetes:	Yes	47	31.3
		No	103	68.7
	Stroke:	Yes	8	5.3
		No	142	94.7
	Other heart disease:	Yes	25	16.7
		No	125	83.3
	Previous MI:	Yes	37	24.7
		No	113	75.3
	Other comorbidities:	Yes	58	38.7
		No	92	61.3

LVEF = Left Ventricular Ejection Fraction; MI = Myocardial Infarction; NSTEMI = non-ST elevation myocardial infarction; SD = Standard Deviation; STEMI = ST-elevation myocardial infarction.

Changes in HRQoL

The changes in total scores of HRQoL and the subscales from baseline to three-month follow-up are shown in Table 12. Overall, the results indicate that HRQoL of the 136 participants showed statistically significant improvements in all the dimensions of the MacNew with a mean difference of 0.98 for emotional, 1.11 for physical, and 1.06 for social dimensions. The total score of the MacNew also improved significantly from baseline to three-month follow-up, with the mean difference of 1.03.

Table 12. Changes in the MacNew scores of the participants over three months (n =136)

Variables (range)	**Baseline Mean**	**SD**	**Follow-up Mean**	**SD**	**Mean difference (95% CI)**	***t***	***p***
MacNew total	4.51	0.81	5.54	0.78	1.03 (0.88, 1.17)	13.896	0.000
Emotional	4.42	0.82	5.40	0.85	0.98 (0.81, 1.14)	11.617	0.000
Physical	4.43	0.99	5.55	0.85	1.11 (0.95, 1.27)	13.834	0.000
Social	4.83	0.93	5.89	0.82	1.06 (0.89, 1.23)	12.356	0.000

MacNew = MacNew Quality of Life after Myocardial Infarction Questionnaire; SD = Standard Deviation.
Notes: The MacNew scores are the average of responses over relevant items.

Predictors of HRQoL at three-month follow-up

Table 13 shows the results the backward elimination stepwise regression analysis. The first model of the stepwise regression included a total of 11 variables—age, gender, the level of education, perceived financial status, type of MI (STEMI/NSTEMI), LVEF, depression, anxiety, stress, illness perception, and social support. Of these variables, age, LVEF, depression, stress, illness perception, and social support were statistically significant. At the next step, the two least significant variables—education level and perceived financial status—were eliminated, resulting in gender, type of MI and anxiety to become statistically insignificant predictors. Gender and anxiety, as the least significant predictors were removed from the model at the third step, resulting in type of MI becoming a statistically significant predictor, while stress showed the least correlation with HRQoL. Following the removal of stress in the next step, all the six remaining variables showed statistically significant correlations with HRQoL at three months post-MI. These predictors included age, type of MI, LVEF, depression, illness perception and social support. Younger age (β=-0.216, t=-2.715, p=0.008) was closely associated with better HRQoL at three months. Being diagnosed with STEMI (*β*=-0.163, *t*=-2.119, *p*=0.036) or having higher LVEF at baseline (*β*=0.207, *t*=2.606, *p*=0.010) were significant predictors of higher HRQoL at three months. Higher score of depression at baseline (*β*=-0.201, *t*=-2.644, *p*=0.009) was closely associated with lower HRQoL at three months. In addition, patients' better understanding of their illness (*β*=0.213, *t*=2.755, *p*=0.007) or perceived higher social support at baseline (*β*=0.199, *t*=2.515, *p*=0.013) were significant predictors of better HRQoL at three months. The final model of the current study explained 27.4% of the variance in HRQoL (adjust R2=0.241, F=8.129, p=0.000).

Table 13. Predictors of HRQoL at three-month follow-up using the backward elimination stepwise regression analysis

	Collinearity		**Step 1**			**Step 2**			**Step 3**			**Step 4**		
Demographic factors	**Tol.**	**VIF**	***β***	***t*-value**	***p***	***β***	***t*-value**	***p***	***β***	***t*-value**	***p***	***β***	***t*-value**	***p***
Age	0.738	1.354	-0.175	-2.034	0.044*	-0.180	-2.239	0.027*	-0.206	-2.602	0.010*	-0.216	-2.715	0.008**
Gender	0.758	1.318	0.098	1.148	0.253	0.112	1.390	0.167	-	-	-	-	-	-
Education level	0.543	1.840	0.035	0.352	0.726	-	-	-	-	-	-	-	-	-
Financial status	0.726	1.377	0.095	1.097	0.275	-	-	-	-	-	-	-	-	-
Clinical factors														
Type of MI	0.887	1.128	-0.124	-1.571	0.119	-0.133	-1.706	0.090	-0.166	-2.188	0.031*	-0.163	-2.119	0.036*
LVEF	0.827	1.210	0.195	2.391	0.018*	0.180	2.277	0.024*	0.204	2.601	0.010*	0.207	2.606	0.010*
Psychosocial factors														
Depression	0.603	1.660	-0.252	-2.637	0.009**	-0.238	-2.527	0.013*	-0.272	-3.253	0.001**	-0.201	-2.644	0.009**
Anxiety	0.581	1.722	-0.111	-1.142	0.256	-0.101	-1.048	0.297	-	-	-	-	-	-
Stress	0.678	1.476	0.203	2.253	0.026*	0.193	2.165	0.032*	0.165	1.946	0.054	-	-	-
B-IPQ 7	0.823	1.215	0.191	2.345	0.021*	0.179	2.309	0.023*	0.205	2.674	0.008**	0.213	2.755	0.007**
ESSI	0.723	1.383	0.244	2.803	0.006**	0.224	2.797	0.006**	0.227	2.849	0.005**	0.199	2.515	0.013*
			$R^2 = 0.320$, adjusted $R^2 = 0.260$			$R^2 = 0.314$, adjusted $R^2 = 0.265$			$R^2 = 0.295$, adjusted $R^2 = 0.257$			$R^2 = 0.274$, adjusted $R^2 = 0.241$		
			$F = 5.312$ ($p = 0.000$)			$F = 6.397$ ($p = 0.000$)			$F = 7.659$ ($p = 0.000$)			$F = 8.129$ ($p = 0.000$)		

β = Standardised β; B-IPQ 7 = Brief Illness Perception Questionnaire 7th item; ESSI = ENRICHD Social Support Instrument; LVEF = Left Ventricular Ejection Fraction; Tol = Tolerance; VIF = Variance Inflation Factor.
* Significant at the level of $p<0.05$.
**Significant at the level of $p<0.01$.

5.3.5. Discussion

The results of our study suggested that HRQoL of patients with MI improved significantly within the first three months after MI. Predictors of better HRQoL at three months included younger age, STEMI diagnosis, higher LVEF, illness perception, perceived social support, and lower depression symptoms at baseline.

Oginska-Bulik (2014) found that younger patients with MI had higher quality of life. This can be explained by higher physical functioning in younger patients after MI (Park et al. 2009). Moreover, younger patients are likely to be treated more intensively in consideration of their physical status (Hawkes, Patrao, Ware, et al. 2013).

We found that patients diagnosed with STEMI had higher HRQoL at three months post-MI compared to those with NSTEMI. This finding seems also consistent with other research which showed STEMI patients had higher overall HRQoL than those with unstable angina or NSTEMI (Kim et al. 2013). Few studies have compared HRQoL between patients with STEMI and NSTEMI, although disease prognosis is different between these two conditions. Patients diagnosed with STEMI are likely to have relatively low mortality at the early stage; however, NSTEMI patients tend to have a better health condition in the long-term period (Kim et al. 2013). As this study focused on the early stage of recovery from MI, higher HRQoL scores in patients with STEMI are expected. Besides, baseline LVEF was one of significant predictors of HRQoL at three months post-MI. This finding is in line with previous studies, which showed that patients with lower LVEF had poorer HRQoL later (Coyne et al. 2000; Ecochard et al. 2001). However, a recent study in South Korea (Son et al. 2012) found that LVEF was not statistically associated with HRQoL in patients with heart failure. LVEF was regarded as the severity of MI (Roger 2009) as this value has been frequently used for measuring cardiac function in clinical practice. However, the association between LVEF and HRQoL has not been adequately studied in patients with MI (Pettersen, Kvan, et al. 2008).

In addition to the demographic and clinical predictors, three psychosocial factors were predictive of HRQoL at three months post-MI in the current study. We found that patients' perception of their illness at early stages after MI was a significant predictor of HRQoL at three months, a finding that is consistent with the results of previous research (French et al. 2005), which consistently report positive relationship between illness perception at early stages of post-MI and HRQoL at different follow-up points (Alsén et al. 2010; French et al. 2005; van der Have et al. 2013). Further research is; however, needed to better understand how to improve patient experiences and outcomes following MI through correcting their perceptions about the disease, particularly perceptions of consequences of MI. A brief intervention that targeted perceptions about MI was found effective in improving anxiety, depression, and HRQoL of patients (Motmaen et al. 2016). Also, consistent with the results of previous studies (French et al. 2005; Rafael et al. 2014; Wang et al. 2016; Wang, Thompson, et al. 2014), we found that depression symptoms at baseline were predictive of inferior HRQoL at three months. This finding supports the results of another study, conducted in South Korea, that cardiac patients with depression symptoms experience decreased HRQoL, irrespective of their gender (Park et al. 2009), and this comorbidity adversely affects all dimensions of HRQoL—emotional, physical and social—in MI patients (Hosseini et al. 2014; Wang et al. 2016; Wang, Thompson, et al. 2014). Similar to illness perception and psychological depression, social support was a predictor of HRQoL at the three-month follow-up. This finding supports the results of the Park et al. (2009) study which reported a positive relationship between social support and HRQoL at one month post-MI. We did not investigate if the role of social support on HRQoL after MI affected men and women differently; however, Park et al. (2009) reported that social support had stronger impact on HRQoL of South Korean women with MI than on men.

Culturally sensitive interventions that target psychological distress and needs for support of patients with MI may have capacity to improve patient experience and HRQoL following MI. People in South Korea generally reluctant to visit mental health professionals or clinics, but rather prefer to cope with their problems by seeking support from their family or friends (Lee, Wachholtz & Choi 2014). This is mainly because people in South Korea have negative attitudes towards mental illnesses and mental health services (Im, Lee & Han 2017). These cultural features may influence the patient's reliance on close personal relationships for dealing with their mental health, particularly negative emotions, including depression, a major health crisis, interpreting health status and information. Studies focusing on the relationship between social support and HRQoL in patients with MI outside South Korea, have reported similar results. Specifically, researchers in Australia found that at six-month follow-up acute MI patients who scored higher in the ESSI showed better HRQoL (Hawkes, Patrao, Ware, et al. 2013). In addition, the influence of perceived social support tended to last up to 12 months after MI when HRQoL (Bucholz et al. 2014; Leifheit-Limson et al. 2012). However, perceived overprotection was negatively associated with HRQoL at nine months (Joekes, Maes & Warrens 2007).

The findings of this study have important implications for health care professionals who are endeavouring to improve patient disease experience and recovery after MI. Comprehensive supportive care is needed to improve the general health status of MI survivors. As found in our model of backward elimination regression analysis, interventions to improve HRQoL in patients post-MI should focus on modifiable predictors including social support, illness perception, and depression management.

Depression is an independent predictor of poor prognosis and mortality after MI. The American Heart Association recommends that all patients with cardiovascular disease should be assessed for depression symptoms and treated if needed (Lichtman et al. 2008). Thus, patient counselling, education, and treatment of depression should be combined with usual care in the early stage of recovery from MI.

Perceived social support was another significant predictor of HRQoL in patients with MI at three months. Social support as measured in this study imply the patients' perceived emotional support, informational support, and instrumental support they received from others (Mitchell et al. 2003). Based on questions of the ESSI, helping in household tasks, giving advice and trust would increase patient's perception of the social support (Mitchell et al. 2003). Therefore, exploring means to support patients emotionally, physically, and financially in early days after MI can be important in helping the patients to improve their HRQoL, overall health and well-being. Yet, perception of overprotection has been shown to have adverse effect on MI patients' sense of well-being. Interventions utilising self-help groups for patients with MI may increase perceived social support and thus HRQoL (Park et al. 2009). In consideration of the South Korean values of familism and communal culture, interventions featuring of group support for patients post MI may be more effective than individual strategies.

The findings of this study should be interpreted with the consideration of several limitations. First, the final model of regression explained only 27.4 per cent of the total variance for HRQoL at three months after MI. This result leads to the fact that HRQoL of MI patients is affected by multiple factors worth investigating by future research. Although our study reached the required sample size to examine the role of 11 independent variables, studies with larger sample sizes can comprehensively identify the potential predictors. In addition, we included both patients who suffered a first-time MI and patients with recurrent MI. It is recommended that future studies compare HRQoL between the two groups.

5.3.6. Conclusions

The results of this study in the South Korean population confirm that HRQoL of patients with MI improves over time. At three months post-MI, patients with a higher HRQoL are those who are younger, diagnosed with ST-elevation MI, have higher LVEF, lower level of depression, a better understanding of their illness and higher perceived social support. The findings indicate that interventions in the form of psychological counselling, patient education, and social support have the potential to improve patient recovery and HRQoL post-MI.

5.3.7. Paper references

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CHAPTER 6: DISCUSSION AND CONCLUSION

6.1. Discussion of the main findings

Throughout the previous chapters, this thesis has described the background, previous literature, psychometric properties of the Korean MacNew, and predictors of HRQoL in patients with MI. For an accurate understanding and evaluation of HRQoL in this patient population, the MacNew questionnaire was found to be one of the most appropriate instruments. The alpha coefficients of the Korean MacNew in this study were high enough to be reliable, compared to other versions of the instrument, which resulted in ranges between 0.89 and 0.97 for the total, 0.86 and 0.97 for the emotional, 0.78 and 0.94 for the physical, and 0.80 and 0.95 for the social domains (Daskapan et al. 2008; Gramm, Farin & Jaeckel 2012; Höfer et al. 2012; Wang et al. 2015). Thus, this Korean version of the MacNew appears to have high reliability.

On the contrary, PCFA with the direct oblimin rotation and EFA with varimax rotation showed questionable results. The PCFA revealed that a few items loaded on unexpected subscales compared to the original study (Valenti et al. 1996), with 50.2% of the total variance explained. Whereas the original study reported 66.5% of the total variance explained, the total variance explained in the current study was similar to the Sinhalese version, which showed 50.9% among stable angina patients, diagnosed between 4 and 16 weeks (Seneviwickrama et al. 2016). However, the proportions of variance explained by each factor were observed skewed distributions. Moreover, the factor structure of the current Korean MacNew was inconsistent with the original three-factor structure (Valenti et al. 1996). Rather than the three-factor structure, supported by most of the validation studies, The Korean version of the MacNew found to have the five-factor structure, corresponding to a UK study, which targeted patients with ischaemic heart disease (Dempster, Donnelly & O'Loughlin 2004), and similar to a German study, which reported the four-factor structure. To conclude, this Korean MacNew is recommended for use among cardiac patients in South Korea; however, scores of the subscales need to be interpreted with caution until further research on this tool is conducted with larger sample sizes to provide more consistent results.

In line with a couple of studies (Eriksson et al. 2013; Rančić et al. 2013), HRQoL in the South Korean MI patients in the present research significantly improved over the three-month period. The majority of previous studies examining HRQoL of MI patients also demonstrated significant improvements during six-month or one-year periods following MI. However, longitudinal studies on HRQoL in patients with MI at three months were insufficient, and only a few studies examined this patient-reported outcome three months after MI (Baas 2004; Doerfler, Paraskos & Piniarski 2005; Joekes, Maes & Warrens 2007). Additionally, inconsistency was spotted in changes of HRQoL among post-MI patients without particular interventions (Lazarewicz, Wlodarczyk & Espnes 2016). Up to three months since discharging from hospital, patients are most likely to visit an outpatient department intensively, as this is a critical period for recovery of from MI. Most deaths that occur during the first year after hospital discharge take place within the first three months (Hines & Marschall 2018). This period has been referred to in the literature as the 'reconditioning phase'. Thus, the three-month follow-up period, examined in this thesis, was appropriate for studying changes in HRQoL of MI patients during the early phase of recovery from MI.

The results from two stepwise regression analyses addressed the main study aims. The first regression model demonstrated that patients with particular demographic, disease-related factors, and psychosocial factors at the acute phase of MI, reported more impaired HRQoL. These findings were consistent with previous studies; however, the percentage of the total variance explained in this study (48.6%) was smaller than some other studies, which reported about 60% of the total variance explained (Kim, Kim & Hwang 2015; Wang et al. 2016; Wrzesniewski & Wlodarczyk 2012), but similar to 45% and 48% of the total variance reported in the Rankin & Fukuoka (2003) and Brink, Karlson & Hallberg (2002) studies respectively. These inconsistencies across studies indicate the complexity of the concept of HRQoL, with different individual and likely socio-cultural factors affecting the subjective patient-reported outcome, warranting further research.

The six variables—lower education level and perceived financial status, the comorbidities of diabetes, stroke and other heart diseases, and higher psychological distress—were found to be independently associated with lower HRQoL in the acute phase of experience of MI (Section 5.2). These findings provide further support for the WHO (2011) report that the two demographic correlates—education and financial situation—are important social determinants of health, negatively affecting health outcomes and contributing to health inequities. Patients from lower socioeconomic background have less individual resources, less social relations, and less awareness of risk factors. Higher and better education can be an advantage for access to wider resources within the community (Zimmerman & Woolf 2014). Moreover, balanced distribution of economic support from the government is essential to achieve health equity (Goldberg 2017). Considering that the improvement of health equity is reported as a vital foundation of better HRQoL in general population of a nation (Goldberg 2017; WHO 2011), the government, responsible for citizens' health, may need to improve accessibility of equitable education systems and to develop wider financial support systems from a long-term point of view. In addition to efforts of the government, health professionals should be able to advise post-MI patients who had less opportunities of education or financial support, of information about access to educational interventions and funding opportunities from either public or private systems.

The second regression model of the present study (Section 5.3) discovered predictors of post-MI patients' HRQoL three months following discharge. Older age, NSTEMI diagnosis, lower LVEF, poor illness perception, lower social support, and higher depression symptoms at baseline were found to be associated with poorer HRQoL at the three-month follow-up. The present study findings were consistent with a plethora of previous studies on relationships of depression, illness perception, and social support with HRQoL among MI patients (Bucholz et al. 2014; French et al. 2005; Wang et al. 2016). Other studies also identified older age as a predictor of decreased

HRQoL (Hawkes, Patrao, Ware, et al. 2013; Oginska-Bulik 2014); however, there are still inconsistent results of the relationship between HRQoL and types of MI or LVEF.

There is ample evidence to suggest that various medical, behavioural and psychosocial interventions and strategies can improve the HRQoL of patients with MI (Hawkes, Patrao, Atherton, et al. 2013; Hevey & Wilczkiewicz 2014; Peixoto et al. 2015). Thus, patients in the early phase of recovery from MI should be supported so they can benefit from these strategies to improve their subjective wellbeing and quality of life, for example, by participating in cardiac rehabilitation programs.

It is, however, important to take note of the cultural context. In South Korean culture, there is greater emphasis on familism (Kang & Lim 2014) and communitarianism (Lee & Kim 2014), so individuals tend to cope with their problems, such as depression, or emotional issues, in the company of their family or close friends. Other cultural features, such as a negative attitude towards visiting mental health clinics (Im, Lee & Han 2017) may impede access to psychological interventions for people with MI. After discharge from hospital, patients with MI are likely to visit outpatient department clinics in accordance with similar procedural protocols. This provides a window of opportunity for the intervention of health care professionals aiming to improve the wellbeing and quality of life of the patients. Given the timeline after discharge, patients can be encouraged to participate in group activities, cardiac rehabilitation programs and educational and psychological interventions. Through participation in these programs, post-MI patients can improve their understanding of their illness and experience more emotional support from health care professionals and self-help groups.

6.2. Study strengths and limitations

This research has notable strengths. First, during the three-month study period, the drop-out rate was extremely low at 9.33%, i.e. 90.67% of the participants enrolled in the study completed the three-month follow-up. Second, causal relationships between HRQoL and various factors could be determined as the participants were followed up at three months after discharge. This time frame could give a prediction of HRQoL with included factors.

However, there are some limitations in this study. Firstly, there is a possibility of selection bias because patients with very poor health conditions refused to participate in the study. Secondly, although the sample size was sufficient to include 11 variables in the regression model, for examining a comprehensive list of potential predictors and improving the total variance explained, studies with larger sample sizes are required. Thirdly, the instruments used in the present study were self-report questionnaires, and therefore there is chance of overrating or underrating the study instruments in accordance with participants' personality traits or due to the study conditions. Due to the subjective nature of HRQoL, direct measurement of this concept is not possible.

6.3. Implications for practice

The findings of this thesis and the recommendation from the American Heart Association support regular assessment of HRQoL as an important cardiovascular health status outcome. The literature reviews conducted in the course of the study highlight the importance of HRQoL as one of the means for assessing patients' subjective health status to inform design and delivery of patient-centred care. As suggested in the report of the American Heart Association (Rumsfeld et al. 2013), HRQoL should be considered as one of the important measures in assessing cardiovascular health since this patient-reported outcome allows health professionals to understand individual's viewpoints of their 'disease and treatment', 'symptoms', and 'functional status' (Rumsfeld et al. 2013).

Assessment of HRQoL in cardiac patients can be particularly important due to its predictive nature of mortality, recurrence, and rehospitalisation (Rumsfeld et al. 2013). In addition, HRQoL can lead to a more appropriate decision on the usefulness of medical and non-medical interventions (Anker et al. 2014). However, despite an increased understanding of its significance, HRQoL is not being routinely assessed in clinical practice in South Korea as well as other countries (Nelson et al. 2015; Soo Hoo, Gallagher & Elliott 2014). Traditionally, the management of patients with MI focuses on procedural care for cardiac patients. It may be claimed that clinical staff are already aware of patients' opinions and that additional assessment of HRQoL may become a burden for both health professionals and patients themselves (Nelson et al. 2015). Nevertheless, HRQoL should be one of the regular health outcomes for the purposes of improving the patient reported subjective outcomes as well as disease outcomes, such as mortality rate and unintentional rehospitalisation (Benzer et al. 2016). Besides, this patient-reported outcome can be helpful for decision making on interventions and communication between clinicians and patients (Nelson et al. 2015).

As identified by the present study findings, psychological distress, perception of illness, and social support are important factors affecting patient experience of disease and their recovery from MI. To optimise management of patients with MI, it is important that patient- reported outcomes are assessed, monitored and improved along with disease outcomes such as survival and death. Furthermore, the findings of this study suggest that HRQoL in acute phase of MI is closely linked to social determinants of health (WHO 2011), specifically to education and financial status. The relationship between socioeconomic status and poorer disease outcomes, such as survival from MI and recurrent cardiac events is also well known (Coady et al. 2014). These findings highlight the need for health policy to reduce the gap in health disparities based on socioeconomic inequities.

6.4. Recommendations for future research

This thesis identifies several areas for future research. In past research and clinical management of patients with MI, there has been paid little attention to patient reported outcomes, such as perceived symptoms and HRQOL compared to disease outcomes, such as survival from disease, reduced rehospitalisation rate, and death (Nelson et al. 2015). Therefore, it is important that future research consider HRQoL, measured by standardised instruments, as a primary health outcome which would lead to development of effective and acceptable treatments for cardiac patients including post-MI patients (Anker et al. 2014). The findings of this thesis and the recommendation from the American Heart Association support regular assessment of HRQoL as an important cardiovascular health status outcome.

This study identified factors that affect HRQoL of patients immediately after MI and at early phase of recovery from MI. These independent factors include education, financial status, illness perception, physiological status, type on MI, and perceived social support, and are mainly modifiable. Future studies should examine the effectiveness of interventions targeting these factors on HRQoL of MI patients and their recovery. Future studies with bigger sample sizes should enable studying of a more comprehensive list of potential independent factors effecting HRQoL in patients with MI to help improve the total variance explained.

It was also found that the type of MI (STEMI or NSTEMI) was significantly associated with HRQoL of MI patients at the three-month follow-up, and patients with NSTEMI were more likely to have poorer HRQoL. Thus, changes in HRQoL in diverse subgroups of MI patients, for example, between male and female patient groups or patients with first-time MI and those with recurrent MI are worth investigation to help develop more specific and targeted programs.

In addition, it is recommended that associations between patient-reported outcomes, including HRQoL, psychological distress, insomnia, perception of illness, and social support and disease-related clinical outcomes in patients with MI are further explored in future research.

6.5. Conclusion

This thesis has provided substantial findings on HRQoL in patients with MI in South Korea, measured by a standardised instrument, the MacNew, during hospitalisation and at three months post-MI.

Myocardial infarction is a life-threatening condition with a high recurrence rate and the need for long-term lifestyle modification. Assessment and monitoring HRQoL is important to provide health care professionals with a better understanding of the impact of MI on the patients' life and to guide treatment choices. The Korean MacNew was found to be a valid and reliable tool to assist health care professionals in assessing HRQoL of patients after MI. This disease-specific tool can provide more accurate and informative information about HRQoL of patients with MI than generic QoL measurements.

Primarily, the results of this thesis found that age, types of MI, LVEF, level of depression, illness perception, and perceived social support at baseline were significantly associated with HRQoL during hospitalisation and at three months after discharge among post-MI patients. In consideration of the modifiable factors, interventions that focus on patient education, psychological counselling, and financial and social support have the potential to improve HRQoL and most aspects of individuals' post-MI life.

6.6. Chapter references

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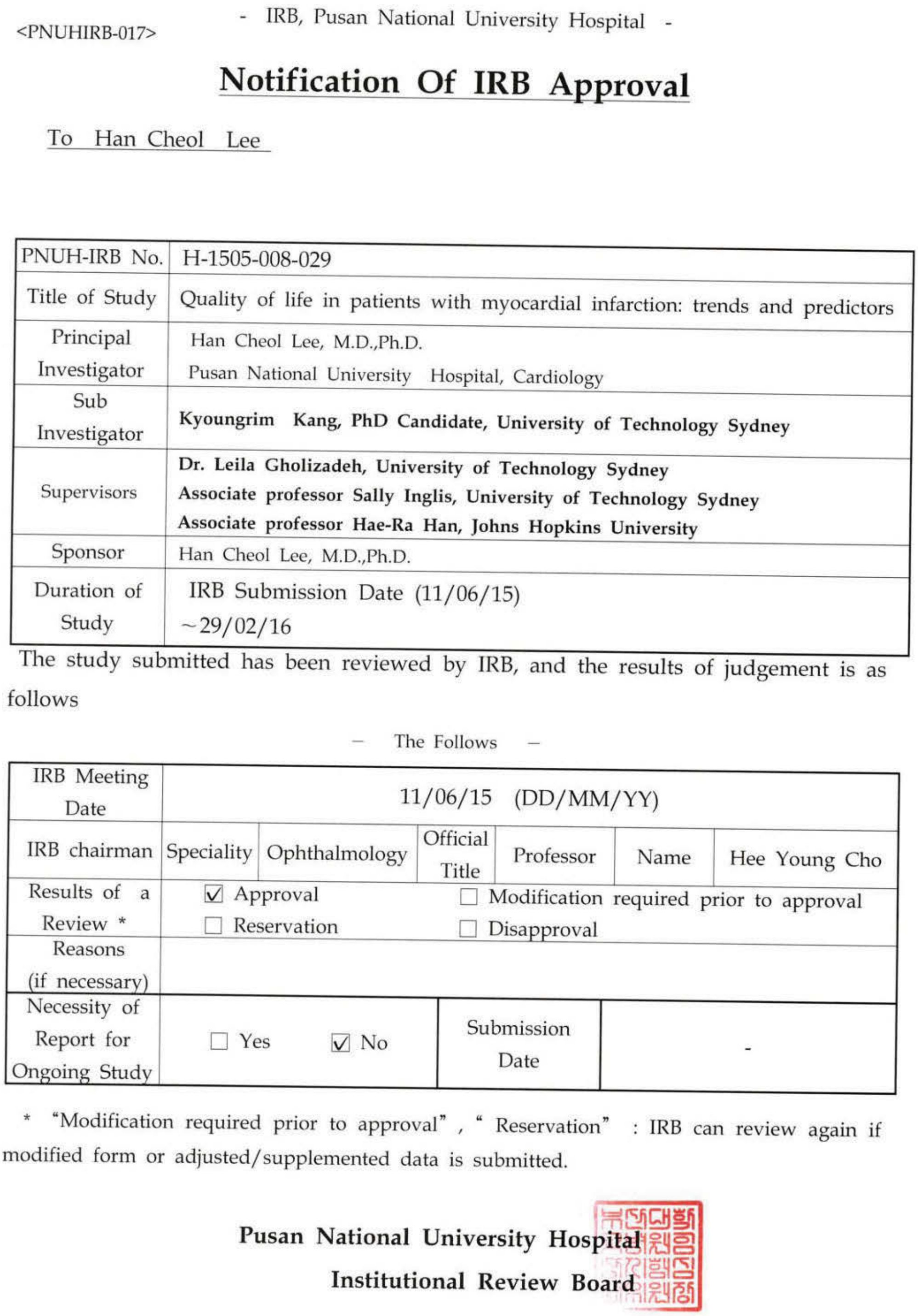
7: APPENDICES

Appendix A: Ethics approvals

a. PNUH



<PNUHIRB-017>

- IRB, Pusan National University Hospital -

Notification Of IRB Approval

To Han Cheol Lee

PNUH-IRB No.	H-1505-008-029
Title of Study	Quality of life in patients with myocardial infarction: trends and predictors
Principal Investigator	Han Cheol Lee, M.D.,Ph.D. Pusan National University Hospital, Cardiology
Sub Investigator	**Kyoungrim Kang, PhD Candidate, University of Technology Sydney**
Supervisors	**Dr. Leila Gholizadeh, University of Technology Sydney** **Associate professor Sally Inglis, University of Technology Sydney** **Associate professor Hae-Ra Han, Johns Hopkins University**
Sponsor	Han Cheol Lee, M.D.,Ph.D.
Duration of Study	IRB Submission Date (11/06/15) ~29/02/16

The study submitted has been reviewed by IRB, and the results of judgement is as follows

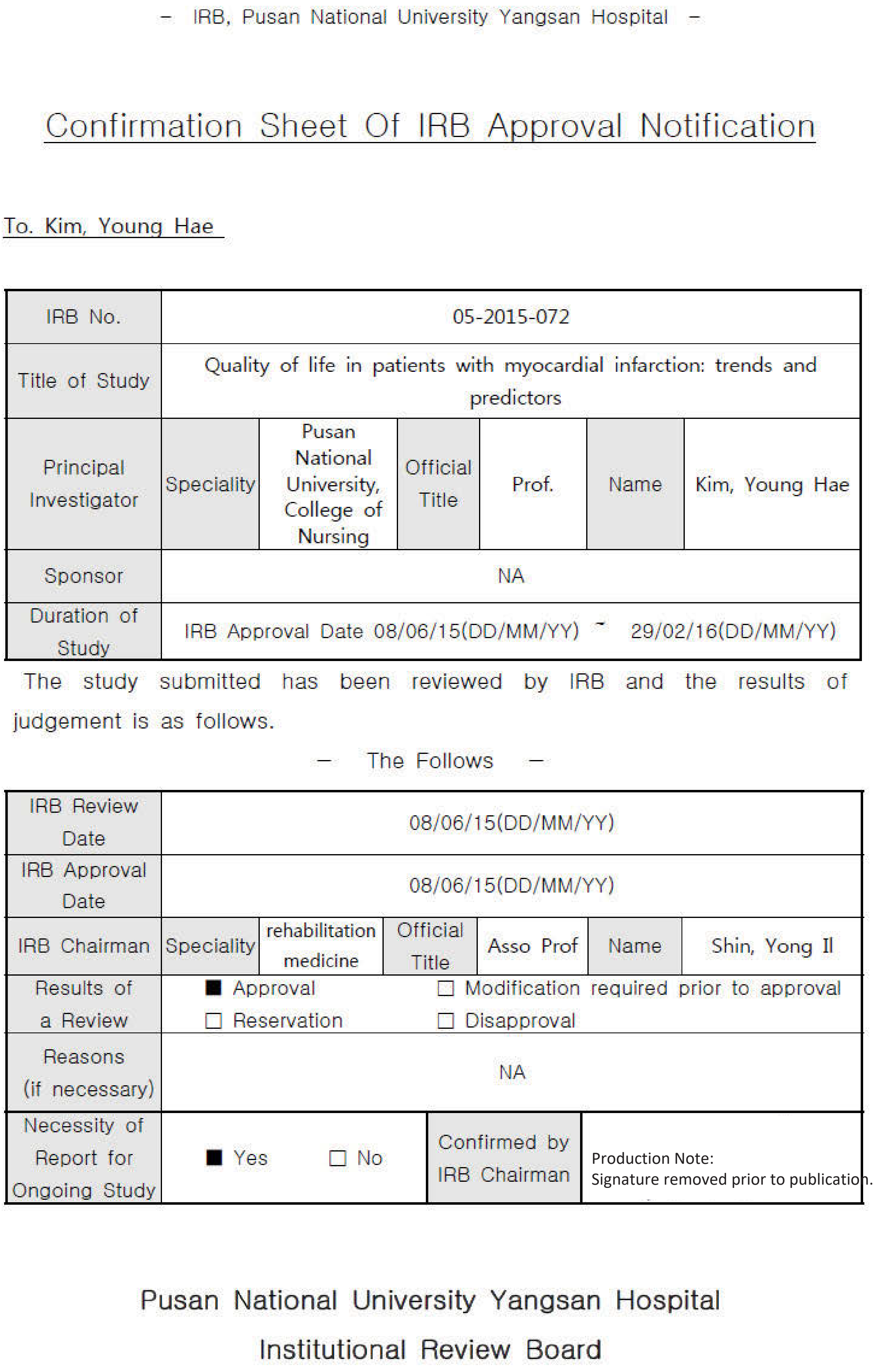
— The Follows —

IRB Meeting Date	11/06/15 (DD/MM/YY)					
IRB chairman	Speciality	Ophthalmology	Official Title	Professor	Name	Hee Young Cho
Results of a Review *	☑ Approval ☐ Reservation		☐ Modification required prior to approval ☐ Disapproval			
Reasons (if necessary)						
Necessity of Report for Ongoing Study	☐ Yes ☑ No		Submission Date	-		

* "Modification required prior to approval", "Reservation" : IRB can review again if modified form or adjusted/supplemented data is submitted.

Pusan National University Hospital
Institutional Review Board

b. PNUYH



– IRB, Pusan National University Yangsan Hospital –

Confirmation Sheet Of IRB Approval Notification

To. Kim, Young Hae

IRB No.	05-2015-072					
Title of Study	Quality of life in patients with myocardial infarction: trends and predictors					
Principal Investigator	Speciality	Pusan National University, College of Nursing	Official Title	Prof.	Name	Kim, Young Hae
Sponsor	NA					
Duration of Study	IRB Approval Date 08/06/15(DD/MM/YY) ~ 29/02/16(DD/MM/YY)					

The study submitted has been reviewed by IRB and the results of judgement is as follows.

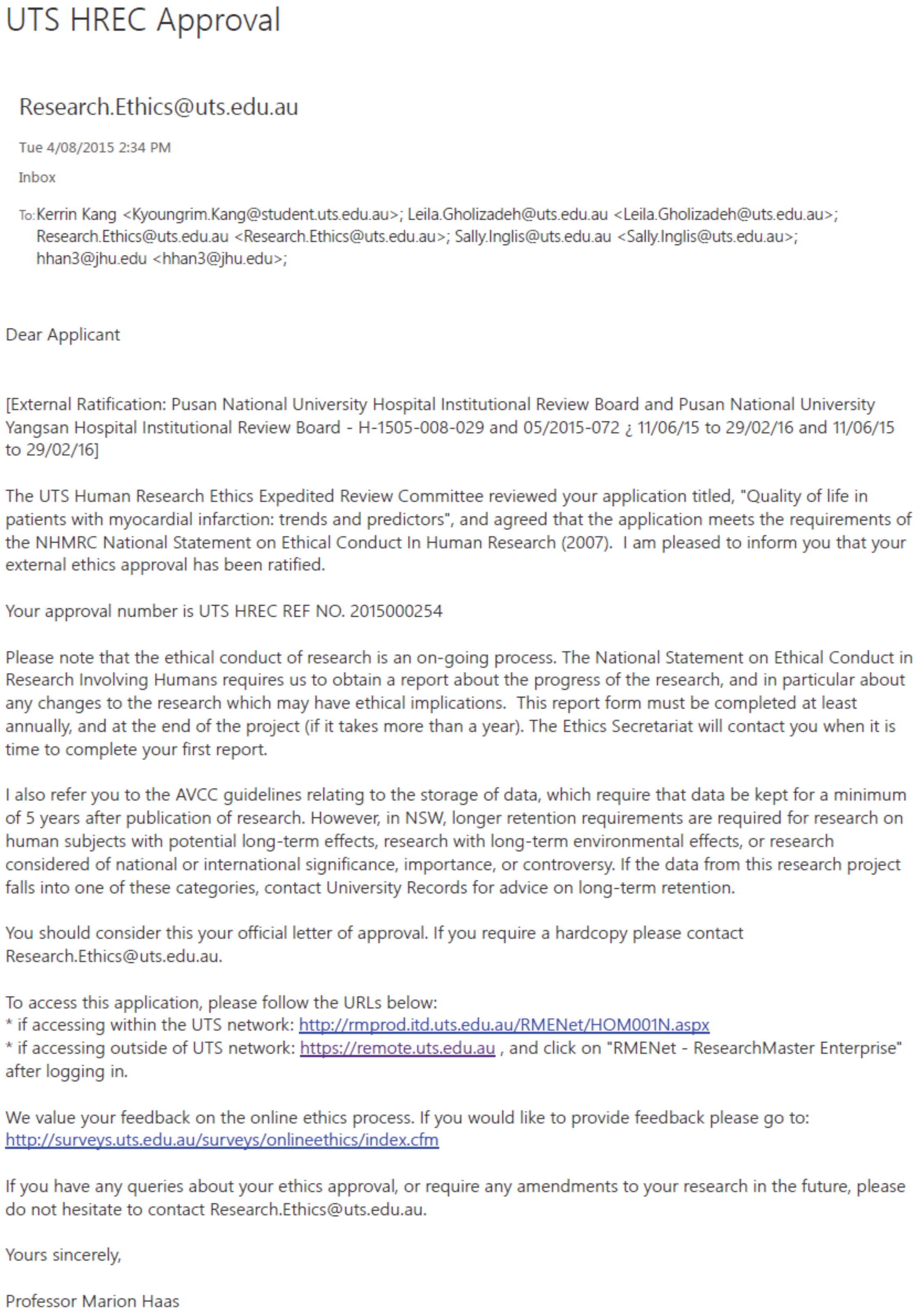
– The Follows –

IRB Review Date	08/06/15(DD/MM/YY)					
IRB Approval Date	08/06/15(DD/MM/YY)					
IRB Chairman	Speciality	rehabilitation medicine	Official Title	Asso Prof	Name	Shin, Yong Il
Results of a Review	■ Approval ☐ Reservation			☐ Modification required prior to approval ☐ Disapproval		
Reasons (if necessary)	NA					
Necessity of Report for Ongoing Study	■ Yes ☐ No		Confirmed by IRB Chairman	Production Note: Signature removed prior to publication.		

Pusan National University Yangsan Hospital

Institutional Review Board

c. UTS



UTS HREC Approval

Research.Ethics@uts.edu.au

Tue 4/08/2015 2:34 PM

Inbox

To: Kerrin Kang <Kyoungrim.Kang@student.uts.edu.au>; Leila.Gholizadeh@uts.edu.au <Leila.Gholizadeh@uts.edu.au>; Research.Ethics@uts.edu.au <Research.Ethics@uts.edu.au>; Sally.Inglis@uts.edu.au <Sally.Inglis@uts.edu.au>; hhan3@jhu.edu <hhan3@jhu.edu>;

Dear Applicant

[External Ratification: Pusan National University Hospital Institutional Review Board and Pusan National University Yangsan Hospital Institutional Review Board - H-1505-008-029 and 05/2015-072 ¿ 11/06/15 to 29/02/16 and 11/06/15 to 29/02/16]

The UTS Human Research Ethics Expedited Review Committee reviewed your application titled, "Quality of life in patients with myocardial infarction: trends and predictors", and agreed that the application meets the requirements of the NHMRC National Statement on Ethical Conduct In Human Research (2007). I am pleased to inform you that your external ethics approval has been ratified.

Your approval number is UTS HREC REF NO. 2015000254

Please note that the ethical conduct of research is an on-going process. The National Statement on Ethical Conduct in Research Involving Humans requires us to obtain a report about the progress of the research, and in particular about any changes to the research which may have ethical implications. This report form must be completed at least annually, and at the end of the project (if it takes more than a year). The Ethics Secretariat will contact you when it is time to complete your first report.

I also refer you to the AVCC guidelines relating to the storage of data, which require that data be kept for a minimum of 5 years after publication of research. However, in NSW, longer retention requirements are required for research on human subjects with potential long-term effects, research with long-term environmental effects, or research considered of national or international significance, importance, or controversy. If the data from this research project falls into one of these categories, contact University Records for advice on long-term retention.

You should consider this your official letter of approval. If you require a hardcopy please contact Research.Ethics@uts.edu.au.

To access this application, please follow the URLs below:
* if accessing within the UTS network: http://rmprod.itd.uts.edu.au/RMENet/HOM001N.aspx
* if accessing outside of UTS network: https://remote.uts.edu.au , and click on "RMENet - ResearchMaster Enterprise" after logging in.

We value your feedback on the online ethics process. If you would like to provide feedback please go to: http://surveys.uts.edu.au/surveys/onlineethics/index.cfm

If you have any queries about your ethics approval, or require any amendments to your research in the future, please do not hesitate to contact Research.Ethics@uts.edu.au.

Yours sincerely,

Professor Marion Haas

Chairperson
UTS Human Research Ethics Committee
C/- Research & Innovation Office
University of Technology, Sydney
T: (02) 9514 9645
F: (02) 9514 1244
E: Research.Ethics@uts.edu.au
I: http://www.research.uts.edu.au/policies/restricted/ethics.html
P: PO Box 123, BROADWAY NSW 2007
[Level 14, Building 1, Broadway Campus]
CB01.14.08.04

Appendix B: Participant information statement and consent form

a. Participant information statement and consent form (PNUH)

Title of Study	Quality of life in patients with myocardial infarction: trends and predictors					
Primary investigator	Name	Han Cheol Lee	Name of institution	Pusan National University Hospital	Contact	051-240-7794
Co-investigators	Name	Kyoungrim Kang	Name of institution	UTS	Contact	010.3072.2171
	Name		Name of institution		Contact	

*** If you have any doubts, difficulty, concerns about the project or the way it is being conducted and would like to speak to someone independent of the project, please contact Kyoungrim Kang.**

1. Invitation

We follow accepted ethical, scientific and medical standards that protect the rights of participants and conduct our study in compliance with recognized international standards, including the principles of the Declaration of Helsinki.

Before making a decision to participate, you should read this Information Letter carefully as it explains fully the intention of the research project. This study will be conducted only to those who sign the consent. Knowing what is involved will help you decide if you want to take part in the research. In addition, it is important that you fully understand the purposes, how information given by you will be used, possible risks, inconveniences and discomforts. Ask questions about anything that you do not understand or want to know more about. Before you decide, you can talk to anyone you feel comfortable with about the research. There may be some words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain.

If you decide you want to take part in the research project, you will be asked to sign the consent section. By signing it, you are telling us that you consent to take part in the research project voluntarily. You will be given a copy of this Participant Information and Consent Form to keep.

2. The purposes of the study

The purposes of this study are 1) to assess the baseline health-related quality of life (HRQOL), which is HRQOL immediately after the experience of MI; 2) to examine the trends in changes of HRQOL of the patients over time; and 3) to identify the predictors of HRQOL in patients at three months after discharge from MI.

3. Method

If you agree to be involved in the study, you will complete the questionnaires, which are validated, at the time of your admission and 3 months after discharge.

4. The procedure of this study

The procedure of this study is as follows.

Visit 1 (baseline): you will complete self-report questionnaires while you are admitted and data about the severity of MI will be collected from medical records. If you feel it is a burden to complete all the questionnaires in one single session, another interview time will be scheduled according to your preference.

Visit 2: A follow-up interview will be carried out by telephone or face-to-face 3 months after discharge at the outpatient department. Also, if you feel it is a burden to complete all the questionnaires in one single session, another interview time will be scheduled according to your preference.

5. Participant compliance

There is no specific participant compliance.

6. Possible risks, inconveniences and discomforts

There will not be adverse effects or risks in relation to participation in this study. However, you might feel a burden while you are answering questionnaires.

7. Potential benefits of the study

We cannot guarantee or promise that you will receive any benefits from this study. However, possible benefits may include that you would see the change of your quality of life and predictors of it. Health-related quality of life is an important patient-reported outcome. This is particularly important in patients with cardiac disease who often experience significant disease burden and need to make lifelong changes. According to the U.S. Centres for Disease Control and Prevention, HRQOL has been recommended to be considered as a primary outcome in the determination of therapeutic benefit. Data collected and analysed will provide a more comprehensive insight into HRQOL of patients with MI and can be used to support the development and delivery of quality services that aim to promote patient experience and recovery.

8. Expected duration and total number of participants in this study

Expected duration of this study is about 3 months. If you decide to participate in this study, you would spend 1-2 days when you are admitted, and 1-2 days in 3 months after discharge when you visit the outpatient department or when you prefer, on completing the questionnaires. The total number of participants in this study will be around 150.

9. Damage compensation

This research does not involve any interventional treatment but is only a survey, so this research is ‘low risk research’.

10. Reimbursements or additional fees

Please be notified that there is no financial reward for your participation in this study and that there are no direct benefits or risks for participating in this study. Neither is there any additional fee.

11. Additional information influencing the desire for continuous participation

If new information arises during this research project, we will tell you (or a legal representative) about it as soon as possible.

12. Voluntary participation and withdrawing consent to participate

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. Whether you choose to participate or not, all the services you receive at this clinic will continue and nothing will change. You are free to withdraw your consent to further involvement in the research project at any time without giving a reason. If you choose to withdraw, we will not collect any further information. However, please note that information collected up to that point in the study might be used. If you discontinue participation in this research project, you will be offered the treatment that is routinely offered in the hospital.

13. Confidentiality of information

The questionnaire is anonymous (no names will be recorded in the survey) and all your answers are confidential. This means they will be seen only by the research team. However, your health records and any information obtained during the research project are subject to inspection for the purpose of verifying the procedures and the data. This review may be done by Pusan National University Hospital Institutional Review Board. By signing the consent form, you authorise release of, or access to, this confidential information to the relevant research personnel and regulatory authorities as noted above.

The information obtained will only be considered for the purpose of the research and all scored measurements will be kept in a secure, private location that will be only available for the researcher.

Any written reports we make from this research will only contain aggregate (group) data and will not identify any individual or name any program or organisation.

14. Providing information about a participant’s right

This study has been reviewed and approved by the Institutional Review Board of Pusan National University Hospital, which is responsible for protection of participants’ rights, safety and welfare. If you have any question about your right as a participant in the study, feel free to ask to the IRB secretary (TEL 051-240-7529) at Pusan National University Hospital.

The Consent Form

Title of Study: Quality of life in patients with myocardial infarction: trends and predictors

1. I have read the information letter and someone has given a verbal explanation to me in a language that I understand. I have also discussed it with an investigator.

2. I have had an opportunity to be given information about the risks and benefits and I am satisfied with the answers I have received.

3. I freely agree to participate in this study.

4. I understand that I am free to withdraw at any time during the project without affecting my future health care.

5. I understand that by signing this consent, I agree with the investigators' collecting and handling my personal information within the current policy and the law. I understand that such information will remain confidential.

6. I understand that I will be given a signed copy of this document to keep.

Participant:	Name	Signature	Date
A legal representative (if necessary):	Name	Signature	Date
	(Relationship with the participant)		
A witness (if necessary):	Name	Signature	Date
Person who has given a verbal explanation:	Name	Signature	Date
Investigator:	Name	Signature	Date

If you have any questions, please contact Kyoungrim Kang on [redacted] or at Kyoungrim.Kang@student.uts.edu.au.

This consent is valid only if it is reviewed and approved by Pusan National University Hospital Institutional Review Board (IRB).

b. Participant information statement and consent form (PNUYH)

Title of Study	Quality of life in patients with myocardial infarction: trends and predictors					
Primary investigator	Name	Young Hae Kim	Name of institution	Pusan National University	Contact	051-510-8346
Co-investigators	Name	Jeong Su Kim	Name of institution	Pusan National University Yangsan Hospital	Contact	010.8520.7403
	Name	Kyoungrim Kang	Name of institution	UTS	Contact	010.3072.2171

*** If you have any doubts, difficulty, concerns about the project or the way it is being conducted and would like to speak to someone independent of the project, please contact Kyoungrim Kang.**

1. Invitation

We follow accepted ethical, scientific and medical standards that protect the rights of participants and conduct our study in compliance with recognized international standards, including the principles of the Declaration of Helsinki.

Before making a decision to participate, you should read this Information Letter carefully as it explains fully the intention of the research project. This study will be conducted only to those who sign the consent. Knowing what is involved will help you decide if you want to take part in the research. In addition, it is important that you fully understand the purposes, how information given by you will be used, possible risks, inconveniences and discomforts. Ask questions about anything that you do not understand or want to know more about. Before you decide, you can talk to anyone you feel comfortable with about the research. There may be some words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain.

If you decide you want to take part in the research project, you will be asked to sign the consent section. By signing it, you are telling us that you consent to take part in the research project voluntarily. You will be given a copy of this Participant Information and Consent Form to keep.

2. The purposes of the study

The purposes of this study are 1) to assess the baseline health-related quality of life (HRQOL), which is HRQOL immediately after the experience of MI; 2) to examine the trends in changes of HRQOL of the patients over time; and 3) to identify the predictors of HRQOL in patients at three months after discharge from MI.

3. Method

If you agree to be involved in the study, you will complete the questionnaires, which are validated, at the time of your admission and 3 months after discharge.

4. The procedure of this study

The procedure of this study is as follows.

Visit 1 (baseline): you will complete self-report questionnaires while you are admitted and data about the severity of MI will be collected from medical records. If you feel it is a burden to complete all the questionnaires in one single session, another interview time will be scheduled according to your preference.

Visit 2: A follow-up interview will be carried out by telephone or face-to-face 3 months after discharge at the outpatient department. Also, if you feel it is a burden to complete all the questionnaires in one single session, another interview time will be scheduled according to your preference.

5. Participant compliance

There is no specific participant compliance.

6. Possible risks, inconveniences and discomforts

There will not be adverse effects or risks in relation to participation in this study. However, you might feel a burden while you are answering questionnaires.

7. Potential benefits of the study

We cannot guarantee or promise that you will receive any benefits from this study. However, possible benefits may include that you would see the change of your quality of life and predictors of it. Health-related quality of life is an important patient-reported outcome. This is particularly important in patients with cardiac disease who often experience significant disease burden and need to make lifelong changes. According to the U.S. Centres for Disease Control and Prevention, HRQOL has been recommended to be considered as a primary outcome in the determination of therapeutic benefit. Data collected and analysed will provide a more comprehensive insight into HRQOL of patients with MI and can be used to support the development and delivery of quality services that aim to promote patient experience and recovery.

8. Expected duration and total number of participants in this study

Expected duration of this study is about 3 months. If you decide to participate in this study, you would spend 1-2 days when you are admitted, and 1-2 days in 3 months after discharge when you visit the outpatient department or when you prefer, on completing the questionnaires. The total number of participants in this study will be around 150.

9. Damage compensation

This research does not involve any interventional treatment but is only a survey, so this research is 'low risk research'.

10. Reimbursements or additional fees

Please be notified that there is no financial reward for your participation in this study and that there are no direct benefits or risks for participating in this study. Neither is there any additional fee.

11. Additional information influencing the desire for continuous participation

If new information arises during this research project, we will tell you (or a legal representative) about it as soon as possible.

12. Voluntary participation and withdrawing consent to participate

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. Whether you choose to participate or not, all the services you receive at this clinic will continue and nothing will change. You are free to withdraw your consent to further involvement in the research project at any time without giving a reason. If you choose to withdraw, we will not collect any further information. However, please note that information collected up to that point in the study might be used. If you discontinue participation in this research project, you will be offered the treatment that is routinely offered in the hospital.

13. Confidentiality of information

The questionnaire is anonymous (no names will be recorded in the survey) and all your answers are confidential. This means they will be seen only by the research team. However, your health records and any information obtained during the research project are subject to inspection for the purpose of verifying the procedures and the data. This review may be done by Pusan National University Yangsan Hospital Institutional Review Board. By signing the consent form, you authorise release of, or access to, this confidential information to the relevant research personnel and regulatory authorities as noted above.

The information obtained will only be considered for the purpose of the research and all scored measurements will be kept in a secure, private location that will be only available for the researcher.

Any written reports we make from this research will only contain aggregate (group) data and will not identify any individual or name any program or organisation.

14. Providing information about a participant's right

This study has been reviewed and approved by the Institutional Review Board of Pusan National University Yangsan Hospital, which is responsible for protection of participants' rights, safety and welfare. If you have any question about your right as a participant in the study, feel free to ask to the IRB secretary (TEL 055-360-3854~5) at Pusan National University Yangsan Hospital.

PNUYH- Instruction 3

The Consent Form

Title of Study: Quality of life in patients with myocardial infarction: trends and predictors

1. I have read the information letter, and someone has given a verbal explanation to me in a language that I understand. I have also discussed it with an investigator.

2. I have had an opportunity to be given information about the risks and benefits and I am satisfied with the answers I have received.

3. I freely agree to participate in this study.

4. I understand that I am free to withdraw at any time during the project without affecting my future health care.

5. I understand that by signing this consent, I agree with the investigators' collecting and handling my personal information within the current policy and the law. I understand that such information will remain confidential.

6. I understand that I will be given a signed copy of this document to keep.

Participant:	Name	Signature	Date
A legal representative (if necessary):	Name	Signature	Date
	(Relationship with the participant)		
A witness (if necessary):	Name	Signature	Date
Person who has given a verbal explanation:	Name	Signature	Date
Investigator:	Name	Signature	Date

If you have any questions, please contact Kyoungrim Kang on [redacted] or at Kyoungrim.Kang@student.uts.edu.au.

This consent is valid only if it is reviewed and approved by Pusan National University Yangsan Hospital Institutional Review Board (IRB).

Appendix C: Questionnaires at baseline and follow-up

a. Baseline

Quality of life in patients with myocardial infarction-Baseline

Patient Initials ☐☐☐ Subject No. ☐☐☐

Centre No. ☐☐☐ Date: __ __ / __ __ __ / __ __ __ __

Contact details

Phone:…………….….. Mobile:…………….…..

Address:…………………………..……

Date of admission: __ __ / __ __ __ / __ __ __ __ (DD / MMM / YYYY)

Demographical profile

1. Age: …………………..years

2. Gender: ☐1 Female ☐2 Male

3. Height: ………………….cm Weight: ………………….kg

4. Marital status: ☐1 Never Married ☐2 Married ☐3 Separated
☐4 Divorced ☐5 Widowed

5. The highest level of education:
☐1 Primary ☐2 Middle school ☐3 High school
☐4 Junior college ☐5 Undergraduate / Bachelor's
☐6 Postgraduate degrees

6. Current employment status:
☐1 Regular employee ☐2 Temporary employee
☐3 Daily worker ☐4 Self-employed worker
☐5 Unpaid family worker ☐6 Retired / Unemployed

7. How would you rate your financial situation?
☐1 Excellent ☐2 Good ☐3 Only fair ☐4 Poor

Health Behaviour profile

8. Which one of the items below best describes your physical activity?
☐1 Moderate physical activity at least 30 minutes most or all days of the week
☐2 Moderate physical activity less 30 minutes less than 5 days in a week
☐3 Not physically active

9. How many hours per day do you usually spend on sitting? ……….hours per day

10. smoking

Do you smoke cigarette currently?
☐1 No, I don't
☐2 I had smoked, but I quit smoking____year(s) ago.
☐3 Yes, I do

How many cigarettes do (did) you smoke a day?
☐1 less than a half pack
☐2 more than a half pack but less than one pack
☐3 more than one pack but less than two packs
☐4 two packs or more

How long have you been smoking? If you quit smoking, how long did you smoke?
☐1 less than 5 years ☐2 5~9years ☐3 10~19years ☐4 20~29years
☐5 more than 30years
☐6 the year when you started smoking :

11.alcohol

How often do you drink alcohol?

- ☐1 I never(rarely) drink.
- ☐2 I drink twice or three times a month.
- ☐3 I drink once or twice a week.
- ☐4 I drink three or four times a week.
- ☐5 I drink almost everyday.

When you drink, how much do you usually drink? (based on one bottle of Soju)

☐1 less than a half bottle ☐2 one bottle ☐3 one and a half bottles ☐4 more than two bottles

Clinical profile

Do you have current personal history of:

12. High blood pressure ☐1 Yes ☐0 No ☐2 Don’t know
13. Diabetes ☐1 Yes ☐0 No ☐2 Don’t know
14. High blood cholesterol ☐1 Yes ☐0 No ☐2 Don’t know
15. Cancer ☐1 Yes ☐0 No ☐2 Don’t know
16. Stroke ☐1 Yes ☐0 No ☐2 Don’t know
17. Mental problems ☐1 Yes ☐0 No ☐2 Don’t know

    If yes, please mention …………………..
18. Heart diseases? ☐1 Yes ☐0 No ☐2 Don’t know
19. Time since the first diagnosis of heart disease? …………year …………months
20. Previous MI? ☐1 Yes ☐0 No ☐2 Don’t know
21. Time since your last MI? …………year …………months
22. Other diseases ☐1 Yes ☐0 No ☐2 Don’t know

    If yes, please mention …………………..
23. What type of intervention/s have you received for your recent MI? (Tick more than one if it applies) ☐1 Automatic External Defibrillators (AED)
    - ☐2 Thrombolysis therapy, mention the name
    - ☐3 Angiography
    - ☐4 Angioplasty
    - ☐5 CABG
    - ☐6 Others …………………..
24. What type of intervention (e.g. thrombolysis therapy or PCI) has the patient had for the recent MI?
25. Time from the recent MI to the start of intervention? ……….hours

The severity of MI

26. Left Ventricular Ejection Fraction (LVEF) …………………%
27. Peak CK-Mb………..
28. Peak Troponin……………
29. Creatinine………..

30. Haemoglobin……………….

31. Killip class……………….

Fatigue, Self-efficacy, and Pain

32. How fatigued do you currently feel?

|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
0 1 2 3 4 5 6 7 8 9 10
(Not at all) (extremely)

33. How confident are you that you will be able to reduce your risk of future cardiac events?

|---------|---------|---------|---------|---------|
(Not at all) 0 1 2 3 4 5 (Very much)

34. How would you like to rate your pain on a scale from zero to ten?

|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
0 1 2 3 4 5 6 7 8 9 10
(No pain) (Moderate pain) (Worst imaginable pain)

35. How has been your chest pain after your MI?

☐1 No pain most of the days
☐2 Mild pain most of the days
☐3 Moderate pain most of the days
☐4 Severe pain most of the days

36. **DASS 21**

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement appl
you *over the past week*. There are no right or wrong answers. Do not spend too much time on any state

The rating scale is as follows:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

1	I found it hard to wind down	0 1 2 3
2	I was aware of dryness of my mouth	0 1 2 3
3	I couldn't seem to experience any positive feeling at all	0 1 2 3
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0 1 2 3
5	I found it difficult to work up the initiative to do things	0 1 2 3
6	I tended to over-react to situations	0 1 2 3
7	I experienced trembling (eg, in the hands)	0 1 2 3
8	I felt that I was using a lot of nervous energy	0 1 2 3
9	I was worried about situations in which I might panic and make a fool of myself	0 1 2 3
10	I felt that I had nothing to look forward to	0 1 2 3
11	I found myself getting agitated	0 1 2 3
12	I found it difficult to relax	0 1 2 3
13	I felt down-hearted and blue	0 1 2 3
14	I was intolerant of anything that kept me from getting on with what I was doing	0 1 2 3
15	I felt I was close to panic	0 1 2 3
16	I was unable to become enthusiastic about anything	0 1 2 3
17	I felt I wasn't worth much as a person	0 1 2 3
18	I felt that I was rather touchy	0 1 2 3
19	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0 1 2 3
20	I felt scared without any good reason	0 1 2 3
21	I felt that life was meaningless	0 1 2 3

37. **Insomnia Severity Index**

The Insomnia Severity Index has seven questions. The seven answers are added up to get a total score. When you have your total score, look at the 'Guidelines for Scoring/Interpretation' below to see where your sleep difficulty fits.

For each question, please CIRCLE the number that best describes your answer.

Please rate the CURRENT (i.e. LAST 2 WEEKS) SEVERITY of your insomnia problem(s).

Insomnia Problem	**None**	**Mild**	**Moderate**	**Severe**	**Very Severe**
1. Difficulty falling asleep	0	1	2	3	4
2. Difficulty staying asleep	0	1	2	3	4
3. Problems waking up too early	0	1	2	3	4

4. How SATISFIED/DISSATISFIED are you with your CURRENT sleep pattern?

Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied
0	1	2	3	4

5. How NOTICEABLE to others do you think your sleep problem is in terms of impairing the quality of your life?

Not at all Noticeable	A Little	Somewhat	Much	Very Much Noticeable
0	1	2	3	4

6. How WORRIED/DISTRESSED are you about your current sleep problem?

Not at all Worried	A Little	Somewhat	Much	Very Much
0	1	2	3	4

7. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.) CURRENTLY?

Not at all Interfering	A Little	Somewhat	Much	Very Much
0	1	2	3	4

38. **The Brief Illness Perception Questionnaire**

For the following questions, please circle the number that best corresponds to your views:

How much does your illness affect your overall life?

0	1	2	3	4	5	6	7	8	9	10
no affect at all										severely affects my life

How long do you think your illness will continue?

0	1	2	3	4	5	6	7	8	9	10
a very short time										forever

How much control do you feel you have over your illness?

0	1	2	3	4	5	6	7	8	9	10
absolutely no control										extreme amount of control

How much do you think your treatment can help your illness?

0	1	2	3	4	5	6	7	8	9	10
not at all										extremely helpful

How much do you experience symptoms from your illness?

0	1	2	3	4	5	6	7	8	9	10
no symptoms at all										many severe symptoms

How concerned are you about your illness?

0	1	2	3	4	5	6	7	8	9	10
not at all concerned										extremely concerned

How well do you feel you understand your illness?

0	1	2	3	4	5	6	7	8	9	10
don't understand at all										understand very clearly

How much does your illness affect you emotionally?
(e.g. does it make you angry, scared, upset or depressed?)

0	1	2	3	4	5	6	7	8	9	10
not at all affected emotionally										extremely affected emotionally

Please list in rank-order the three most important factors that you believe caused your illness.
The most important causes for me:

1. ____
2. ____
3. ____

39. ENRICHD Social support instrument (ESSI)

1. Is there someone available to you whom you can count on to listen to you when you need to talk?

None of the time	A little of the time	Some of the time	Most of the time	All the time
1	2	3	4	5

2. Is there someone available to give you good advice about a problem?

None of the time	A little of the time	Some of the time	Most of the time	All the time
1	2	3	4	5

3. Is there someone available to you who shows you love and affection?

None of the time	A little of the time	Some of the time	Most of the time	All the time
1	2	3	4	5

4. Is there someone available to help you with daily chores?

None of the time	A little of the time	Some of the time	Most of the time	All the time
1	2	3	4	5

5. Can you count on anyone to provide you with emotional support (talking over problems or helping you make a difficult decision)?

None of the time	A little of the time	Some of the time	Most of the time	All the time
1	2	3	4	5

6. Do you have as much contact as you would like with someone you feel close to, someone in whom you can trust and confide?

None of the time	A little of the time	Some of the time	Most of the time	All the time
1	2	3	4	5

7. Are you currently married or living with a partner?

Yes	No
1	0

40. **MacNew Quality of Life after Myocardial Infarction Questionnaire**

We would like to ask you some questions about how you have been feeling DURING THE LAST 2 WEEKS.

1. In general, how much of the time during the last 2 weeks, have you felt frustrated, impatient or angry?

   ☐1 All of the time
   ☐2 Most of the time
   ☐3 A good bit of the time
   ☐4 Some of the time
   ☐5 A little of the time
   ☐6 Hardly any of the time
   ☐7 None of the time

2. How often, during the last 2 weeks, have you felt worthless or inadequate?

   ☐1 All of the time
   ☐2 Most of the time
   ☐3 A good bit of the time
   ☐4 Some of the time
   ☐5 A little of the time
   ☐6 Hardly any of the time
   ☐7 None of the time

3. In the last 2 weeks, how much of the time did you feel very confident and sure that you could deal with your heart problem?

   ☐1 None of the time
   ☐2 A little of the time
   ☐3 Some of the time
   ☐4 A good bit of the time
   ☐5 Most of the time
   ☐6 Almost all of the time
   ☐7 All of the time

4. In general how much of the time did you feel discouraged or down in the dumps during the last 2 weeks?

   ☐1 All of the time
   ☐2 Most of the time
   ☐3 A good bit of the time
   ☐4 Some of the time
   ☐5 A little of the time
   ☐6 Hardly any of the time
   ☐7 None of the time

5. How much of the time, during the last 2 weeks, did you feel relaxed and free of tension?

   ☐1 None of the time
   ☐2 A little of the time
   ☐3 Some of the time
   ☐4 A good bit of the time
   ☐5 Most of the time
   ☐6 Almost all of the time
   ☐7 All of the time

6. How often, during the last 2 weeks, have you felt worn out or low in energy?

   ☐1 All of the time
   ☐2 Most of the time
   ☐3 A good bit of the time

☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

7. How happy, satisfied, or pleased have you been with your personal life during the last 2 weeks?

☐1 Very dissatisfied, unhappy most of the time
☐2 Generally dissatisfied, unhappy
☐3 Somewhat dissatisfied, unhappy
☐4 Generally satisfied, pleased
☐5 happy most of the time
☐6 Very happy most of the time
☐7 Extremely happy, could not have been more satisfied or pleased

8. In general, how often during the last 2 weeks, have you felt restless, or as if you were having difficulty trying to calm down?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

9. How much shortness of breath have you experienced during the last 2 weeks while doing your day-to-day physical activities?

☐1 Extreme shortness of breath
☐2 Very shortness of breath
☐3 Quite a bit of shortness of breath
☐4 Moderate shortness of breath
☐5 Some shortness of breath
☐6 A little shortness of breath
☐7 No shortness of breath

10. How often, during the last 2 weeks, have you felt tearful, or like crying?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

11. How often, during the last 2 weeks, have you felt as if you were more dependent than you were before your heart problem?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

12. How often, during the last 2 weeks, have you felt you were unable to do your usual social activities or social activities with your family?

☐1 All of the time
☐2 Most of the time

☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

13. How often, during the last 2 weeks, have you felt as if others no longer have the same confidence in you as they did before your heart problem?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

14. How often, during the last 2 weeks, have you experienced chest pain while doing your day-to-day activities?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

15. How often, during the last 2 weeks, have you felt unsure of yourself or lacking in self-confidence?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

16. How often, during the last 2 weeks, have you been bothered by aching or tired legs?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

17. During the last 2 weeks, how much have you been limited in doing sports or exercise as a result of your heart problem?

☐1 Extremely limited
☐2 Very limited
☐3 Limited quite a bit
☐4 Moderately limited
☐5 Somewhat limited
☐6 Limited a little
☐7 Not limited at all

18. How often, during the last 2 weeks, have you felt apprehensive or frightened?

☐1 All of the time
☐2 Most of the time

☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

19. How often, during the last 2 weeks, have you felt dizzy or lightheaded?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

20. In general, during the last 2 weeks, how much have you been restricted or limited as a result of your heart problem?

☐1 Extremely limited
☐2 Very limited
☐3 Limited quite a bit
☐4 Moderately limited
☐5 Somewhat limited
☐6 Limited a little
☐7 Not limited at all

21. How often, during the last 2 weeks, have you felt unsure as to how much exercise or physical activity you should be doing?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

22. How often, during the last 2 weeks, have you felt as if your family is being over-protective toward you?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

23. How often, during the last 2 weeks, have you felt as if you were a burden on others?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

24. How often, during the last 2 weeks, have you felt excluded from doing things with other people because of your heart problem?

☐1 All of the time
☐2 Most of the time

☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

25. How often, during the last 2 weeks, have you felt unable to socialise because of your heart problem?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

26. In general, during the last 2 weeks, how much have you been physically restricted or limited as a result of your heart problem?

☐1 Extremely limited
☐2 Very limited
☐3 Limited quite a bit
☐4 Moderately limited
☐5 Somewhat limited
☐6 Limited a little
☐7 Not limited at all

27. How often, during the last 2 weeks, have you felt your heart problem limited or interfered with sexual intercourse?

☐0 Not applicable
☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

41. Is your health Excellent, Very Good, Good, Fair, or Poor?

☐1 Excellent ☐2 Very Good ☐3 Good ☐4 Fair ☐5 Poor

b. Follow-up

Quality of life in patients with myocardial infarction

-3-month follow-up-

Patient Initials ☐☐☐ Subject No. ☐☐☐

Centre No. ☐☐☐ Date: __ __ / __ __ __ / __ __ __ __

Contact details

Phone:……………..….. Mobile:……………..…..

Address:……………………….……

Date of discharge: __ __ / __ __ __ / __ __ __ __ (DD / MMM / YYYY)

Demographical and clinical profile

1. Since we met, have you had any adverse events? ☐1 Yes ☐0 No
   If yes, Please mention……………..

2. Since we met, how many times have you visited your doctor? ………… times

3. Since we met, have you been re-admitted to hospital? ☐1 Yes ☐0 No

4. Since we met, have there been any changes in conditions? Please mention…(including any medical procedures)

5. Have you returned to your normal work? ☐1 Yes ☐0 No

6. Have you returned to your normal sexual activities? ☐1 Yes ☐0 No

7. Have you attended the cardiac rehabilitation program? ☐1 Yes ☐0 No

8. How would you rate your financial situation?
   ☐1 Excellent ☐2 Good ☐3 Only fair ☐4 Poor

9. Which one of the items below best describes your physical activity?
   ☐1 Moderate physical activity at least 30 minutes most or all days of the week
   ☐2 Moderate physical activity less 30 minutes less than 5 days in a week
   ☐3 Not physically active

10. How many hours per day do you usually spend on sitting? ……..……hours per day

11. Smoking

Do you smoke cigarette currently?
☐1 No, I don't
☐2 I had smoked, but I quit smoking____year(s) ago.
☐3 Yes, I do

How many cigarettes do (did) you smoke a day?
☐1 less than a half pack
☐2 more than a half pack but less than one pack
☐3 more than one pack but less than two packs
☐4 two packs or more

How long have you been smoking? If you quit smoking, how long did you smoke?
☐1 less than 5 years ☐2 5~9years ☐3 10~19years ☐4 20~29years ☐5 more than 30years

12. Alcohol

How often do you drink alcohol?
☐1 I never(rarely) drink.

☐2 I drink twice or three times a month.
☐3 I drink once or twice a week.
☐4 I drink three or four times a week.
☐5 I drink almost everyday.

When you drink, how much do you usually drink? (based on one bottle of Soju)
☐1 less than a half bottle ☐2 one bottle ☐3 one and a half bottles ☐4 more than two bottles

13. What type of intervention (e.g. thrombolysis therapy or coronary angioplasty) has the patient had for the recent MI? …………………

14. Time from the recent MI to the start of intervention? ……….hours

The severity of MI

15. Left Ventricular Ejection Fraction (LVEF) …………………%

16. Killip class……………….

Fatigue, Self-efficacy, and Pain

17. How fatigued do you currently feel?

|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
0 1 2 3 4 5 6 7 8 9 10
(Not at all) (extremely)

18. How confident are you that you will be able to reduce your risk of future cardiac events?

|---------|---------|---------|---------|
1 2 3 4 5
(Not at all) (Very much)

19. How would you like to rate your pain on a scale from zero to ten?

|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
0 1 2 3 4 5 6 7 8 9 10
(No pain) (Moderate pain) (Worst imaginable pain)

20. How has been your chest pain after your MI?
☐1 No pain most of the days
☐2 Mild pain most of the days
☐3 Moderate pain most of the days
☐4 Severe pain most of the days

21. DASS 21

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time

2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

1	I found it hard to wind down	0 1 2 3
2	I was aware of dryness of my mouth	0 1 2 3
3	I couldn't seem to experience any positive feeling at all	0 1 2 3
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0 1 2 3
5	I found it difficult to work up the initiative to do things	0 1 2 3
6	I tended to over-react to situations	0 1 2 3
7	I experienced trembling (eg, in the hands)	0 1 2 3
8	I felt that I was using a lot of nervous energy	0 1 2 3
9	I was worried about situations in which I might panic and make a fool of myself	0 1 2 3
10	I felt that I had nothing to look forward to	0 1 2 3
11	I found myself getting agitated	0 1 2 3
12	I found it difficult to relax	0 1 2 3
13	I felt down-hearted and blue	0 1 2 3
14	I was intolerant of anything that kept me from getting on with what I was doing	0 1 2 3
15	I felt I was close to panic	0 1 2 3
16	I was unable to become enthusiastic about anything	0 1 2 3
17	I felt I wasn't worth much as a person	0 1 2 3
18	I felt that I was rather touchy	0 1 2 3
19	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0 1 2 3
20	I felt scared without any good reason	0 1 2 3
21	I felt that life was meaningless	0 1 2 3

22. Insomnia Severity Index

The Insomnia Severity Index has seven questions. The seven answers are added up to get a total score. When you have your total score, look at the 'Guidelines for Scoring/Interpretation' below to see where your sleep difficulty fits.

For each question, please CIRCLE the number that best describes your answer.

Please rate the CURRENT (i.e. LAST 2 WEEKS) SEVERITY of your insomnia problem(s).

Insomnia Problem	**None**	**Mild**	**Moderate**	**Severe**	**Very Severe**
1) Difficulty falling asleep	0	1	2	3	4
2) Difficulty staying asleep	0	1	2	3	4
3) Problems waking up too early	0	1	2	3	4

4) How SATISFIED/DISSATISFIED are you with your CURRENT sleep pattern?

Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied
0	1	2	3	4

5) How NOTICEABLE to others do you think your sleep problem is in terms of impairing the quality of your life?

Not at all Noticeable	A Little	Somewhat	Much	Very Much Noticeable
0	1	2	3	4

6) How WORRIED/DISTRESSED are you about your current sleep problem?

Not at all Worried	A Little	Somewhat	Much	Very Much
0	1	2	3	4

7) To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.) CURRENTLY?

Not at all Interfering	A Little	Somewhat	Much	Very Much
0	1	2	3	4

23. The Brief Illness Perception Questionnaire

For the following questions, please circle the number that best corresponds to your views:

How much does your illness affect your overall life?

0	1	2	3	4	5	6	7	8	9	10
no affect at all										severely affects my life

How long do you think your illness will continue?

0	1	2	3	4	5	6	7	8	9	10
a very short time										forever

How much control do you feel you have over your illness?

0	1	2	3	4	5	6	7	8	9	10
absolutely no control										extreme amount of control

How much do you think your treatment can help your illness?

0	1	2	3	4	5	6	7	8	9	10
not at all										extremely helpful

How much do you experience symptoms from your illness?

0	1	2	3	4	5	6	7	8	9	10
no symptoms at all										many severe symptoms

How concerned are you about your illness?

0	1	2	3	4	5	6	7	8	9	10
not at all concerned										extremely concerned

How well do you feel you understand your illness?

0	1	2	3	4	5	6	7	8	9	10
don't understand at all										understand very clearly

How much does your illness affect you emotionally? (e.g. does it make you angry, scared, upset or depressed?)

0	1	2	3	4	5	6	7	8	9	10
not at all affected										extremely affected

Please list in rank-order the three most important factors that you believe caused your illness. ***The most important causes for me:-***

1. ____

2. ____

3. ____

24. ENRICHD Social support instrument (ESSI)

1) Is there someone available to you whom you can count on to listen to you when you need to talk?

None of the time	A little of the time	Some of the time	Most of the time	All the time
1	2	3	4	5

2) Is there someone available to give you good advice about a problem?

None of the time	A little of the time	Some of the time	Most of the time	All the time
1	2	3	4	5

3) Is there someone available to you who shows you love and affection?

None of the time	A little of the time	Some of the time	Most of the time	All the time
1	2	3	4	5

4) Is there someone available to help you with daily chores?

None of the time	A little of the time	Some of the time	Most of the time	All the time
1	2	3	4	5

5) Can you count on anyone to provide you with emotional support (talking over problems or helping you make a difficult decision)?

None of the time	A little of the time	Some of the time	Most of the time	All the time
1	2	3	4	5

6) Do you have as much contact as you would like with someone you feel close to, someone in whom you can trust and confide?

None of the time	A little of the time	Some of the time	Most of the time	All the time
1	2	3	4	5

7) Are you currently married or living with a partner?

Yes	No
1	0

25. MacNew Quality of Life after Myocardial Infarction Questionnaire

We would like to ask you some questions about how you have been feeling DURING THE LAST 2 WEEKS.

1) In general, how much of the time during the last 2 weeks, have you felt frustrated, impatient or angry?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

2) How often, during the last 2 weeks, have you felt worthless or inadequate?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

3) In the last 2 weeks, how much of the time did you feel very confident and sure that you could deal with your heart problem?

☐1 None of the time
☐2 A little of the time
☐3 Some of the time
☐4 A good bit of the time
☐5 Most of the time
☐6 Almost all of the time
☐7 All of the time

4) In general how much of the time did you feel discouraged or down in the dumps during the last 2 weeks?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

5) How much of the time, during the last 2 weeks, did you feel relaxed and free of tension?

☐1 None of the time
☐2 A little of the time
☐3 Some of the time
☐4 A good bit of the time
☐5 Most of the time
☐6 Almost all of the time
☐7 All of the time

6) How often, during the last 2 weeks, have you felt worn out or low in energy?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

7) How happy, satisfied, or pleased have you been with your personal life during the last 2 weeks?

☐1 Very dissatisfied, unhappy most of the time
☐2 Generally dissatisfied, unhappy
☐3 Somewhat dissatisfied, unhappy
☐4 Generally satisfied, pleased
☐5 happy most of the time
☐6 Very happy most of the time
☐7 Extremely happy, could not have been more satisfied or pleased

8) In general, how often during the last 2 weeks, have you felt restless, or as if you were having difficulty trying to calm down?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

9) How much shortness of breath have you experienced during the last 2 weeks while doing your day-to-day physical activities?

☐1 Extreme shortness of breath
☐2 Very shortness of breath
☐3 Quite a bit of shortness of breath
☐4 Moderate shortness of breath
☐5 Some shortness of breath
☐6 A little shortness of breath

☐7 No shortness of breath

10) How often, during the last 2 weeks, have you felt tearful, or like crying?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

11) How often, during the last 2 weeks, have you felt as if you were more dependent than you were before your heart problem?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

12) How often, during the last 2 weeks, have you felt you were unable to do your usual social activities or social activities with your family?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

13) How often, during the last 2 weeks, have you felt as if others no longer have the same confidence in you as they did before your heart problem?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

14) How often, during the last 2 weeks, have you experienced chest pain while doing your day-to-day activities?

☐1 All of the time
☐2 Most of the time

☐3 A good bit of the time

☐4 Some of the time

☐5 A little of the time

☐6 Hardly any of the time

☐7 None of the time

15) How often, during the last 2 weeks, have you felt unsure of yourself or lacking in self-confidence?

☐1 All of the time

☐2 Most of the time

☐3 A good bit of the time

☐4 Some of the time

☐5 A little of the time

☐6 Hardly any of the time

☐7 None of the time

16) How often, during the last 2 weeks, have you been bothered by aching or tired legs?

☐1 All of the time

☐2 Most of the time

☐3 A good bit of the time

☐4 Some of the time

☐5 A little of the time

☐6 Hardly any of the time

☐7 None of the time

17) During the last 2 weeks, how much have you been limited in doing sports or exercise as a result of your heart problem?

☐1 Extremely limited

☐2 Very limited

☐3 Limited quite a bit

☐4 Moderately limited

☐5 Somewhat limited

☐6 Limited a little

☐7 Not limited at all

18) How often, during the last 2 weeks, have you felt apprehensive or frightened?

☐1 All of the time

☐2 Most of the time

☐3 A good bit of the time

☐4 Some of the time

☐5 A little of the time

☐6 Hardly any of the time

☐7 None of the time

19) How often, during the last 2 weeks, have you felt dizzy or lightheaded?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

20) In general, during the last 2 weeks, how much have you been restricted or limited as a result of your heart problem?

☐1 Extremely limited
☐2 Very limited
☐3 Limited quite a bit
☐4 Moderately limited
☐5 Somewhat limited
☐6 Limited a little
☐7 Not limited at all

21) How often, during the last 2 weeks, have you felt unsure as to how much exercise or physical activity you should be doing?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

22) How often, during the last 2 weeks, have you felt as if your family is being over-protective toward you?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time
☐6 Hardly any of the time
☐7 None of the time

23) How often, during the last 2 weeks, have you felt as if you were a burden on others?

☐1 All of the time
☐2 Most of the time
☐3 A good bit of the time
☐4 Some of the time
☐5 A little of the time

☐6 Hardly any of the time

☐7 None of the time

24) How often, during the last 2 weeks, have you felt excluded from doing things with other people because of your heart problem?

☐1 All of the time

☐2 Most of the time

☐3 A good bit of the time

☐4 Some of the time

☐5 A little of the time

☐6 Hardly any of the time

☐7 None of the time

25) How often, during the last 2 weeks, have you felt unable to socialise because of your heart problem?

☐1 All of the time

☐2 Most of the time

☐3 A good bit of the time

☐4 Some of the time

☐5 A little of the time

☐6 Hardly any of the time

☐7 None of the time

26) In general, during the last 2 weeks, how much have you been physically restricted or limited as a result of your heart problem?

☐1 Extremely limited

☐2 Very limited

☐3 Limited quite a bit

☐4 Moderately limited

☐5 Somewhat limited

☐6 Limited a little

☐7 Not limited at all

27) How often, during the last 2 weeks, have you felt your heart problem limited or interfered with sexual intercourse?

☐0 Not applicable

☐1 All of the time

☐2 Most of the time

☐3 A good bit of the time

☐4 Some of the time

☐5 A little of the time

☐6 Hardly any of the time

☐7 None of the time

26. How would you rate your overall quality of life?

|---------|---------|---------|---------|---------|

0 1 2 3 4 5

(Poor) (Excellent)

Appendix D: Copyright

a. *International Journal of Nursing Studies*

Title: Correlates of health-related quality of life in patients with myocardial infarction: A literature review

Author: Kyoungrim Kang,Leila Gholizadeh,Sally C. Inglis,Hae-Ra Han

Publication: International Journal of Nursing Studies

Publisher: Elsevier

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b. *Quality of Life Research*

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Licensed Content Author	Kyoungrim Kang, Leila Gholizadeh, Sally C. Inglis et al
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Requestor type	academic/university or research institute
Format	print and electronic
Portion	full article/chapter
Will you be translating?	no
Circulation/distribution	<501
Author of this Springer Nature content	yes
Title	Health-related quality of life in patients with myocardial infarction: trends and predictors
Instructor name	Leila Gholizadeh, Sally C. Inglis, Hae-Ra Han
Institution name	University of Technology Sydney
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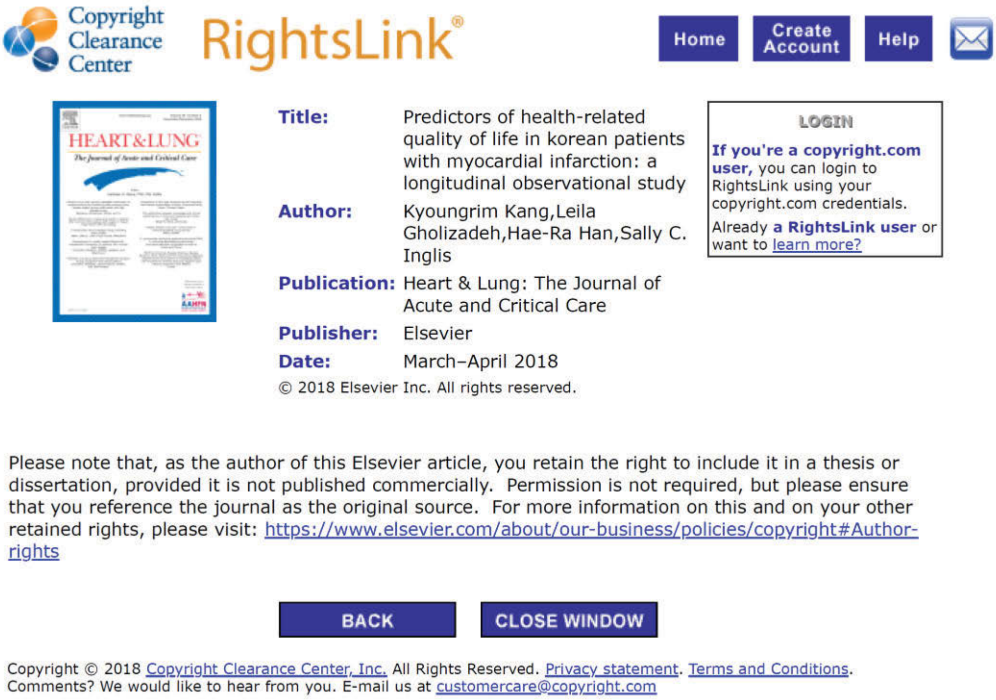
c. *Journal of Nursing Research*

d. Heart & Lung: The Journal of Acute and Critical Care



Title: Predictors of health-related quality of life in korean patients with myocardial infarction: a longitudinal observational study

Author: Kyoungrim Kang,Leila Gholizadeh,Hae-Ra Han,Sally C. Inglis

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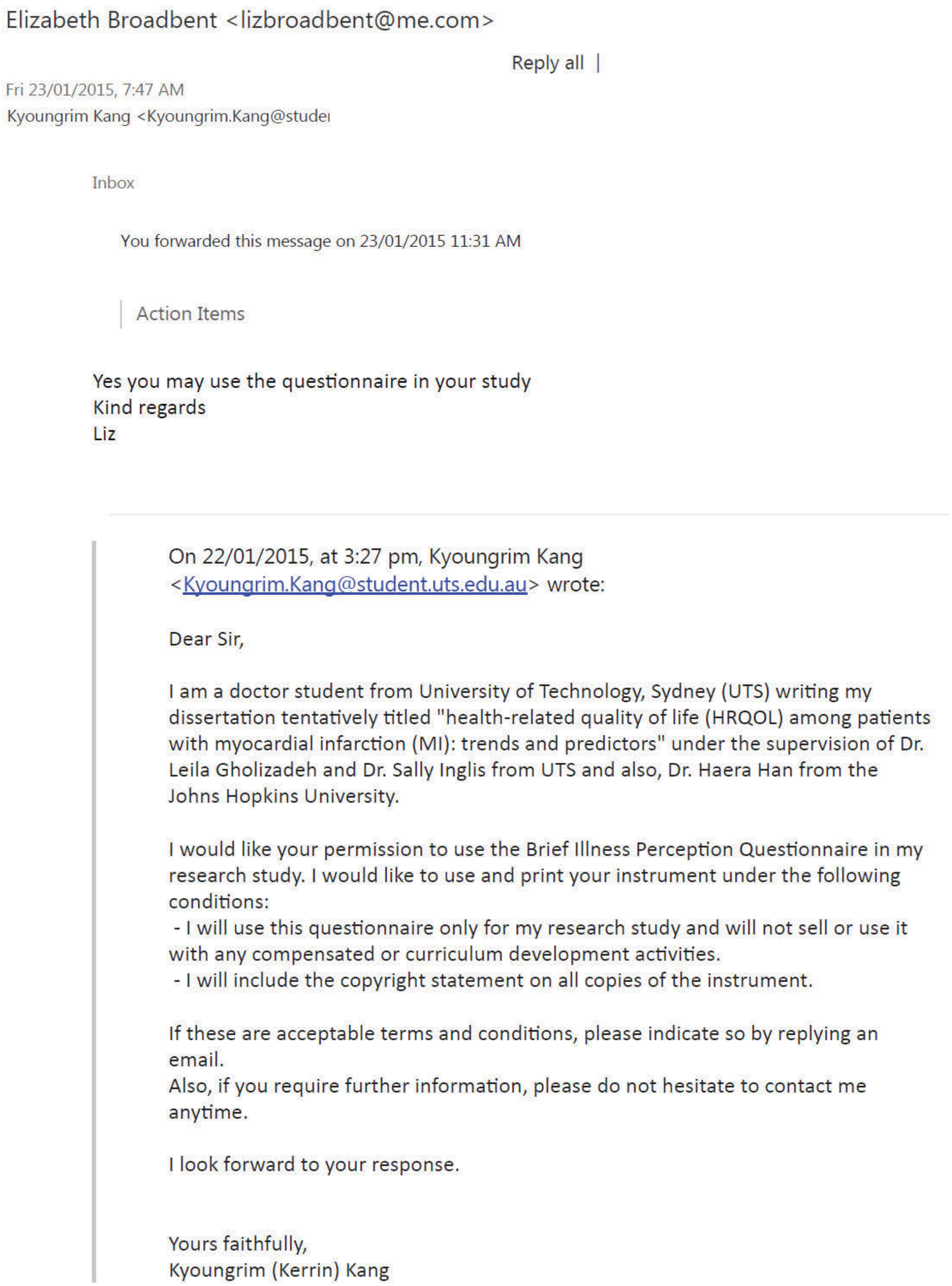

Elizabeth Broadbent <lizbroadbent@me.com>

Reply all |

Fri 23/01/2015, 7:47 AM
Kyoungrim Kang <Kyoungrim.Kang@stude

Inbox

You forwarded this message on 23/01/2015 11:31 AM

Action Items

Yes you may use the questionnaire in your study
Kind regards
Liz

> On 22/01/2015, at 3:27 pm, Kyoungrim Kang <Kyoungrim.Kang@student.uts.edu.au> wrote:
>
> Dear Sir,
>
> I am a doctor student from University of Technology, Sydney (UTS) writing my dissertation tentatively titled "health-related quality of life (HRQOL) among patients with myocardial infarction (MI): trends and predictors" under the supervision of Dr. Leila Gholizadeh and Dr. Sally Inglis from UTS and also, Dr. Haera Han from the Johns Hopkins University.
>
> I would like your permission to use the Brief Illness Perception Questionnaire in my research study. I would like to use and print your instrument under the following conditions:
> - I will use this questionnaire only for my research study and will not sell or use it with any compensated or curriculum development activities.
> - I will include the copyright statement on all copies of the instrument.
>
> If these are acceptable terms and conditions, please indicate so by replying an email.
> Also, if you require further information, please do not hesitate to contact me anytime.
>
> I look forward to your response.
>
> Yours faithfully,
> Kyoungrim (Kerrin) Kang

Appendix E: Publications associated with this thesis

a. Correlates of health-related quality of life in patients with myocardial infarction: A literature review

International Journal of Nursing Studies 73 (2017) 1–16

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Review

Correlates of health-related quality of life in patients with myocardial infarction: A literature review

Kyoungrim Kang[a,*], Leila Gholizadeh[a], Sally C. Inglis[a], Hae-Ra Han[b]

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[b] The Johns Hopkins University, Baltimore, MD, USA

ARTICLE INFO

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ABSTRACT

Background: By the increasing emphasis on health-related quality of life (HRQoL) in patients with myocardial infarction (MI), it is necessary to explore factors that affect HRQoL in this population.
Objectives: This study aimed to identify correlates of HRQoL in patients with MI.
Design: A literature review of the factors that affect HRQoL in patients with MI (1995–2016).
Data sources: Three main databases—CINAHL, MEDLINE and PsychINFO—were searched to retrieve relevant peer-reviewed articles published in English.
Review methods: In consultation with a medical librarian, we identified relevant MeSH terms and used them for searching the literature: health-related quality of life/quality of life/HRQoL/QoL, myocardial infarction/heart attack/MI and predict*/factor. Data elements were extracted and narratively described variables synthesised into four categories.
Results: A total of 48 studies met the inclusion criteria and were included in the review. Correlates of HRQoL in patients with MI were identified in the following categories: demographic, behavioural, disease-related, and psychosocial factors. Specific correlates included age and gender-identity for demographic factors; physical activity and smoking for behavioural factors; severity of MI, symptoms, and comorbidities for disease-related factors; anxiety and depression for psychosocial factors.
Conclusions: Identifying correlates of HRQoL can help identify patients who are at risk for poor HRQoL in the recovery or rehabilitation stage of post-MI. Future intervention should focus on adjustable correlates such as behavioural and psychosocial factors to promote HRQoL among patients after experiencing MI.

What is already known about the topic?

- Several demographic, behavioural, disease-related and psychosocial factors were related to HRQoL in patients with heart disease.
- Anxiety, depression, and stress consistently showed a significantly negative impact on MI patients' HRQoL throughout the literature.

What this paper adds

- Several demographic, behavioural, disease-related and psychosocial factors were found out to affect HRQoL, whereas demographic and disease-related factors are unlikely to be modifiable. Altering or preventing modifiable factors can be more effective strategies for the recovery of HRQoL in patients with MI.
- Early identification and interventions for depression, anxiety, and stress in cardiac patients, as recommended by American Heart Association, may improve HRQoL of patients with MI.
- A single study of investigating all the factors, including demographic, behavioural, disease-related and psychosocial ones, is needed to identify the relationship between the variables and HRQoL among patient with MI.

1. Introduction

Myocardial infarction (MI) is the most frequent manifestation of coronary heart disease (CHD) and one of the leading causes of death worldwide (Saeed et al., 2011; Wang et al., 2014a). The life-threatening nature of the disease, the need for long-term lifestyle changes and medical regimens after MI (Boersma et al., 2006) often result in reduced health-related quality of life (HRQoL) among patients (Kang et al., 2016; Wang et al., 2014b). Relevant literature indicates that once HRQoL decreases post-MI, patients rarely recover to the level preceding to MI (Wang et al., 2014) or to the standard of the general population (Sakai et al., 2011).

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Health-related quality of life (HRQoL) is a multidimensional concept that examines the physical, emotional, and social impacts of a disease/illness on the patients' life (Sertoz et al., 2013). One of the most popular patient-reported outcomes, quality of life (QoL) is used as a means of assessing the overall well-being of patients in the recovery stage of MI (Lidell et al., 2014; Wang et al., 2014b). In particular, HRQoL provides a patient-centred assessment of one's health condition (Norris et al., 2007), which in turn, can be used to evaluate an individual patient's experience and to predict the reoccurrence of cardiac events, rehospitalisation, and mortality (Rumsfeld et al., 2013). Thus, the American Heart Association recommends that the assessment of HRQoL needs to be included as one of the routine evaluations of health status among patients with cardiovascular disease (Rumsfeld et al., 2013).

By the increasing emphasis on HRQoL in patients with CHD, in particular MI (Rumsfeld et al., 2013), it is necessary to explore factors that affect HRQoL in this population. Knowledge about these factors may help identify patients who are likely to experience poor HRQoL at the time of hospital admission and during recovery and hence, provide a window of opportunity to eventually improve clinical outcomes associated with MI (Hawkes et al., 2013).

To the best of our knowledge, there are no reviews integrating correlates of HRQoL in patients with MI. This study was designed to collect, review and critically synthesise the results of research on factors affecting HRQoL in patients with MI.

2. Methods

A comprehensive electronic search was performed using CINAHL, MEDLINE and PsychINFO databases. In consultation with a medical librarian, we identified relevant MeSH terms and used them for searching the literature: health-related quality of life/quality of life/HRQoL/QoL, myocardial infarction/heart attack/MI and predict*/factor. Only peer-reviewed studies published in English were searched. To ensure relevancy of the studies, articles were restricted to those published in the last 20 years, from 1995 to July 2016. This was because the management of MI and assessment of HRQoL has drastically improved over the past two decades.

2.1. Study selection

A total of 640 articles were identified from the database searches. Ninety articles were removed as duplicates. The title and abstract of the remaining 550 articles were reviewed. Articles were included: 1) if study subjects were patients with MI exclusively; 2) if a dependent variable was HRQoL; and 3) if a study examined factors or predictors of HRQoL. The exclusion criteria were irrelevant articles, scientific letters, or posters, studies of validation or reliability of measurements or qualitative studies. One author extracted articles according to the predetermined inclusion and exclusion criteria, and results were discussed with the other authors for accuracy of the extracted articles. The selection process led to inclusion of 48 articles for the review. One additional article was identified through manual searching of the reference lists of the included studies, increasing the number of the articles for full-text screening to 49. After excluding one irrelevant study of a medical intervention, the total number of the reviewed articles was 48 (Fig. 1).

2.2. Data extraction and quality assessment

A pre-developed table template (Table 1) was used for data extraction, and extracted data were examined, compared, discussed and agreed with the other authors. Data elements were extracted and narratively described variables synthesised into four categories. Data of study characteristics were countries where the studies were conducted, study designs, sample size, mean age, MI diagnostic criteria, tools that assessed HRQoL, instruments examined variables, follow-up periods and factors that affected HRQoL in patients with MI.

Fig. 1. The process of article selection.

The quality of all included articles were evaluated and rated using the Quality Assessment Tool for Quantitative Studies of the Effective Public Health Practice Project (EPHPP) (National Collaborating Centre for Methods and Tools, 2008). This tool comprises six criteria—selection bias, study design, confounders, blinding, data collection method, and withdrawals and dropouts. Each section rates 'strong (1)', 'moderate (2)' and 'weak (3)'. Then, the global rating for the paper and the final decision of the reviewers can be determined as 'strong (1)', 'moderate (2)' and 'weak (3)' (National Collaborating Centre for Methods and Tools, 2008). The final scores of the articles included in the current review are presented in Table 1.

3. Results

The studies were conducted mostly in European countries (n = 33; 6 studies each in Sweden and the UK, 4 in the Netherlands, 3 in Poland, 2 in Norway, and 1 study each in France and Hungary) including one multinational study that included data from 18 European countries. In addition, there were 10 studies undertaken in the USA, 3 studies conducted in Canada, and one international study involving the USA and Spain. Of the 48 studies, 28 studies used cohort, longitudinal, prospective designs, or a combination of them, whereas 10 studies applied a cross-sectional design. Two studies did not report the study design explicitly; however, these studies were prospective in nature in that the participants of these two studies were followed for three months (Mayou et al., 2000; Williams et al., 2012) or up to a year (Mayou et al., 2000). Among the ten cross-sectional studies, the time since MI was not reported in two studies, whereas the other studies

Table 1
Summary of the study characteristics.

1st Author (year) /Country	Study design Study sites	Sample N (male%) Mean age (SD) MI diagnostic criteria	HRQoL Assessment	Variables examined (Instruments)	Follow-up period	Key findings	EPHPP score
Alsen et al. (2013) /Sweden	Longitudinal A single centre	N = 155 (72.3%) 67.0 (9.0) Acute MI	SF-36	Fatigue (MFI-20)	2 years	The physical and mental dimensions of HRQoL two years after MI was predicted by experienced general fatigue at four months ($p < 0.01$).	3
Arnold et al. (2014) /USA	Prospective cohort Multi-centre	N = 2693 (67.0%) 59.9 (11.9) Biomarker evidence of myocardial necrosis and prolonged ischaemic signs/symptoms or electrocardiographic changes during the initial 24 h of admission	SF-12, SAQ	Age, sex, race, depression (PHQ-9), financial difficulties, current smoking, Stress (PSS), angina	1 year	Older patients reported higher SAQ HRQoL scores one year after acute MI than younger patients (< 50 years) ($p < 0.001$). Patients with depressive symptoms, financial difficulties, female sex, current smoking ($p < 0.001$ respectively), elevated chronic stress levels ($p = 0.001$), more angina before their MI ($p = 0.004$), and non-white race ($p = 0.017$) reported lower follow-up HRQoL.	1
Baas (2004) /USA	Ex post facto and correlational Multi-centre	N = 84 (69.0%) 61.0 (11.0) Not reported	The Index of Well-Being	Self-care resources (SCRI-Availability), self-care knowledge (SCRI-Needs), activity level (HAP)	3 to 6 months	The relationship between HRQoL and self-reported activity level was significant ($r = 0.24$). Self-care knowledge and resources had a low relationship with HRQoL.	3
Beck et al. (2001) /Canada	Prospective cohort Multi-centre	N = 554 (28.7%) 60.9 (12.0) Acute MI (Q or non-Q wave)	SF-36, EuroQol	Depression (BDI), age, in-hospital complications	6 months and 1 year	Older age and higher levels of depression predicting worse QoL. Shock in-hospital predicted improved physical QoL, at both six months and one year.	1
Bengtsson et al. (2001) /Sweden	Comparative A single centre	N = 60 (80.0%) 58.0 (7.4) No previous history of MI and either 1) ECG with a pathological Q-wave in two parallel leads or 2) typical symptoms and a biochemical marker or 3) suspect ECG changes and a biochemical marker.	SF-36, Cardiac Health Profile	Age, angina (CCS score)	6 months	Patients below the age of 59 years improved in physical HRQoL ($p = 0.002$) only, whereas patients over 59 years improved significantly in both the physical ($p = 0.030$) and the mental HRQoL ($p = 0.006$). Higher symptom scores predicted low physical HRQoL ($p < 0.001$).	3
Benyamini et al. (2013) /Israel	Longitudinal, prospective cohort Multi-centre	N = 540 (86.0%) 52.1 (8.4) First acute MI	SF-36	Depression (BDI), anxiety (the State Subscale of STAI), MI severity (infarct location and Killip class)	10 years	Depression ($p < 0.05$) and anxiety ($p = 0.05$) were directly related to poorer QoL 10 years later. Their QoL was found to be unrelated to the severity of the initial MI.	1
Boersma et al. (2006) /Netherlands	Longitudinal A single centre	N = 46 (89.1%) 56.4 (8.2) Not reported	MacNew	Goal self-efficacy(a three-item questionnaire)	4 months	Greater self-efficacy was significantly related to the both physical and social HRQoL ($p < 0.05$).	3
Boersma et al. (2005) /Netherlands	Longitudinal Two centres	N = 113 (74.3%) 54.1 (10.3) Not reported	MacNew	Presence of anginal complaints (a self-report NYHA measure), social support (MSQ-H)	4 months	Significant predictors of a low HRQoL scores were presence of anginal complaints ($p = 0.05$), low perceived adequacy of social support ($p < 0.01$).	3
Brink et al. (2012) /Sweden	Longitudinal follow-up Two centres	N = 145 (70.3%) 64.4 (9.4) Not reported	SF-36	General Self-efficacy (GSE)	2 years	General self-efficacy measured four months after MI was positively related to HRQoL after two years (physical: $p < 0.05$, mental: $p < 0.01$).	3
Brink et al. (2005) /Sweden	Longitudinal A single centre	N = 98 (66.3%) Women = 71.4 (8.7)	SF-36	Depression (HAD), fatigue (SHC)	1 year	Depression at one week after an acute MI predicted women's physical HRQoL.	3

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Table 1 (*continued*)

1st Author (year) /Country	Study design Study sites	Sample N (male%) Mean age (SD) MI diagnostic criteria	HRQoL Assessment	Variables examined (Instruments)	Follow-up period	Key findings	EPHPP score
		Men = 64.6 (9.8) First-time acute MI				at one year ($p < 0.01$) and depression at five months were correlated with both physical and mental HRQoL ($p < 0.01$). Depression at five months and fatigue were predictors of men's physical HRQoL ($p < 0.01$) and depression at 1 week was a predictor of men's mental HRQoL 1 year after MI ($p < 0.01$).	
Brink et al. (2002) /Sweden	Longitudinal A single centre	N = 114 (67.5%) Women = 72.2 (8.6) Men = 65.4 (10.1) First-time acute MI	SF-36	Depression (HADS), health complaints, coping strategies (GCQ)	5 months	Depression ($p < 0.01$) and the coping strategy ($p < 0.05$) were found to be negatively and significantly associated with physical HRQoL, and the coping strategy ($p < 0.01$) as well as the variable health complaints ($p < 0.001$) with mental HRQoL.	2
Bucholz et al. (2011) /USA	Prospective Multi-centre	N = 2264 (68.1%) Living alone = 62.7 (13.5) Not living alone = 59.3 (12.3) AMI confirmed by cardiac enzymes, and prolonged ischaemia or electrocardiographic ST-segment elevation changes.	SF-12, SAQ	Living alone	1 year	Living alone appears to be associated with poorer QoL at 1 year after MI ($p < 0.001$).	3
Bucholz et al. (2014) /USA, Spain	Prospective, observational Multi-centre	N = 3432 (32.9%) 48.0 Acute MI was confirmed by the presence of elevated cardiac enzymes (troponin or creatine kinase) and supporting evidence of myocardial ischaemia, including at least one of the following: symptoms of ischaemia; ECG changes suggestive of new ischaemia; or other evidence of myocardial necrosis on imaging.	SF-12, SAQ	Perceived social support (ESSI)	1 year	Patients with low social support continued to have lower QoL at 12 months ($P < 0.01$).	3
Coyne et al. (2000) /USA	Cohort Multi-centre	N = 1848 (79.0%) 59.5 The Global Utilisation of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries (GUSTO)-recorded MI	Combination of DASI, MLHFQ, and SF-36	Infarct artery patency (TIMI flow grade), LVEF (left ventriculograms)	2 years	LVEF was significantly related to physical ($P = 0.021$) and social ($P = 0.014$) function, psychological well-being ($P = 0.042$), and perceived health status ($P = 0.024$). Infarct-related artery patency was not directly related to any HRQoL outcome.	3
De Jonge et al. (2006) /Netherlands	Longitudinal, prospective cohort Multi-centre	N = 421 (79.6%) 61.0 (11.4) Chest pain for at least 20 min, creatine kinase concentration 100% higher than normal or creatine kinase MB fraction greater than 10%; or the presence of new pathological Q wave on the ECG in at least two leads.	RAND 36	Depression (CIDI-Auto)	1 year	Patients with post-MI depression had a significantly poorer HRQoL at 12 months after the MI than patients without a post-MI depression ($p < 0.001$).	2
Dickens et al. (2006) /UK	Prospective cohort Multi-centre	N = 314 (63.0%) 57.6 (11.2) First MI	SF-36 PCS	Depression and anxiety (HADS)	6 and 12 months	Depression and anxiety at 6 months continued to contribute significantly to physical HRQoL at 12 months	2

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Table 1 (*continued*)

1st Author (year) /Country	Study design Study sites	Sample N (male%) Mean age (SD) MI diagnostic criteria	HRQoL Assessment	Variables examined (Instruments)	Follow-up period	Key findings	EPHPP score
						($p < 0.0005$). Depression and anxiety right before the first MI did not predict the physical HRQoL 12 months later.	
Doerfler et al. (2005) /USA	Cross-sectional A single centre	N = 52 (69.2%) 57.7 (12.0) History consistent with ischaemic symptoms and electrocardiogram changes with ST elevation or depression of at least 1 mm in 2 contiguous leads with positive cardiac enzymes.	MOS-20	PTSD (PSS, IES)	3 to 6 months	Higher depression scores were associated with poorer QoL ($p < 0.05$).	3
Ecochard et al. (2001) /France	Prospective Multi-centre	N = 671 (84.5%) Women = 63.6 (13.4) Men = 57.9 (11.2) Acute MI	NHP	Myocardial dysfunction and coronary stenosis (Maximal Killip class)	1 year	Impaired QoL was not associated with the initial Killip class.	3
French et al. (2005) /UK	Prospective A single centre	N = 194 (73.2%) 63.3 (10.6) Acute MI	QLMI	Illness perception (IPQ), Anxiety and depression (HADS), gender, smoking status, rehabilitation attendance, living alone, previous MI, employment status	6 months	For emotional HRQoL, anxiety and depression emerged as the only significant predictors. For both physical and social HRQoL, depression emerged as the only significant predictor. For all three HRQoL scales, illness perception was related to emotional ($p = 0.05$), physical ($p = 0.051$), and social HRQoL ($p = 0.044$). Of the categorical variables, only employment status was related to any HRQoL scale ($p = 0.002$).	3
Ginzburg et al. (2011) /Israel	Prospective Multi-centre	N = 173 (84.0%) Recovered/resilient group = 54.0 (8.2) Chronic group = 54.7 (9.6) Typical clinical symptomatology, electrocardiographic evidence of MI and typically elevated serum levels of myocardial enzymes	SF-36	Acute stress disorder (SASRQ), PTSD (PTSD Inventory)	8 years	HRQoL at 8 years was inversely correlated with the severity of acute stress during their hospitalization ($p < 0.01$), PTSD approximately 7 months after their admission ($p < 0.001$), and PTSD approximately 8 years after their MI ($p < 0.001$).	3
Hawkes et al. (2013) /Australia	Randomised controlled trial Two centres	N = 294 (79.0%) 60.5 (10.7) Newly diagnosed MI	SF-36	Age, alcohol intake, health behaviours (the Active Australia Survey, a 5-item measure of physical activity intention), self-efficacy (a 10-point scale), smoking, depression and anxiety (HADS), social support (ESSI)	6 months	Older age ($p < 0.001$), lower confidence levels ($p < 0.001$), no intention to be physically active ($p < 0.001$), and greater sedentary behaviour ($p = 0.001$) were strong independent predictors of lower physical HRQoL. Younger age ($p = 0.01$), depression ($p < 0.001$), lower social support ($p = 0.001$) and greater sedentary behaviour ($p = 0.01$) were predictors of lower mental HRQoL.	1
Ho et al. (2008) /USA	Prospective cohort Multi-centre	N = 2498 (67.0%) 60.9 (13.0) Biomarker evidence of myocardial necrosis and clinical evidence of an acute MI during the initial 24 h of admission, prolonged	SAQ	Age	12 months	Increasing age was associated with better HRQoL at 12 months ($p < 0.0001$).	3

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Table 1 *(continued)*

1st Author (year) /Country	Study design Study sites	Sample N (male%) Mean age (SD) MI diagnostic criteria	HRQoL Assessment	Variables examined (Instruments)	Follow-up period	Key findings	EPHPP score
		(> 20 min) ischaemic signs/ symptoms or electrocardiographic ST changes.					
Hosseini et al. (2014) /Iran	Prospective cohort Two centres	N = 196 (74.0%) 55.8 (11.1) Acute non-fatal MI, MI from the results of coronary bypass graft surgery or angiography was excluded	SF-12	Depression (BDI), Anxiety (STAI)	5 years	The association of depression and poor QoL survived in the model (p < 0.0001). Only a trend of lower physical HRQoL score with anxiety was observed (p = 0.004).	3
Joekes et al. (2007) /Netherlands	Longitudinal dyadic Two centres	N = 73 MI patients (86.0%) and their partners Male = 54.7 (9.8) Female = 55.3 (8.8) Not reported	MacNew	Overprotection and active engagement (subscales from a questionnaire measuring support styles), chest pain, illness duration	3 and 9 months	When partners had been more overprotective, patients reported worsening physical HRQoL 9 months later (p < 0.05). More active engagement perceived by the patient significantly predicted enhanced emotional, social and global HRQoL (p < 0.05). Illness duration was associated with reduced social HRQoL (p = 0.006). Patients who experienced chest pain reported lower emotional, physical, social and global HRQoL (p = 0.000).	3
Kim et al. (2015) /S. Korea	Descriptive correlational A single centre	N = 105 (79.0%) 65.0 (10.9) LVEF at less than 50%	MLHFQ	Gender, monthly income, NYHA class and symptoms (Friedman-Heart Failure Symptom Checklist)	12 months and over after the initial cardiac event	Patients who were female, with low income, and had greater functional limitation and more symptoms had worse HRQoL (p < 0.001).	3
Kristofferzon et al. (2005a,b) /Sweden	Cross-sectional and descriptive-comparative A single centre	N = 171 (56.7%) Women = 76.8 (11.6) Men = 71.3 (12.1) Not reported	SF-36, QLI-C	Gender	1 month	Women reported significantly lower HRQoL than men in both the physical (p = 0.01) and mental (p = 0.007) components of the SF-36 and the QLI (p = 0.04).	3
Lane et al. (2001) /UK	Cohort Two centres	N = 257 (75.0%) 61.6 (11.4) Typical ischaemic chest pain lasting at least 20 min, presence of new pathological Q waves on the electrocardiogram, a peak creatinine phosphokinase level > 1.5 times the normal limit, or a CK-MB (myocardial isoenzyme of creatinine phosphokinase) value ≥25 IU/l or > 5% of a simultaneous creatinine phosphokinase value exceeding the normal limit.	COOP chart system	Depression (BDI), anxiety (STAI), Living alone, severity of infarction (Peel Index score)	12 months	Symptoms of depression (p = 0.001) and anxiety (p = 0.008) predicted 12-month QoL among survivors, as did living alone (p = 0.001), and indices of disease severity (p = 0.001).	2
Lane et al. (2000) /UK	Cohort Two centres	N = 263 (75.3%) 61.9 (11.4) Typical ischaemic chest pain lasting at least 20 min; presence of new pathological Q-waves on the electrocardiogram; a peak creatinine phosphokinase level greater than 1.5 × the normal limit, or a CK-MB (the myocardial	Dartmouth COOP charts	Depression (BDI), anxiety (STAI), severity of infarction (Peel Index score), previous exercise behaviour, demographic characteristics (gender, partner status, living alone, and employment status)	4 months	Baseline depression score (p = 0.001), anxiety (p = 0.001), and previous exercise behaviour (p = 0.003) correlated significantly with QoL. QoL was also positively associated with being male, having a partner, not living alone, and being employed (p < 0.05). The higher the Peel Index score, the poorer the QoL (p = 0.001).	1

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Table 1 *(continued)*

1st Author (year) /Country	Study design Study sites	Sample N (male%) Mean age (SD) MI diagnostic criteria	HRQoL Assessment	Variables examined (Instruments)	Follow-up period	Key findings	EPHPP score
		isoenzyme of CK) value ≥25 IU/l or > 5% of a simultaneous CK value exceeding the normal limit.					
Leifheit-Limson et al. (2012) /USA	Prospective Multi-centre	N = 1951 (67.0%) 60.9 (13.0) Acute MI with increased troponin or creatine kinase-MB levels and (> 20 min of ischaemic symptoms or electrocardiographic ST changes.	SF-12, SAQ (QoL subscale)	Social support (ESSI)	1, 6, and 12 months	Patients with persistently high support experienced higher disease-specific QoL ($p < 0.001$) and general physical ($p < 0.001$ at 1 month, $p = 0.049$ at 6 months, and $p = 0.006$ at 12 months) and mental functioning ($p < 0.001$) across time points.	3
Lidell et al. (2014) /18 European countries	International cross-sectional Multi-centre	N = 452 (0.0%) 61.0 (11.8) Not reported	MacNew	Socio-demographic factors (marital status, BMI, managerial responsibility)	6 months	In the Northern Europe region, physical HRQoL was predicted by marital status ($p < 0.02$), and social HRQoL by managerial responsibility ($p < 0.01$) in the Eastern Europe region including Hungary, Poland, Russia, and Ukraine. Emotional HRQoL was predicted by marital status ($p = 0.02$), and physical HRQoL by BMI ($p = 0.02$) in the older age group.	3
Mayou et al. (2000) /UK	Not reported Two centres	N = 344 (73.0%) 63.2 Daily screening of biochemistry records for requests for cardiac enzyme and electrocardiographic tests	SF-36	Depression and anxiety (HADS)	3 and 12 months	Patients who had been distressed at baseline had a significantly worse outcome at both 3 months and 1 year on all dimensions of the SF-36 than non-distressed patients ($p < 0.05$).	2
McBurney et al. (2002) /USA	Cross-sectional A single centre	N = 200 (68.0%) 63.4 (13.1) Acute MI (International Classification of Diseases-9 code 410)	SF-12	Patient and disease characteristics (age, personal history, comorbidities, and rehospitalisation)	7 months	History of chronic heart failure ($p = 0.02$) and transient ischaemic attack ($p = 0.04$), the total number of other illnesses ($p = 0.001$), and rehospitalisation due to heart disease ($p < 0.001$) were related to lower physical HRQoL. Age ($p = 0.006$) was related to lower mental HRQoL.	3
Norekval et al. (2010) /Norway	Survey A single centre	N = 145 (0.0%) 72.0 International Classification of Diseases-9 code 410	WHOQOL-BREF	Sense of coherence (SOC-29)	6 months	There was a significant difference between all sense of coherence groups on overall QoL ($p < 0.001$). The significant positive relationships between SOC and all QoL domains at three months to five years after MI remained stable at a follow-up after six months ($p < 0.001$).	3
Norris et al. (2007) /Canada	Prospective cohort Multi-centre	N = 486 (79.0%) Women = 66.0 Men = 59.0 Q or non-Q wave acute MI	SF-36	Gender	1 year	Significant gender differences were found for worse HRQoL among women at both baseline and 1-year post-acute MI compared to men ($p < 0.05$).	2
Oginska-Bulik (2014) /Poland	Cross-sectional Two centres	N = 86 (72.1%) 60.5 (10.1) Not reported	Life Satisfaction Questionnaire	Personality type (DS-14 scale), age, gender	The mean time since MI was 2.81 ± 2.62 years	Subjects with D type of personality showed lower QoL compared to non-type D subjects ($p < 0.05$). Gender was also not related to HRQoL. Those younger than 58 years showed a slightly higher HRQoL compared to those older than 58 years ($p < 0.05$).	3
Oldridge et al.	Randomised	N = 201 (89.0%)	QLMI, Quality of	Baseline cardiovascular risk	8-week and 12-month follow-ups	More improvement in HRQoL was	3

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Table 1 *(continued)*

1st Author (year) /Country	Study design Study sites	Sample N (male%) Mean age (SD) MI diagnostic criteria	HRQoL Assessment	Variables examined (Instruments)	Follow-up period	Key findings	EPHPP score
(1998) /Canada	controlled trial Multi-centre	53.2 (9.0) Acute MI	Well-Being Scale, Time Trade-off			associated with the absence of a previous MI, absence of angina, less smoking, and higher exercise tolerance as well as the absence of shortness of breath at 8 weeks ($p < 0.05$) and 12 months ($p < 0.04$).	
Pettersen et al. (2008) /Norway	Cohort Multi-centre	N = 408 (71.0%) 66.0 (12.0) Acute MI, defined as codes121 and I22 in the International Statistical Classification of Diseases and Related Health Problems, tenth revision	SF-36	Socio-demographic factors, medical records	2.5 (SD 0.2) years	Age, time since the index MI, COPD, previous MI, and stroke predicted physical HRQoL in women ($p < 0.02$). Education, COPD, infarct localisation, and subsequent MI predicted physical HRQoL in men ($p < 0.02$). Smoking status, education, and Q-wave MI were determinants for mental HRQoL in men ($p < 0.02$).	3
Rafael et al. (2014) /Hungary	Descriptive correlational and cross-sectional survey A single centre	N = 97 (69.1) 56.1 (10.1) The basis of the electrocardiogram and subsequent enzyme rise	WHO Well-Being Scale	Depression (BDI), anxiety (STAI-T), vital exhaustion (MQ), sleep disturbance (AIS)	8.5 days after MI on average (3–14 days)	Vital exhaustion ($p < 0.0001$) and anxiety ($p < 0.05$) were found to have a significant correlation with subjective QoL.	3
Rankin et al. (2003) /USA	Repeated measure descriptive Multi-centre	N = 30 (0.0%) 65.0 (12.8) Not reported	SF-36, QLI-C	Social support (PSP), psychological distress (POMS), cardiac functional status (DASI)	1 year	Social support ($p = 0.014$) and mood states ($p = 0.034$) were the only predictors of QoL for women. Cardiac functional status did not explain a significant proportion of the variance.	3
Saeed et al. (2011) /Pakistan	Cross-sectional A single centre	N = 80 (61.0%) Age group (years) 45–50 = 14.0% 50–55 = 47.0% 56–60 = 39.0% The first MI by a consultant cardiologist, excluding silent MI	WHOQOL-BREF	Type D personality (DS-14)	Not reported	Higher scores on type-D personality had a negative impact on QoL in MI patients ($p < 0.001$).	3
Sakai et al. (2011) /Japan	Prospective cohort Multi-centre	N = 215 (100.0%) No post-discharge depressive symptoms = 62.0 (10.0) Post-discharge depressive symptoms = 59.0 (11.0) Ischaemic chest discomfort lasting at least 30 min; electrocardiographic changes, such as elevation of ST segment, abnormal Q-wave, and inverted T-wave; and elevated serum creatine phosphokinase that was more than twice the normal upper limit.	SF-36	Post-discharge depressive symptoms (MHI-5)	6 months post-discharge	The presence of depressive symptoms at 1 month after discharge adversely affected the recovery of HRQoL at 6 months ($p < 0.05$).	1
Sertoz et al. (2013) /Turkey	Cross-sectional Multi-centre	N = 998 (79.2%) 57.4 (10.1) Chest pain or shortness of breath, ST segment elevation, loss of R waves, and/or new pathological Q waves, elevation of creatinine phosphokinase-MB exceeding the normal limit or elevation of	WHOQOL-BREF	Depression (BDI), comorbid medical conditions, age	Not reported	Both depression and comorbid medical conditions were found to have a negative impact on QoL of post-MI patients ($p < 0.03$). Increasing age had a negative effect on both the physical ($p < 0.01$) and social ($p < 0.0001$) domains of QoL.	3

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Table 1 *(continued)*

1st Author (year) /Country	Study design Study sites	Sample N (male%) Mean age (SD) MI diagnostic criteria	HRQoL Assessment	Variables examined (Instruments)	Follow-up period	Key findings	EPHPP score
		creatinine phosphokinase, serum troponin T or I to > 2 times normal					
Uchmanowicz et al. (2013) /Poland	Prospective A single centre	N = 120 (63.0%) 62.5 (9.8) a positive troponin blood test and electrocardiographic changes (ST-segment elevation, ST-segment depression, or T-wave inversion)	SF-36	Diabetes, demographic and clinical variables	6 months	The influence of diabetes, multi-vessel disease, hypertension, and the high triglyceride level have negative impact on life quality evaluation ($p < 0.05$).	3
Wang et al. (2014a) /Singapore	Cross-sectional correlational A single centre	N = 128 (89.8%) 55.4 (9.5) At least two of the following three conditions, including typical ischaemia chest pain, elevated cardiac enzyme levels in the serum, usually creatine kinase-myocardial band, and typical ECG changes of the pathological Q-wave that are consistent with ischaemia	SF-12v2, MIDAS	Depression and anxiety (HADS), monthly household income, ex-smoker, alcohol user, hypertension	The length of diagnosis of MI ranged from 15 days to 30 months.	Monthly household income ($p = 0.002$) was identified as a predictor of physical HRQoL. For mental HRQoL, four predictors were identified—hypertension ($p = 0.017$), ex-smoker ($p = 0.034$), alcohol user ($p = 0.007$), and anxiety ($p < 0.001$). For overall HRQoL, anxiety ($p = 0.030$), and depression ($p = 0.004$) were significant predictors.	3
Wang et al. (2014b) /China	Cross-sectional Two centres	N = 192 (76.6%) 59.8 (12.1) At least two of the following three criteria: typical ischaemic chest pain, elevated cardiac enzyme levels in the serum, usually creatine kinase-MB, and typical ECG changes consistent with ischaemia	SF-36, MIDAS	Depression and anxiety (HADS), socio-demographic and clinical variables (smoking status, hypertension, heart failure)	1 and 4 weeks (mean of 13 days) after the MI.	Six predictors were identified for poor physical HRQoL: increasing age, smoking status, heart failure, hypertension, anxiety, and depression ($p < 0.05$). Heart failure, anxiety, and depression were identified for poor mental HRQoL ($p < 0.05$). Four predictors were identified: age, heart failure, anxiety, and depression for overall HRQoL ($p < 0.05$).	3
White et al. (2007) /USA	Descriptive Multi-centre	N = 27 (0.0%) 60.7 (15.4) Not reported	SF-36	Depression (BDI)	Surveys were completed an average of 11 months after MI (SD = 9.88 months)	Depression had a significant negative correlation with mental HRQoL ($p = 0.0005$), but not correlated with physical HRQoL ($p = 0.360$).	3
Williams et al. (2012) /UK	Not reported A single centre	N = 192 (71.9%) 66.0 (10.8) Not reported	MacNew	Type D personality (DS14)	3 months	Type D was significantly associated with poor QoL in MI patients ($p < 0.001$).	3
Wrzesniewski et al. (2012) /Poland	Prospective A single centre	N = 83 (59.0%) 50.2 (6.2) First uncomplicated MI	MacNew	Sense of coherence (SOC-13), level of education	1 year	Sense of coherence is a good predictor of HRQoL one year after MI both in men ($p < 0.05$) and in women ($p < 0.01$). Significant HRQoL predictors in the physical dimension included level of education ($p = 0.03$).	3

AIS = Athens Insomnia Scale; BDI = Beck Depression Inventory; BMI = Body Mass Index; BMS = Bare-Metal Stents; CCS = Canadian Cardiovascular Society; CIDI-Auto = Composite International Agnostic Interview; COPD = Chronic Obstructive Pulmonary Disease; CVA = Cerebro Vascular Accident; DASI = Duke Activity Status Index; DES = Drug-Eluting Stents; DS-14 = the 14-item type D Scale; EF = Ejection Fraction; EPHPP = Effective Public Health Practice Project (1 = strong, 2 = moderate, 3 = weak); ESSI = ENRICHD Social Support Instrument; GCQ = General Coping Questionnaire; GSE = General Self-Efficacy; HADS = Hospital Anxiety and Depression Scale; HAP = Human Activity Profile; HCS = Health Complaints Scale; HRQoL = Health-Related Quality of Life; IES = Impact of Events Scale; IPQ = Illness Perception Questionnaire; LVEF = Left Ventricular Ejection Fraction; MacNew = the MacNew Heart Disease Health-Related Quality of Life Questionnaire; MFI-20 = Multidimensional Fatigue Inventory; MHI-5 = Mental Health Inventory; MI = Myocardial Infarction; MIDAS = Myocardial Infarction Dimensional Assessment Scale; MLHFQ = Minnesota Living with Heart Failure Questionnaire; MOS-20 = Medical Outcomes Study 20-item short-form General Health Survey; MQ = Shortened Maastricht Vital Exhaustion Questionnaire; MSQ-H = Multidimensional Support Questionnaire for Heart Patients; NHP = Nottingham Health Profile; NYHA = New York Heart Association; PCI = Percutaneous Coronary Intervention; POMS = Profile of Mood States; PSP = Preferred Support Profile; PSS = PTSD Symptom Scale; PTSD = Post Traumatic Stress Disorder; QLI-C = Quality of Life Index-Cardiac Version; QLMI = Quality of Life after MI questionnaire; QoL = Quality of Life; SAQ = Seattle Angina Questionnaire; SASRQ = Stanford Acute Stress Reaction Questionnaire; SCRI = Self-care Resource Inventory; SD = Standard Deviation; SF-12 = Short Form-12; SF-36 = the 36-item Short Form Health Survey; SHC = Somatic Health Complaints; SOC = Sense of Coherence Scale; STAI = Spielberger State-Trait Anxiety Inventory; TIMI = Thrombolysis In Myocardial Infarction; WHOQOL-BREF = World Health Organization Quality of Life Instrument Abbreviated.

Table 2
Summary of factors that affect HRQoL of patients with MI.

Demographic factors	
Age	Arnold et al. (2014); Beck et al. (2001); Bengtsson et al. (2001); Hawkes et al. (2013); Ho et al. (2008); McBurney et al. (2002); Oginska-Bulik (2014); Sertoz et al. (2013); Wang et al. (2014a,b).
Education level	Pettersen et al. (2008); Wrzesniewski and Wlodarczyk (2012).
Employment status	French et al. (2005); Lane et al. (2000).
Financial status	Arnold et al. (2014); Kim et al. (2015); Wang et al. (2014a).
Gender	Arnold et al. (2014); French et al. (2005); Kim et al. (2015); Kristofferzon et al. (2005a,b); Lane et al. (2001); Lane et al. (2000); Norris et al. (2007); Oginska-Bulik (2014); Pettersen et al. (2008); Uchmanowicz et al. (2013); Wang et al. (2014b).
Living alone	Bucholz et al. (2011); French et al. (2005); Lane et al. (2001); Lane et al. (2000).
/marital status.	Lane et al. (2000); Lidell et al. (2014).
Managerial responsibility	Lidell et al. (2014).
Race	Arnold et al. (2014)
Behavioural factors	
Physical activity	Baas (2004); Hawkes et al. (2013); Lane et al. (2000); Oldridge et al. (1998)
Alcohol	Hawkes et al. (2013); Wang et al. (2014a)
Smoking	Arnold et al. (2014); French et al. (2005); Hawkes et al. (2013); Oldridge et al. (1998); Pettersen et al. (2008); Wang et al. (2014a); Wang et al. (2014b)
BMI	Lidell et al. (2014)
Disease-related factors	
Severity of MI	Benyamini et al. (2013); Coyne et al. (2000); Ecochard et al. (2001); Kim et al. (2015); Lane et al. (2001); Lane et al. (2000); Pettersen et al. (2008); Rankin and Fukuoka (2003); Uchmanowicz et al. (2013)
Symptoms	
Health complaints	Brink et al. (2002)
Chest pain	Joekes et al. (2007)
Shortness of breath	Oldridge et al. (1998)
Symptoms	Kim et al. (2015)
Angina	Arnold et al. (2014); Bengtsson et al. (2001); Boersma et al. (2005); Oldridge et al. (1998)
Fatigue	Alsén and Brink (2013); Brink et al. (2005)
Vital exhaustion	Rafael et al. (2014)
Sleep disturbance	Rafael et al. (2014)
Illness duration	Joekes et al. (2007)
In-hospital complications	Beck et al. (2001)
Previous MI	French et al. (2005); Oldridge et al. (1998); Pettersen et al. (2008)
Comorbidities	Joekes et al.(2007); McBurney et al. (2002); Pettersen et al. (2008); Sertoz et al. (2013); Uchmanowicz et al. (2013); Wang et al. (2014a); Wang et al. (2014b)
Psychosocial factors	
Anxiety	Benyamini et al. (2013); Dickens et al. (2006); French et al. (2005); Hawkes et al. (2013); Hosseini et al. (2014); Lane et al. (2001); Lane et al. (2000); Mayou et al. (2000); Rafael et al. (2014); Wang et al., (2014a); Wang et al. (2014b)
Depression	Arnold et al. (2014); Beck et al. (2001); Benyamini et al. (2013); Brink et al. (2005); Brink et al. (2002); de Jonge et al. (2006); Dickens et al. (2006); French et al. (2005); Hawkes et al. (2013); Hosseini et al. (2014); Lane et al. (2001); Lane et al. (2000); Mayou et al. (2000); Rafael et al. (2014); Sakai et al. (2011); Sertoz et al. (2013); Wang et al. (2014a); Wang et al. (2014b); White and Groh (2007)
Psychologic distress	Rankin & Fukuoka (2003)
Stress	Arnold et al. (2014); Doerfler et al. (2005); Ginzburg and Ein-Dor (2011)
Illness perception	French et al. (2005)
Coping strategies	Brink et al. (2002)
Overprotection /active engagement	Joekes et al. (2007)
Self-care	Baas (2004)
Self-efficacy	Boersma et al. (2006); Brink et al. (2012); Hawkes et al. (2013)
Sense of coherence	Norekvål et al. (2010); Wrzesniewski and Wlodarczyk (2012)
Social support	(Boersma et al. (2005); Bucholz et al. (2014); Hawkes et al. (2013); Leifheit-Limson et al. (2012); Rankin and Fukuoka (2003)
Type D personality	Oginska-Bulik (2014); Saeed et al. (2011); Williams et al. (2012)

reported the time since an MI event. Apart from the cross-sectional studies, the follow-up period of 31 studies was less than 12 months, ranging from one month to one year; seven studies followed up with the study participants for longer than a year, including one with a follow-up period of 10 years. The sample size of the included studies varied from 27 to 3,432 participants, whose age ranged from 21 to 98 years of age. Four studies exclusively examined female patients, while one study included male patients only. Excluding these five studies, the proportion of male participants in the remaining 43 studies was 60% or more.

Correlates of HRQoL were studied in the following four main categories: demographic, behavioural, disease-related and psychosocial factors. As such, the following section describes each category of factors affecting HRQOL of MI patients. Table 1 summarises characteristics of the studies included in the review (Table 2).

3.1. Demographic factors

Several demographic factors were closely associated with HRQoL in patients with MI. Those factors include: age, gender-identity, living alone or marital status, education level, employment status, managerial responsibility, race, and financial status. Specifically, older age, higher education, being employed, having more managerial responsibility, Caucasian, higher income or not having financial difficulties, being male, and not living alone or having a partner were associated with higher HRQoL than the comparators.

3.1.1. Age

Nine studies reported that age was closely associated with HRQoL in patients with MI (Arnold et al., 2014; Beck et al., 2001; Bengtsson et al., 2001; Hawkes et al., 2013; Ho et al., 2008; McBurney et al., 2002; Oginska-Bulik, 2014; Sertoz et al., 2013; Wang et al., 2014b). While the majority of studies revealed that older age was associated with better HRQoL in patients with MI (Arnold et al., 2014; Bengtsson et al., 2001; Ho et al., 2008; McBurney et al., 2002), there were two studies in which the finding was the opposite. For example, the studies conducted by Oginska-Bulik (2014) and Beck et al. (2001) found that older age predicted lower HRQoL (Beck et al., 2001; Oginska-Bulik, 2014), particularly in the physical domains at six-month and 12-month follow-ups (Beck et al., 2001). However, the results of three studies suggest that except for the physical dimension of the HRQoL, which was more adversely affected in older patients, younger patients with MI experienced poorer HRQoL life than older patients did (Hawkes et al., 2013; Sertoz et al., 2013; Wang et al., 2014b).

3.1.2. *Gender-identity*

Eleven studies examined the association between gender-identity and HRQoL (Arnold et al., 2014; French et al., 2005; Kim et al., 2015; Kristofferzon et al., 2005a,b; Lane et al., 2001, 2000; Norris et al., 2007; Oginska-Bulik, 2014; Pettersen et al., 2008; Uchmanowicz et al., 2013; Wang et al., 2014a,b). Except for three studies, all the other eight studies showed a consistent result, suggesting that women after MI report lower HRQoL than their male comparators. In Wang, Thompson et al.'s study (2014b), women, immediately after MI, reported lower HRQoL than men, particularly in physical-related subscales of the 36-item Short Form Health Survey (SF-36) and the Myocardial Infarction Dimensional Assessment Scale (MIDAS) (Wang et al., 2014b). Similarly, the short-term studies found that female patients showed significantly poorer HRQoL than male patients one month after MI, measured by the SF-36 and the Quality of Life Index-Cardiac Version (QLI-C) (Kristofferzon et al., 2005a,b),at four months, as measured by the Dartmouth COOP Charts (Lane et al., 2000), and at the six-month follow-up when HRQoL was measured using the SF-36 (Uchmanowicz et al., 2013). Likewise, following patients up to one year, female patients with MI showed poorer HRQoL than male patients, as measured by different instruments including the SF-36 of a moderate study (Norris et al., 2007), the Short Form-12 (SF-12), the Seattle Angina Questionnaire (SAQ) of a strong study (Arnold et al., 2014), the Minnesota Living with Heart Failure Questionnaire (MLHFQ) (Kim et al., 2015), and the COOP Chart System (Lane et al., 2001). However, two studies found no relation of gender-identity to the Quality of Life after MI questionnaire (QLMI) scores at six months after MI (French et al., 2005), and to the SF-36 scores at an average of 2.5 years since MI (Pettersen et al., 2008). Only did one study report that women even had a higher HRQoL than men, as scored by the Life Satisfaction Questionnaire, at the mean time of 2.81 years since MI (Oginska-Bulik, 2014).

3.1.3. *Living alone/marital status*

The effect of either living alone or marital status on HRQoL was examined in five studies reviewed in the current study (Bucholz et al., 2011; French et al., 2005; Lane et al., 2001, 2000; Lidell et al., 2014). Two studies, which used the COOP Chart System for measuring HRQoL in patients with MI, identified the positive association of HRQoL with having a partner or not living alone at four months (Lane et al., 2000) and 12 months (Lane et al., 2001). Consistently, a better HRQoL was observed in patients who did not live alone at one year after MI, as scored using the SF-12 and the SAQ (Bucholz et al., 2011). Moreover, marital status was a predictor of higher physical and emotional HRQoL in scores of the MacNew in a cohort of patients from European countries (Lidell et al., 2014). However, the QLMI scores of the British patients were not affected by their living status at six months (French et al., 2005).

3.1.4. *Other demographic factors*

Education level was one of the predictors of low physical HRQoL in men, as measured by the MacNew Heart Disease Health-Related Quality of Life Questionnaire (MacNew) at one year (Wrzesniewski and Wlodarczyk, 2012) and by the SF-36 at 2.5-year follow-ups (Pettersen et al., 2008). Both studies reported that men with lower education level had significantly poorer physical HRQoL after MI. Being employed was strongly related to improved HRQoL at four months using the Dartmouth COOP charts (Lane et al., 2000) and at the six-month follow-up measured by the QIMI (French et al., 2005). Additionally, there was only one study that identified that women from Eastern European countries including Hungary, Poland, Russia, and Ukraine had better HRQoL in the social dimension if they had managerial responsibilities (Lidell et al., 2014). Of the 48 studies reviewed, there was also only one study which found that non-Caucasian was associated with poor HRQoL one year after first MI (Arnold et al., 2014). The financial status of participants was one of the predictors of HRQoL in the three papers reviewed. The results of these studies consistently suggested that patients who had lower monthly income or financial difficulties reported lower HRQoL than patients who had higher income or no financial difficulties (Arnold et al., 2014; Kim et al., 2015; Wang et al., 2014a).

3.2. *Behavioural factors*

Some behavioural factors including physical activity, alcohol consumption, smoking, and body mass index (BMI) were significantly associated with HRQoL in patients after experiencing MI. In particular, patients who had a more active lifestyle, showed lower alcohol consumption, were non-smokers, and who had normal BMI presented higher HRQoL scores than their comparators.

Four studies examined the relationship between physical activity and HRQoL (Baas, 2004; Hawkes et al., 2013; Lane et al., 2000; Oldridge et al., 1998). Patients who were physically active right before MI showed better HRQoL at four months after MI (Lane et al., 2000). Also, patients who participated in physical activities after discharge from hospital and who had an more intention to be involved in physical activity reported significantly higher HRQoL at the six-month follow-ups (Baas, 2004; Hawkes et al., 2013). In addition, a higher exercise tolerance after the 8-week rehabilitation program also promised better HRQoL, as measured with the QLMI (Oldridge et al., 1998).

The association between alcohol use and HRQoL among patients with MI appears to be controversial. Alcohol users in Wang, Chow, et al.'s study (2014a) scored significantly lower in the mental dimension of the SF-12 than non-alcohol users, while another study did not find any associations between alcohol consumption and physical or mental dimensions of the SF-36 at six months after MI (Hawkes et al., 2013). Seven studies found that the smoking status of MI patients was associated with HRQoL (Arnold et al., 2014; French et al., 2005; Hawkes et al., 2013; Oldridge et al., 1998; Pettersen et al., 2008; Wang et al., 2014a,b). Patients who had a history of smoking (Wang et al., 2014a) or were smoking at the time of MI (Pettersen et al., 2008) scored low in the mental dimension of HRQOL. Patients who smoked at the time of MI also reported poorer physical functioning shortly after MI, as measured by the SF-36 immediately after MI (Wang et al., 2014), the SAQ (Arnold et al., 2014) and the QLMI (Oldridge et al., 1998) at one-year follow-up. Yet, two studies showed that smoking status had no relation with any dimensions of HRQoL, scored with the SF-36 (Hawkes et al., 2013) and the QLMI at six months (French et al., 2005). Only one study identified BMI as an indicator of low HRQoL in MI patients, particularly in the physical domain of the MacNew. This study recruited female patients aged over 65 years and examined the relationship between baseline BMI of MI patients and HRQoL at the six-month follow-up (Lidell et al., 2014).

3.3. *Disease-related factors*

Disease-related factors including severity of MI, symptoms, illness duration, in-hospital complications, previous MI, and comorbidities had a strong prediction to some aspects of HRQoL, measured using different instruments.

3.3.1. *Severity of MI*

The reviewed studies used several indicators to assess the severity of patient MI and examine the relationship between disease severity and HRQoL. These indicators included infarct location, left ventricular ejection fraction (LVEF), infarct-related artery patency, the Killip class, the Peel index scores, the New York Heart Association (NYHA) class, the Duke Activity Status Index (DASI), and Q-wave. Poor HRQoL was strongly associated with the higher Peel index score at four months (Lane et al., 2000) and 12 months from MI (Lane et al., 2001) as well as the higher NYHA class at longer than 12-month follow-ups (Kim et al., 2015). Baseline LVEF was also related with decreased HRQoL (Coyne et al., 2000; Kim et al., 2015) and Q-wave MI limitedly predicted the mental component of HRQoL in men at the 2.5-year follow-up (Pettersen et al., 2008). However, infarct-related artery patency (Coyne et al., 2000) or cardiac functional status measured using the DASI scores (Rankin and Fukuoka, 2003) was unrelated to HRQoL outcomes. The location of infarction and the Killip class showed mixed results. A strong study conducted by Benyamini et al. (2013) did not find any association between infarct location and the Killip class with MI patients' HRQoL at the 10-year follow-up (Benyamini et al., 2013). Likewise, Ecochard et al. (2001) claimed that HRQoL was not affected by the Killip class of MI patients one year after MI (Ecochard et al., 2001). While, in another study, the location of infarction could predict men's physical HRQoL measured by the SF-36 at 2.5 years from MI (Pettersen et al., 2008), and the worse Killip class indicated more impaired HRQoL of the Dartmouth COOP Charts 12 months after MI (Lane et al., 2001).

3.3.2. *Symptoms*

The reviewed studies consistently reported a negative association between angina symptoms and HRQoL scores (Arnold et al., 2014; Bengtsson et al., 2001; Boersma et al., 2005; Oldridge et al., 1998). Baseline cardiac-specific symptoms such as chest pain and dyspnoea, fatigue, weakness, lack of energy and sleep disturbance showed strong associations with the mental component of the SF-36 at the five-month follow-up (Brink et al., 2002). Likewise, higher symptom scores on the Friedman-Heart Failure Symptom Checklist was associated with worse HRQoL measured by the MLHFQ at one year or longer follow-ups (Kim et al., 2015).

Among the cardiac symptoms, chest pain seemed to have an obvious and negative effect on the MacNew scores at three months and nine months of the follow-ups (Joekes et al., 2007). Additionally, patients with dyspnoea at baseline scored lower than those who did not experience shortness of breath in the QLMI measured HRQoL at the 8-week and 12-month follow-ups (Oldridge et al., 1998). Moreover, patients with higher scores on the Multidimensional Fatigue Inventory-20 at four months after MI reported poorer HRQoL at the two-year follow-up, as measured by the SF-36 (Alsén and Brink, 2013). The Somatic Health Complaints Scale at one week after MI also had a prediction of the SF-36 scores at five months, particularly in men's physical HRQoL (Brink et al., 2005). Excessive fatigue shortly after MI, measured with the Shortened Maastricht Vital Exhaustion Questionnaire, and sleep disturbance, measured by the Athens Insomnia Scale and WHO Well-Being Scale, were also negatively associated with HRQoL scores at the acute phase of MI (Rafael et al., 2014).

3.3.3. *Illness duration/in-hospital complications*

There was only one study each which identified the impact of illness duration (Joekes et al., 2007) and in-hospital complications, which included reinfarction, shock, congestive heart failure, recurrent ischaemia, any arrhythmia, acute mitral regurgitation or acute ventriculoseptal defect or tamponade in a strong study (Beck et al., 2001). It was found that illness duration had a negative relationship with the social dimension of HRQoL measured using MacNew at three and nine months from a diagnosis of MI (Joekes et al., 2007). Among the in-hospital complications, shock predicted more improved physical HRQoL of the SF-36 at both six months and one year (Beck et al., 2001).

3.3.4. *History of MI*

Patients with a history of MI experienced greater impaired HRQoL than those with first-time MI at both eight weeks and 12 months, measured using the Quality of Well-Being Questionnaire (Oldridge et al., 1998). Likewise, women in Pettersen et al.'s study (2008) scored lower in the physical domain of the SF-36 if they had a previous experience of MI (Pettersen et al., 2008). However, in another study, there was found no association between MI and HRQoL, measured by the QLMI at six months (French et al., 2005).

3.3.5. *Comorbidities*

The presence of comorbidities seems to affect HRQoL of patients with MI negatively. Several studies found patients with hypertension reported impaired HRQoL in the total score of the SF-36 at six months (Uchmanowicz et al., 2013), low mental HRQoL of the SF-12 after being diagnosed from 15 days to 30 months (Wang et al., 2014), poor physical HRQoL of the SF-36 at the acute phase of MI (Wang et al., 2014), and decreased physical and social dimensions of the World Health Organization Quality of Life Instrument Abbreviated (WHOQOL-BREF) in a cross-sectional study (Sertoz et al., 2013).

In addition to hypertension, HRQoL was also adversely affected by the total number of comorbidities, history of heart failure, transient ischaemic attack (McBurney et al., 2002), diabetes, multi-vessel disease, or high triglyceride level (Uchmanowicz et al., 2013). In particular, comorbid heart failure was identified as a predictor of worse scores in both physical and mental domains of the SF-36 and the total score of the MIDAS at the acute phase of MI (Wang et al., 2014). Moreover, the comorbidity of chronic obstructive pulmonary disease in both genders and stroke in women had a negative effect on the physical domain of the SF-36 of MI patients at longer follow-ups (Pettersen et al., 2008). In one study conducted by Joekes, Maes and Warrens (2007), the presence of other chronic illnesses, which were not specified, was negatively associated with physical and global HRQoL scores (Joekes et al., 2007).

3.4. *Psychosocial factors*

Psychosocial factors are one of the most frequently studied variables in the HRQoL literature targeting MI patients. Anxiety and depression were measured more frequently than other studies, appearing in 11 and 19 of 48 studies, respectively. Other psychosocial factors examined in the literature include: stress, social support, illness perception, coping strategies, overprotection, active engagement, self-care, self-efficacy, sense of coherence, and type D personality. Patients scored lower HRQoL when they had higher anxiety, depression and stress, lower social support, illness perception, coping strategies, self-efficacy and sense of coherence, were overprotected, had a partner less actively engaged, and had type D personality. Yet, there was an insufficient relation between self-care resources of patients and their HRQoL.

3.4.1. *Anxiety*

The impact of anxiety on HRQoL of patients with MI has been widely studied. A higher anxiety level at baseline was associated with poorer HRQoL at six-month follow-up, as measured by different generic and disease-specific quality of life tools including the SF-36 (Hawkes et al., 2013; Mayou et al., 2000; Wang et al., 2014b), the SF-12 (Wang et al., 2014a), the Dartmouth Coop Chart (Lane et al., 2000), WHO Well-Being Scale (Rafael et al., 2014), the MIDAS (Wang et al., 2014a,b), and the QLMI (French et al., 2005). Anxiety was also predicted HRQoL of the patients in longer follow-ups (one year), using the SF-36 (Dickens et al., 2006; Mayou et al., 2000) and the Dartmouth COOP Chart (Lane et al., 2001). Baseline anxiety was significantly and negatively associated with impaired HRQoL one year after MI (Lane et al., 2001; Mayou et al., 2000). There was a finding not supported by the Dickens et al. study that found a significant association between HRQoL at one year with anxiety, assessed at six months, but not baseline anxiety (Dickens et al., 2006).

3.4.2. *Depression*

The impact of depression on HRQoL of MI patients has also been widely studied and revealed mainly consistent results. A cross-sectional study found that depression negatively affected physical and social dimensions as well as the total score of the WHOQOL-BREF (Sertoz et al., 2013). The total scores of the MIDAS (Wang et al., 2014a) and the WHO Well-Being Scale (Rafael et al., 2014) were also affected by the experience of depression immediately after MI. These results are consistent in a study that used a shorter follow-up. Patients who experienced depression after MI scored lower in the SF-36 and the MIDAS (Wang et al., 2014b) at the one-month follow-up. At the six-month follow-up, depression at baseline (Beck et al., 2001; French et al., 2005) and depression at one month in a strong study (Sakai et al., 2011) had also a significant prediction to all the dimensions including emotional, physical, and social of the QLMI scores (French et al., 2005) as well as physical and mental domains of the SF-36 (Beck et al., 2001; Sakai et al., 2011) and overall HRQoL of the EuroQol (Beck et al., 2001). The results are in line with the result of a four-month follow-up study, which found an independent and strong correlation between depression and HRQoL, as measured by the Dartmouth COOP Charts in a study rated strong (Lane et al., 2000).

On the other hand, a five-month follow-up study claimed that depression right after MI was significantly associated with the physical component of HRQoL but not with the mental dimension (Brink et al., 2002), while results of two studies showed contrast at six months (Hawkes et al., 2013), and at an average of 11 months after MI (White and Groh, 2007). Additionally, higher depression one week after MI predicted lower physical HRQoL in women and mental HRQoL in men at one year (Brink et al., 2005). Three other long-term studies also identified that patients who reported higher depression scores had lower HRQoL one year after MI, as measured by the SAQ in a strong study (Arnold et al., 2014), the SF-36 in two moderate studies (de Jonge et al., 2006; Mayou et al., 2000), and the COOP Charts (Lane et al., 2001). Similarly, psychologic distress, measured using the short form Profile of Mood States in women who experienced MI one year prior, was adversely associated with HRQoL measured by the QLI-C (Rankin and Fukuoka, 2003). This association was consistently observed at the five-year follow-up (Hosseini et al., 2014) and at the ten-year follow-up (Benyamini et al., 2013). On the contrary, one study found that depression immediately after MI did not predict impaired HRQoL in the physical aspect at one year; however, depression assessed at six months predicted physical HRQoL of patients 12 months after MI (Dickens et al., 2006).

3.4.3. *Social support*

Lower social support, assessed with the ENRICHD Social Support Instrument (ESSI) in a strong study, could predict worse physical and mental HRQoL scores on the SF-36 at six months (Hawkes et al., 2013). Also, in the other two studies, scores of the ESSI were significantly related to HRQoL scores in both physical and mental domains of the SF-12 and the overall scores of the SAQ at 12 months post-MI (Bucholz et al., 2014; Leifheit-Limson et al., 2012). Likewise, social support, measured by the Preferred Support Profile, showed a significant prediction for HRQoL in female patients at the 12-month follow-up (Rankin and Fukuoka, 2003). A lower level of perceived social support, measured with the Multidimensional Support Questionnaire for Heart Patients, also predicted lower scores in the MacNew at four months (Boersma et al., 2005).

3.4.4. *Other psychosocial factors*

The impact of stress on HRQoL of patients after MI was consistent across the studies. The level of stress immediately after MI (Arnold et al., 2014; Ginzburg and Ein-Dor, 2011), three to six months after MI (Doerfler et al., 2005) and approximately seven months after discharge from hospital (Ginzburg and Ein-Dor, 2011) negatively affected HRQoL of MI survivors at the three to six-month follow-up (Doerfler et al., 2005), at the one-year follow-up (Arnold et al., 2014), and at the eight-year follow-up (Ginzburg and Ein-Dor, 2011).

The relationship between illness perception and HRQoL among patients with MI has not been widely studied, yet one study found that the scores of the Illness Perception Questionnaire were positively associated with HRQoL of the patients at the six-month follow-up, assessed using the QLMI (French et al., 2005). In addition, only one study examined the association between applied coping strategies, including adaptation, management of illness and stress, and HRQoL of patients with MI. This study found that copying strategies were positively associated with both physical and mental dimensions of HRQoL, measured by the SF-36 at five months after discharge from hospital (Brink et al., 2002). Patients' HRQoL was also influenced by patients' perception of their partner's overprotection and active engagement. The more patients perceived their partners overprotecting them, the worse physical HRQoL they showed after nine months, while active engagement, which presented patients' perception towards partner's support in patient's emotion and solving problems, was positively linked to enhanced emotional, social and overall HRQoL, as measured by the MacNew (Joekes et al., 2007). In one study, self-care factors including self-care knowledge and resources, assessed by the Self-care Resource Inventory (SCRI), showed a low association with HRQoL scores in patients with MI (Baas, 2004). Three studies included in this review examined self-efficacy in general (Brink et al., 2012), with respect to the achievement of goals (Boersma et al., 2006), and in regards to physical activity (Hawkes et al., 2013). This concept reflected MI patients' beliefs that their behaviours were responsible for the outcomes (Brink et al., 2012). Higher general self-efficacy, measured with the General Self-Efficacy Scale at four months after MI, was able to predict better HRQoL after two years (Brink et al., 2012). Additionally, higher self-efficacy on goal attainment predicted better physical and social dimensions of HRQoL, assessed by the MacNew at four months (Boersma et al., 2006), while low level of confidence in undertaking physical activities was a predictor of low physical HRQoL, measured with the SF-36 at six months (Hawkes et al., 2013). The association between HRQoL and sense of coherence was examined in two studies. Sense of coherence refers to the extent to which one has a pervasive, enduring though dynamic feeling of confidence (Wrzesniewski and Wlodarczyk, 2012). This concept was found to be significantly and positively associated with HRQoL in patients with MI at six months (Norekvål et al., 2010) and one year after MI (Wrzesniewski and Wlodarczyk, 2012). The current review revealed that the Type D personality, assessed by the 14-item Type D Personality Scale, was strongly related to the low level of HRQoL in patients with MI (Oginska-Bulik, 2014; Saeed et al., 2011; Williams et al., 2012), as was assessed using the MacNew (Williams et al., 2012), the WHOQOL-BREF (Saeed et al., 2011), and the Life Satisfaction Questionnaire (Oginska-Bulik, 2014).

4. Discussion

Our comprehensive review reveals that patients who have particular factors listed above at the early stage after MI could show lower HRQoL than their comparators during the recovery phase. Among nine demographic factors examined in the literature, the effect of age was found to be a predictor of HRQoL among patients with MI. In particular, older patients had better HRQoL except for the physical domain, which was negatively affected by older age. The fact that older people tend to have more sedentary behaviours and limitations related to physical activities may cause decreased physical HRQoL (Longmore et al., 2011). Thus, the increasing tendency of physical activity in this patient population can be vital (Sun et al., 2014). For instance, the Tai Chi program can be apt to encourage older patients to exercise after MI (Song et al., 2009). Gender-identity was another widely studied demographic factor. Most studies of the association between gender-identity and HRQoL reviewed in this study suggested that MI could impose a greater adverse impact on HRQoL of women than that of men. However, considering the fact that women in the general population also score lower on the SF-36 than men in the general population (Pettersen et al., 2008), similar effects to both female and male patients can be assumed (Pettersen et al., 2008). Regarding the other demographic factors, a higher level of education, being employed, higher income, involvement in more managerial responsibility, and being Caucasian were associated with higher HRQoL in MI patients. Yet, there was an insufficient number of studies to draw a clear conclusion.

In cases where patients were more involved in physical activity, consumed less alcohol, were non-smokers, and had a BMI in the normal range, their HRQoL scores tended to be higher. A previous review found that the cardiac rehabilitation programs with exercise were helpful for recovering HRQoL after MI (Kang et al., 2016). Promoting patient participation in a cardiac rehabilitation program, which is a comprehensive intervention including exercise, education or counselling and monitoring by health professionals (Kang et al., 2016), can be one of the ways to enhance patients' physical activities, and risk-reducing behaviours in the form of smoking cessation and reducing alcohol consumption in the recovery phase of MI. On the other hand, the disease-related factors are unlikely to be modified despite the fact that having more disease-related factors tend to cause decreased HRQoL after MI. Thus, it seems that altering or preventing modifiable factors will be more effective strategies for the recovery of HRQoL in patients with MI (Yusuf et al., 2004).

It was consistent throughout the previous literature that anxiety, depression, and stress had a significantly negative impact on MI patients' HRQoL. Early identification and interventions for depression, anxiety, and stress may help improve HRQoL in the early stage of recovery from MI (Arnold et al., 2014; Rafael et al., 2014; Wang et al., 2014a). Depression, which is apparently connected to the mortality of patients with CHD, can increase 1.64 times more possibility of CHD risk. Moreover, it was also found that moderate or higher level of depression raised 69% and 78% greater risks of cardiac death and all-cause deaths, respectively (Gholizadeh et al., 2014). By contrast, patients after experiencing MI are likely to have three times higher probability of depression than the general population (Lichtman et al., 2008). Likewise, anxiety can increase 26% of CHD risk and 48% of cardiac death (Holt et al., 2013) and the close relationship between anxiety and CHD cannot be overlooked (Davies and Allgulander, 2013). Therefore, in accordance with the recommendations of the American Heart Association for depression and CHD, depression should be routinely considered in the treatment of CHD based on the fact that depressive symptoms of patients with heart disease may reflect their medical condition (Lichtman et al., 2008). Social support had a strong influence on HRQoL. It is important to consider perceived social support as a part of the treatment for MI patients since social support is closely associated with outcomes of heart disease including morbidity and mortality (Lett et al., 2005; Uchino, 2006). Social support can be relatively easily modified by giving education programs for patients' caregivers or expanding social service within the community so that patients can be supported and encouraged to cope with the aftermath of MI (Kristofferzon et al., 2005a,b). It was found throughout the literature review that having higher scores of illness perception, coping strategies, self-efficacy and sense of coherence, having partners or caregivers being involved in appropriate protection and actively engaged in the process of the treatment, and not having a type D personality were associated with increased HRQoL after MI. As the psychosocial factors except the type D personality are considered as modifiable factors, it can be more effective and efficient to pay attention to these factors for recovering HRQoL among patients with MI when patients undergo the process of treatments.

Our review revealed several areas where the evidence is not sufficient hence further research is warranted. For example, an age-adjusted and/or sex-adjusted study of comparing HRQoL in female and male patients in comparison with the general female and male population may be needed to explore correlations between age, gender-identity and HRQoL. Similarly, in the majority of studies included in this review, the ratio of female to male subjects was observed to be unbalanced with significantly fewer females. Therefore, it is suggested that recruitment targeted female patients with MI will be needed for future studies in order to make these adjustments. Furthermore, given the paucity of data related to ethnically and racially diverse populations, studies targeting the populations including transgender, gender non-conforming, or other gender identities can be recommended. Although the behavioural factors are mostly modifiable through cardiac rehabilitation programs or counselling, studies of these factors and HRQoL are sparse. Despite the fact that sleep disturbance was closely associated with cardiovascular disease including MI, and had a strong association with HRQoL, the relationship between sleep disturbance and HRQoL has been scarcely studied (Rafael et al., 2014). A study conducted by Redeker and Hilkert (2005) examined the relationships of subjective and objective sleep problems, including sleep quality, duration and continuity, with physical and mental health, measured by the SF-36, among heart failure patients whose LVEF was less than 35%. Given the importance of sleep quality and continuity for physical and mental HRQoL, further studies on sleep disturbance of MI patients are also recommended for developing effective clinical evaluation and interventions (Redeker and Hilkert, 2005). Likewise, the relationship between illness perception and HRQoL among patients with MI has not been widely studied, yet there is evidence that the scores of the Illness Perception Questionnaire had an association with HRQoL in patients with MI after six months assessed using the QLMI (French et al., 2005). Studies of the relationship between HRQoL and these factors need to be identified due to the importance of improvement in health outcomes of MI patients. Moreover, each study in this review has focused on a few variables. Therefore, one single study examining these variables together can be recommended in order to determine correlations of various factors affecting HRQoL in patients with MI.

Although the current review covered broad facets, there are some limitations in this review. First, despite rigorous search and study selection, there may have been some potentially relevant studies omitted due to our limitation to studies in English, the search duration of 20 years, and the exclusion of grey literature. Second, due to the heterogeneity among the studies included in the review, only a descriptive review was possible. Despite these limitations, the current review addressed critical factors, which were significantly associated with HRQoL among patients with MI throughout the previous literature.

5. Conclusion

There seem to be various types of factors including modifiable and non-modifiable ones that affect different dimensions of HRQoL in patients with MI. Identifying these factors can provide early detection of patients who tend to have worse HRQoL in the recovery or rehabilitation stage of post-MI, focusing on adjustable factors such as behavioural and psychosocial ones which would be more effective in helping them recover HRQoL to the normative level after experiencing MI.

Ethical considerations

Not applicable.

Conflicts of interest

None.

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b. Interventions that improve health-related quality of life in patients with myocardial infarction

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REVIEW

Interventions that improve health-related quality of life in patients with myocardial infarction

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Abstract

Purpose Patients with myocardial infarction (MI) often report lower health-related quality of life (HRQoL) than those without MI. Interventions can affect HRQoL of these patients. The purpose of this review was to identify effective strategies for improving HRQoL among individuals with MI.

Methods Three electronic databases were searched and limited to articles peer-reviewed and published in English between 1995 and 2015. We screened titles and abstracts of the retrieved articles for studies that examined effectiveness of interventions to improve HRQoL in patients with MI.

Results Twenty-three studies were found that examined the effects of behavioural interventions—cardiac rehabilitation programmes (CRP), education and counselling programmes, and other psychological and cognitive interventions—to improve HRQoL in patients with MI. The studies included were mainly randomised controlled trials (14 studies) with a wide age range of participants (18–80 years) and a mean age group of 50–70 years. CRPs, including home- and hospital-based CRPs, regular weekly aerobic training programmes, and group counselling mostly resulted in improvement of HRQoL in patients with MI.

Conclusion Most CRPs and other interventions were beneficial to MI patients. Therefore, patients with MI should be encouraged to participate in programmes that can help promote their HRQoL.

Keywords Health-related quality of life · Myocardial infarction · Interventions · Cardiac rehabilitation

Introduction

Cardiovascular disease (CVD) is the leading cause of death globally [1]; mortality from heart disease increased worldwide between 2000 and 2012 [2]. In particular, myocardial infarction (MI) is a life-threatening event caused by a complete blockage in a blood vessel that supplies blood, oxygen, and nutrients to the heart muscle [3]. The survival of patients with MI has remarkably improved as the result of timely use of thrombolysis and primary percutaneous coronary intervention (PCI) that help restore the flow of the culprit vessels [4]. Yet, these patients frequently experience negative physiological effects such as depression and uncertainty as well as other adverse effects such as a disrupted daily life associated with persistent and/or reoccurring disease symptoms [5]. As a result of MI, patients often report reduced health-related quality of life (HRQoL), which is increasingly recognised as a critical outcome measure in health care [6].

HRQoL is a multidimensional concept that encompasses self-reported measures of physical and mental health [7]. The American Heart Association recommends assessment of HRQoL as an integral part of patient-reported health status assessment in patients with cardiovascular disease [8]. HRQoL has been found to be an independent predictor of death and future cardiac events in patients with MI [5]. In the acute phase of MI, the focus is often placed on physical health; however, after discharge from hospital or considering the long-term effects, HRQoL becomes a significant factor reflecting the impact of the disease on diverse aspects of the patient's life [5]. Patients with MI

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and their health care providers often discuss HRQoL to develop a shared view of the disease and treatment outcomes [5, 9]. Some studies [10, 11] suggest HRQoL as an indicator of therapeutic response. This understanding is important to help optimise the management of MI and assist patients to return to a normal active life and to obtain required lifestyle changes.

Health professionals are in a unique position to intervene and support patients as they recover from MI. While medical interventions, thrombolytic therapy, and coronary angioplasty have important roles in survival of patients with MI [12], interventions that improve patients' recovery after discharge also need to be developed and used to help promote patients' overall health status, wellbeing and quality of life (QoL). Currently, there is no comprehensive literature review to examine the evidence on QoL interventions for patients with MI. This study aims to review the effectiveness of behavioural interventions to improve the HRQoL of patients with MI.

Methods

Literature Search

Relevant studies were identified by searching the electronic databases including MEDLINE, CINAHL, and PsycINFO. Key search terms included: health-related quality of life/quality of life/HRQoL/QoL and myocardial infarction/heart attack/MI. At the stage of screening, only studies that focused on behavioural interventions were included. Search was limited to English-language and peer-reviewed articles published from 1995 to October 2015. Management of patients with MI has significantly improved over the last couple of decades. Thus, the search was limited to the last 20 years to ensure that the interventions were still relevant.

Study Selection

A total of 2523 articles were found from the search, and 1996 were retained after duplicates were removed. Firstly, 1996 articles were screened by titles and abstracts if they reported original data on HRQoL in patients exclusively with MI. 1879 studies were excluded due to irrelevant study subjects, irrelevant dependent variables, and validation studies of measurements. Scientific letters or posters were also excluded, as well as studies of applied qualitative methods were excluded. Articles for which full texts were not available were also excluded. Table 1 describes the inclusion and exclusion criteria of the study. Following the screening of the titles and abstracts, 116 potential articles were selected for further screening. A hand search of the reference lists of relevant published articles was done and resulted in 16 additional articles. Among 132 studies screened by full texts, 109 studies were excluded due to non-interventional studies or studies on medical procedures such as PCI. Finally, 23 studies on HRQoL of MI patients combined with the effects of a particular intervention were included in the present review (Fig. 1).

Results

Participants and setting

Table 2 summarises the characteristics of each study included in the review. Out of 23 articles, 9 studies were conducted in Europe (the UK, Norway, and the Netherlands, 2 studies each, and Finland, Italy, and Ireland, 1 study each). The remaining studies were carried out in North and South America (2 studies in Brazil, and 1 study in the US), Asia (3 studies in Japan, 2 studies in Iran, and 1 study each in Hong Kong, South Korea, Turkey, and China), and Australia (2 studies). The included studies were mainly randomised controlled trials (RCT; 14 studies), followed by prospective studies. Two of the reviewed studies also considered cost-effectiveness as an outcome measure [13, 14], and one study analysed the cost-effectiveness of the programme in an additional separate article [15]. The reviewed studies included a wide age range of participants (18–80 years), with a mean age group of 50–70 years. More male participants were recruited in most of the studies, and one study targeted male patients exclusively [16]. The reviewed studies recruited between 46 and 2481 participants.

Assessment of HRQoL

A number of QoL measures were used to assess HRQoL in the reviewed studies. These included the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36), the Sickness Impact Profile (SIP), EuroQol-5D (EQ-5D), the World Health Organization Quality of Life Questionnaire Brief Version (WHOQOL-BREF), the 8-item Life Satisfaction Scale (LSS), a 1–10 ladder technique (Ladder of Life, LOL), the Time Trade-off instrument, and Quality of life, which is a short 10-item visual analogue scale [17], as a generic measurement. SF-36 was one of the most widely used generic tools to measure HRQoL in this patient population [18], used in 11 reviewed studies conducted by Hanssen et al. [19, 20], Hawkes et al. [15], Izawa, Hirano, et al. [21], Izawa, Yamada, et al. [22], Mendes de Leon et al. [23], Uysal and Özcan [24], Wang et al. [18], West et al. [25], Yonezawa et al. [26], Yu et al. [14]. It was a global QoL tool addressing eight domains,

Table 1 Inclusion/exclusion criteria

Inclusion criteria	Exclusion criteria
Subjects exclusively with MI	Scientific letters or posters
English language	Articles for which full texts were not available
Peer-reviewed	Validation studies of measurements
	Qualitative studies
	Studies about medical interventions

including physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health, which were also classified with two psychometrical dimensions—physical component summary (PCS) and mental component summary (MCS) [15]. The measurement was scored from 0 to 100 with lower scores indicating lower HRQoL and higher scores representing better HRQoL [22].

Other studies used disease-specific tools, such as the MacNew Heart Disease HRQoL Instrument (MacNew), the Myocardial Infarction Dimensional Assessment Scale (MIDAS), or the Quality of Life Index (QLI)–Cardiac Version III. Among these specific tools, the MacNew questionnaire was the most commonly used tool to assess HRQoL. MacNew was an improved version of Quality of Life after Myocardial Infarction (QLMI) Questionnaire, consisting of 27 items including physical, emotional, social function domains and five items about symptoms. Each item was scored within a range of 1–7, with higher total scores indicating better HRQoL [27]. In three retrieved studies [18, 24, 28], researchers used both generic and disease-specific QoL instruments.

Interventions to improve the HRQoL of patients with MI

Twenty-three studies were found that examined the effects of behavioural interventions—cardiac rehabilitation programmes (CRP), education and counselling programmes, and other psychological and cognitive interventions—to improve HRQoL in patients with MI. Heterogeneity of the interventions was observed across the reviewed studies; as the result, the studies were grouped and discussed according to the type of intervention. The assessment points of HRQoL of MI patients were mostly comparison between the intervention group and the control group by asking with various patient-reported QoL questionnaires as well as dimensions of HRQoL that were improved after the interventions.

Cardiac rehabilitation programmes

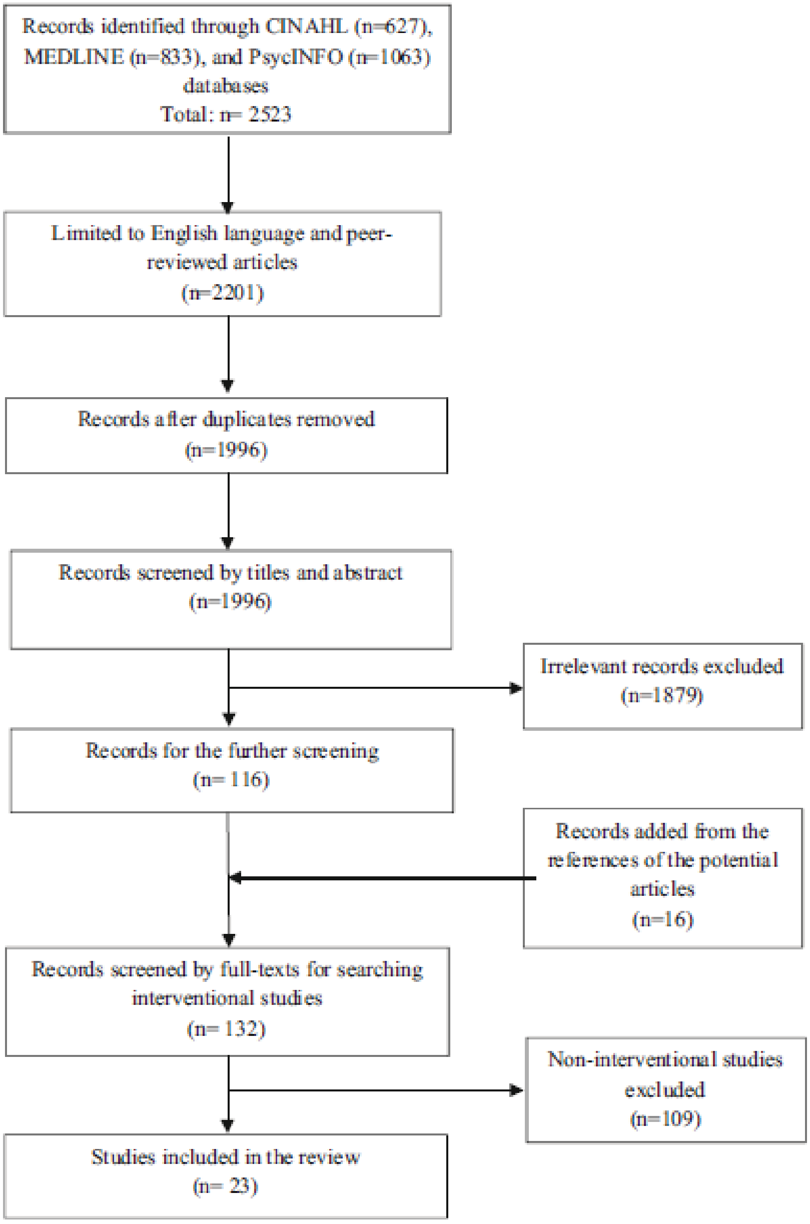
Cardiac rehabilitation programme (CRP) is a comprehensive intervention for improvement of HRQoL in patients who have heart disease. Among the studies reviewed, 11 studies applied CRP, including exercise, education or counselling and monitoring by health professionals, and two studies applied exercise programmes only.

In the present study, CRPs have shown promising results on HRQoL scores of patients with MI. Yu et al. [14] examined the effects of a cardiac rehabilitation and prevention programme on HRQoL of patients with MI, within an age range of 53–75 years. In this RCT, the control group was given standard care without an exercise component. Compared to the control group, participants in the intervention group had significantly higher HRQoL in four domains at the phase 3, and in five domains: the same four domains at the phase 3 plus vitality, at the 2-year follow-up ($p < 0.005$). The control group reported increased physical pain and no improvement in any of the HRQoL dimensions by phase 2. Only four dimensions of SF-36 were slightly improved at the end of the study period [14].

A supervised exercise-based CRP at the hospital seemed to better improve the QoL of MI patients compared to a home-based unsupervised exercise programme. For example, researchers from Korea compared the effectiveness of a supervised exercise-based CRP with a self-administered home-based exercise programme. The study found that patients in the supervised exercise-based group showed greater improvements in overall QoL scores after 8 weeks ($p < 0.0001$) compared to the home-based comparison group [29]. These findings imply that the social support and formal structure offered by the supervised programme played an important role in improving QoL.

Findings of a recent study, conducted by Peixoto et al. [30], were also in line with past studies. A significant improvement was observed particularly in the physical and emotional domains in the intervention group, which underwent a 1-month exercise-based CRP ($p < 0.001$), compared with the control group [30]. Moreover, other 3-month follow-up studies [21, 28] reported positive results in promoting HRQoL among MI patients. In one of these two studies, Japanese participants who completed a CRP had superior HRQoL in four of the eight subscales of the SF-36 ($p = 0.000$, $p = 0.03$) to the control group [21]. In the other study, Iranian patients also scored higher in the physical domain of the MacNew ($p < 0.05$) and the WHOQOL ($p < 0.05$) after completing a 40-session

Fig. 1 A process of article selection



hospital-based CRP than participants who did not participate in the programme [28].

In Marchionni's study, participants who attended either a hospital- or home-based CRP for 8 weeks showed better HRQoL than those who did not participate in any of the programmes. Although both interventions were similarly effective in a range of $p < 0.001$ to $p < 0.01$, the home-based intervention was more cost-effective than the hospital-based CRP [13]. Likewise, a 6-week home-based CRP using a self-help manual, which contained information about Tai Chi, Qi Gong and Chinese diet, was effective in improving the HRQoL of Chinese patients at 6 weeks and 6 months post-MI ($p < 0.05$) compared to the control group who received only instructions on taking

Table 2 Summary of the studies that examined the effectiveness of an intervention on HRQoL of patients with MI

First Author (year)/Country	Study design	Participants/male %	HRQoL Assessment	Interventions	Counter-intervention	Follow-ups	Key findings
Bagheri et al. [33]/Iran	RCT	62 patients with MI who were referred to hospitals/male = NR	MacNew	A 4-week group counselling programme (2 1-hour sessions/week)	No counselling	1 month (post-intervention)	Improved a total score in the IG ($p < 0.001$) compared to the CG
Benetti et al. [16]/Brazil	Prospective study	87 patients (57.7 ± 6.1 years old) IG I = 29, IG II = 29, CG = 29/male = 100 %	MacNew	I: a 12-week high-intensity physical training (85 % maximum heart rate) II: a 12-week moderate-intensity training (75 % maximum heart rate)	No exercise	After 12 weeks (post-intervention)	QoL improved significantly ($p < 0.05$) in the IG I (from 5.66 to 6.80) and in the IG II (from 5.38 to 6.72), compared to the CG (from 5.30 to 5.15)
Boersma et al. [34]/The Netherlands	Longitudinal study	46 outpatients excluded older than 70 years of age; CABG or angioplasty following their MI/male = NR	MacNew	The 4-month attainment of three mid-level goals shortly after discharge from hospital	None	4 months after MI (post-intervention)	Positive effects on social component of HRQoL ($p = 0.05$)
Choo et al. [29]/Korea	A quasi-experimental design study with a non-randomized, pre-test–post-test control group	60 subjects admitted for a first MI, ≤75 years/male = 81.7 %	QLI–Cardiac Version III	A 8-week supervised exercise-based CRP (3 sessions/week) at the hospital	A self-administered home-based exercise programme	8 weeks (post-intervention)	IG showed significant improvements in health/functioning ($p < 0.0001$) and psycho/spiritual ($p = 0.016$) subscales
Dugmore et al. [17]/UK	RCT	124 patients, IG = 62, CG = 62/male = 98.4 %	Quality of life—a short 10-item visual analogue scale	12-month regular weekly aerobic training programme (3 times/week)	No formal exercise	12 month (post-intervention)	Improved QoL scores. Good prognosis group: IG = 85.9 versus CG = 66.7 ($p < 0.001$)/poor prognosis group: IG = 80.8 versus CG = 59.4 ($p < 0.001$)
Hanssen et al. [19]/Norway	A prospective RCT	288 patients (IG = 156, CG = 132) and aged less than 80/male = 80.9 %	SF-36	A 6-month telephone follow-up intervention about common problems or queries and risk factor modification	One visit to a physician 6–8 weeks after discharge and subsequent visits to their general practitioner	6 months (post-intervention)	Significantly improved the HRQoL in the PCS score ($p = 0.039$) in the IG compared to the CG, but no effects on the MCS score ($p = 0.447$)

Table 2 continued

First Author (year)/Country	Study design	Participants/male %	HRQoL Assessment	Interventions	Counter-intervention	Follow-ups	Key findings
Hanssen et al. [20]/Norway	A prospective RCT	288 patients admitted to the hospital with a diagnosis of AMI, excluded CABG/male = 80.9 %	SF-36	A 6-month telephone follow-up intervention about common problems or queries and risk factor modification	One visit to a physician 6–8 weeks after discharge and subsequent visits to their general practitioner	18 months after discharge (after a year of the intervention)	No long-term effects in the overall physical domain ($p = 0.250$) and the overall mental domain ($p = 0.280$)
Hawkes et al. [15]/Australia	A parallel group, prospective RCT	430 adult MI patients/male = 74.6 %	SF-36	Telephone-delivered secondary prevention programme including ten health coaching sessions over 6 months	Usual care	6-month follow-up (post-intervention)	Significant improvement in mental component ($p = 0.02$), social functioning ($p = 0.04$), and role-emotional ($p = 0.03$) subscales
Hevey and Wilczkiewicz [35]/Ireland	Not reported	89 patients (expressive writing = 43; control = 46)/male = 76 %	MacNew	Expressive writing for 20 min per day for 3 consecutive days	Objective writing	After 3 months (post-intervention)	Higher total HRQOL ($p < 0.05$)
Izawa et al. [21]/Japan	Prospective observational study	124 AMI patients; outpatient CR group (n = 82) and a non-CR group (n = 42)/male = 77.4 %	SF-36	8-week CRP covered individual education and exercise therapy (2/week)	No CRP	3-month follow-up (after a month of the intervention)	Significant improvements in the physical functioning ($p = 0.000$), role-physical ($p = 0.000$), general health ($p = 0.03$), and vitality ($p = 0.03$) subscales
Izawa et al. [22]/Japan	Observational study	109 AMI patients (89 men, 20 women; mean age 63.5 ± 10.1 yrs)/male = 81.6 %	SF-36	A supervised 5-month recovery-phase CRP including exercise therapy based on cardiopulmonary exercise testing and muscle strength testing	No CRP, no exercise	6-month follow-up (after a month of the intervention)	Physical functioning, role-physical, bodily pain, general health, vitality, role-emotional, and mental health subscales were significantly higher in the IG compared with the CG ($p < 0.001$)
Marchionni et al. [13]/Italy	RCT	270 outpatients older than 45 years/male = 67.8 %	Italian-SIP	2-month Hosp-CR; 40 exercise sessions (3/week), 2-month Home-CR; overall 4–8 supervised exercise sessions at home.	No CRP	8-month and 14-month follow-ups (after 6 and 12 months of the intervention)	Hosp-CR and Home-CR were similarly effective. SIP total score: age 45–65 group: $p = 0.029$/age 66–75 group: $p = 0.318$/> 75 group: $p = 0.017$

Table 2 continued

First Author (year)/Country	Study design	Participants/male %	HRQoL Assessment	Interventions	Counter-intervention	Follow-ups	Key findings
Mendes de Leon et al. [23]/USA	RCT	2481 patients with AMI/1296 completed at 6 months/male = 56.3 %	SF-36, the 8-item LSS, a 1–10 ladder technique (LOL)	Psychosocial intervention included 11 individual sessions delivered over 6 months	Usual care	After 6-month (post-intervention)	Significant differences in the SF-12-MCS, the LSS, and the LOL scores, but not in the SF-12-PCS
Oranta et al. [32]/Finland	RCT	103 MI patients < 75 age/male = 70.9 %	EQ-5D	Interpersonal counselling consisting of starting (sessions 1–2), encouragement (3–4), and ending phase (5–6) (not reported about the time of the intervention)	Usual care	6 and 18 months after discharge	No significant improvement in the IG in any of dimensions compared to the CG. Only improved in patients under 60 years ($p < 0.001$ at 6 months, $p = 0.004$ at 18 months)
Peixoto et al. [30]/Brazil	RCT	88 patients ranged between 18 and 70 years of age/male = 70.5 %	MacNew	Stage 1: an educational programme to both groups Stage 2: IG—an unsupervised progressive exercise programme (4 sessions/ week) for a month.	Usual care	30 days after discharge (post-intervention)	Physical ($p < 0.0001$) and emotional domains ($p < 0.001$) improved in the IG
Roncella et al. [36]/The Netherlands	RCT	94 patients admitted patients aged ≤ 70 years/male = 89.4 %	MacNew	STP including 3–10 individual sessions and 5 group sessions over 6 months	No STP	1-year follow-up (after 6 months of the intervention)	Improved physical domain ($p = 0.03$), and trended towards enhanced QoL in the social domain ($p = 0.06$) and global QoL ($p = 0.07$)
Uysal and Özcan [24]/Turkey	Controlled clinical trial	90 patients/male = 77.8 %	SF-36, MIDAS	Individual training for an hour before discharge and counselling programme in the fourth and eighth weeks following discharge	No telephone counselling and training	3-month follow-up (after a month of the intervention)	Improvement in all dimensions of MIDAS ($p = 0.000 \sim 0.04$) and SF-36 ($p = 0.000 \sim 0.02$) except bodily pain ($p = 0.15$)
Varnfield et al. [31]/Australia	RCT	60 post-MI patients recruited to each group/male = 83.5 %	EQ-5D	A 6-week smartphone-based home service delivery (CAP-CR)	A 6-week traditional centre-based CRP	After 6 weeks (post-intervention), 6 months (after 18 months of the intervention)	The median scores of HRQoL improved significantly in the IG ($p < 0.001$) at 6 weeks, but not at 6 months

Table 2 continued

First Author (year)/Country	Study design	Participants/male %	HRQoL Assessment	Interventions	Counter-intervention	Follow-ups	Key findings
Wang et al. [18]/China	RCT	133 outpatients with MI/male = 83.5 %	SF-36, Chinese MIDAS	A 6-week home-based CRP.	Usual care	3- and 6-month follow-ups (after 6 weeks and 18 months of the intervention)	Significantly improved in physical functioning ($p < 0.01$), role functioning ($p < 0.05$), vitality ($p < 0.05$), and mental health ($p < 0.05$) subscales
West et al. [25]/UK	Prospective RCT	1813 patients following AMI/male = 73.5 %	SF-36	CRP—exercise training, health education about heart, heart disease, risk factors and treatment, counselling for recovery and advice for long-term secondary prevention over 6–8 weeks	Usual care	1 year (after about 10 months of the intervention)	No significant differences between IG and CG in any of eight domains of SF-36
Yonezawa et al. [26]/Japan	Not reported	109 outpatients (57 ± 7 years) who completed a phase I CR programme after AMI/male = 82.6 %	SF-36	Phase II CRP—supervised exercise training and counselling for an hour once a week. (5 months)	No CRP	6 months after the AMI (after a month of the intervention)	The bodily pain ($p < 0.05$) and social functioning ($p < 0.05$) subscale scores improved in the IG
Yousefy et al. [28]/Iran	Experimental study	121 patients with AMI in past 6–12 months, ≥30 years old/male = 68.8 %	MacNew, WHOQOL-BREF	The hospital-based CRP consisted of 40 exercise sessions over 2–3 months (3 sessions/week)	No CRP	3-month follow-up (post-intervention	Improved physical functioning; MacNew physical: IG = 73.10 versus CG = 59.13 ($p < 0.05$) WHOQOL physical: IG = 3.51 versus CG = 2.94 ($p < 0.05$)
Yu et al. [14]/Hong Kong	RCT	269 patients with recent AMI or after elective PCI at a CR centre/male = 76 %	SF-36	A 8-week cardiac rehabilitation and prevention programme including exercise	Standard care without exercise	8 weeks (phase 2; post-intervention), 6 months (phase 3), 2 years (phase 4)	Significant improvement in QoL; physical functioning, physical role, bodily pain, and emotional role and vitality ($p < 0.005$)

AMI acute myocardial infarction, *CABG* coronary artery bypass graft surgery, *CAP-CR* Care Assessment Platform of Cardiac Rehabilitation, *CG* control group, *CRP* cardiac rehabilitation programme, *EQ-5D* EuroQol-5D, *Home-CR* home-based cardiac rehabilitation, *Hosp-CR* hospital-based cardiac rehabilitation, *HRQoL* health-related quality of life, *IG* intervention group, *LOL* Ladder of Life, *LSS* Life Satisfaction Scale, *MacNew QLMI* MacNew Quality of Life after Myocardial Infarction Questionnaire, *MCS* mental component summary, *MI* myocardial infarction, *MIDAS* Myocardial Infarction Dimensional Assessment Scale, *NR* not reported, *PCI* percutaneous coronary intervention, *PCS* physical component summary, *PI* psychosocial intervention, *QLI* Quality of Life Index, *QoL* quality of life, *RCT* randomized, controlled trial, *SF-12* The 12-Item Short-Form Health Survey, *SF-36* Medical Outcomes Study 36-Item Short-Form Health Survey, *SIP* Sickness Impact Profile, *STP* short-term humanistic–existential psychotherapy, *WHOQOL-BREF* World Health Organization Quality of Life Questionnaire Brief Version medications, information leaflets about cardiac risk factors, a healthy diet, and smoking cessation, and a follow-up appointment [18]. Varnfield et al. compared the effectiveness of a 6-week CRP using the smartphone-based Care Assessment Platform Cardiac Rehabilitation (CAP-CR) programme with traditional centre-based CRP. They found that patients in the CAP-CR had higher HRQoL median scores as measured by EQ-5D ($p < 0.001$). In addition, the CAP-CR group had a low dropout rate with 80 % of participants completing the programme compared to 47 % of the centre-based CRP group [31].

There were two studies that followed up participants, using the SF-36 over a 6-month period [22, 26]. In Izawa, Yamada, et al.'s study [22], the CRP group had significantly higher QoL than the control group in seven domains of the SF-36 at 6 months ($p < 0.001$); no improvement was observed in social functioning, however. In Yonezawa et al.'s study, the CRP led to significant differences only in bodily pain and social functioning (both $p < 0.05$) at 6 months [26]. Comparison of the intervention group with the control group among Japanese patients after MI revealed the contrast of the social functioning subscale between these two studies.

A regular weekly aerobic training programme, alone, to the intervention group resulted in greater improvements in HRQoL in patients after MI ($p < 0.001$) compared with the control group [17]. Changes in HRQoL scores seemed to be affected by the intensity of exercise. Benetti et al. [16] conducted a prospective case–control study and assigned patients into either a 12-week high-intensity physical training or a 12-week moderate-intensity training. Patients in both groups showed significant improvement in HRQoL from baseline ($p < 0.05$), yet the higher-intensity training resulted in slightly superior HRQoL than the moderate-intensity training and the control group [16]. However, different from the earlier mentioned studies, a study by West et al., which evaluated the long-term effects of an 8-week CRP, failed to show a significant difference between the intervention group and the control group in a 1-year follow-up [25].

Patient education and counselling

Three studies used patient education and counselling to improve HRQoL in post-MI patients [15, 19, 20]. Hawkes et al. examined the effects of a telephone-delivered secondary prevention programme over 6 months including three weekly sessions, three fortnightly sessions, and four monthly sessions. The programme significantly improved the mental component ($p = 0.02$), the social functioning ($p = 0.04$), and role-emotional ($p = 0.03$) subscales of the SF-36 [15].

To assess the long-term effects of an education and counselling intervention via telephone, Hanssen et al. [20] applied weekly phone calls for the first 4 weeks and subsequent calls at 6, 8, 12, and 24 weeks after discharge from MI. The phone follow-ups aimed to help patients solve their common problems or queries after discharge from hospital and to assist patients with their risk factor modification. The results of this RCT showed that the telephone follow-up intervention was effective in increasing HRQoL of patients at a 6-month follow-up compared to the control group [19]. However, the positive effects of the telephone follow-up intervention on HRQoL disappeared at an 18-month follow-up [20].

More recently, the effects of six-session face-to-face interpersonal counselling on HRQoL scores of MI patients were examined [32]. The intervention included a brief introduction by a trained nurse to the framework of the interpersonal counselling, strategies about role transition, and management of therapeutic gains and depressive symptoms. This study found no significant difference in mean HRQoL scores between patients who received interpersonal counselling and the control group. The interpersonal counselling, however, only had a moderate effect on HRQoL of a subgroup of patients aged less than 60 years at either follow-up point [32]. On the other hand, in the study by Uysal and Özcan [24], individual patient education plus counselling positively affected HRQoL of patients after MI. Visual materials were used to provide 1-hour individual training on healthy life after MI in the programme, which was delivered before discharge from hospital. The intervention also included two sessions of telephone counselling on cardiovascular risk-reducing strategies and addressing the patients' queries in week 14th and 18th following discharge from hospital. The study found greater improvements in HRQoL of patients who participated in the programme ($p \leq 0.000$) [24]. It is not, however, clear whether the authors had controlled for cardiac rehabilitation participation as a covariate factor. In line with other counselling interventions, group counselling has also shown promising effects on HRQoL scores. In a study, group counselling resulted in greater HRQoL scores ($p < 0.001$) at a 1-month follow-up compared to the control group [33].

Other psychological and cognitive interventions

Additional intervention programmes included goal attainment, expressive writing, psychosocial intervention, and short-term humanistic-existential psychotherapy. For example, Boersma et al. [34] assessed the effect of the attainment of three self-selected mid-level goals on HRQoL of patients with MI. These goals were related to health promotion, social activities, and open domain for the coming year. The goal attainment intervention had a positive effect on the social dimension of HRQoL of MI patients ($p = 0.05$) [34]. Furthermore, there was a unique study, which used language as a means of intervention. Over a period of the study, the intervention group were asked to express their thoughts and feelings about their MI in writing, while the control group were asked to write objectively about their daily events, as they occurred during the year before heart attack. Patients in the expressive writing group showed superior overall HRQoL scores to the control group ($p < 0.05$). This intervention was cost-effective as it costed only for pens, paper, and envelopes, and had 68 % of response rate [35].

Psychological interventions were also applied to MI patients in the ENRICHD clinical trial [23] and the STEP-IN-AMI trial [36]. The counselling programmes are usually similar to education or questioning and answering; on the other hand, the psychosocial intervention of ENRICHD trial was composed of cognitive behavioural therapy for MI patients who had at least one previous episode of major depression, pharmacotherapy for patients with severe depression, and training of strategies to help with social skill deficits and automatic thoughts or self-talk. The study found significant differences in the mental components of the SF-36 between the intervention group and the control group (2.2; 95 % confidence interval 1.2–3.2); however, no differences were found in the physical components (0.8; 95 % confidence interval −0.5 to 2.0) [23]. In consistent with the above study, a short-term humanistic-existential psychotherapy (STP) used in the STEP-IN-AMI trial enhanced the physical dimension of the MacNew instrument ($p = 0.03$). The intervention consisted of three to ten 1-hour individual sessions, which focused on patient personal history, body language insights, and relaxation techniques, as well as five group sessions over 3 months. The group sessions included information about MI, cardiac risk factors, lifestyle changes, music-guided breathing and muscular relaxation, comprehension of body signals, elements of oneiric language, and attention to specific partner/relationship issues. The study found that the physical domain of HRQoL was significantly improved in the intervention group compared to the control group. Also, positive trends in the social domain and overall HRQoL in the favour of the intervention were found [36].

Discussion

Overall, the studies included in this review showed promising results in improving HRQoL of MI patients. The studies included heterogeneous behavioural interventions, with cardiac rehabilitation programmes being the most commonly reported [28, 29]. Patients who participated in either hospital-based or home-based CRP showed higher HRQoL than those who did not participate in any CRP [13, 28]. This finding is in line with other studies which demonstrated positive effects from CRP on HRQoL of patients with coronary heart disease [37, 38]. Supervised hospital-based CRPs were shown to be superior to unsupervised home-based programmes. However, if supervised, home-based CRPs showed only little difference with hospital-based cardiac rehabilitations [13, 39]. The positive effects of CRPs on HRQoL of MI patients were found to be independent from the cost and duration of these programmes [32]. Similarly, a systematic review that compared home- versus hospital-based CRPs suggested that home-based CRPs are safe and effective on many patient and disease outcomes of cardiac patients including quality of life [40]. Moreover, a study that conduced cost analysis on CRPs found that hospital-based CRP costed an average US$21,298, while the cost for home-based CRP and no programme was estimated to be US$13,246 and US$12,433, respectively [13]. Therefore, home-based CRPs may be a better option for some patients.

In addition, the available evidence suggests that exercise is an important element of CRPs, which positively affects HRQoL of patients with MI [16, 39]. Similarly, a systematic review revealed that most of the exercise-based cardiac rehabilitation programmes promised improvements in QoL of patients with coronary heart disease including patients with MI [37]. In particular, Tai Chi exercise had positive effects on post-menopausal female patients with coronary heart disease, as this exercise is designed similarly to walking exercises with low–moderate intensity [41]. Therefore, it is important that cardiac rehabilitation programmes be based upon moderate-intensity exercise. However, the effects of exercise intensity on HRQoL in patients with MI need further investigation. While Benetti et al. [16] demonstrated a superior effect from high-intensity exercise, a more outdated study conducted by Worcester et al. [42] suggested no significant difference in HRQoL scores between patients who participated in low-intensity and high-intensity exercises. In their study, Worcester et al. [42] described the high-intensity exercise programme as consisting of three 1-hour sessions per week delivered by a teacher of physical education and a doctor, while the low-intensity exercise programme included two 1-hour sessions per week of light calisthenics and intermittent exercise [42]. To sum up, although there is no strong evidence to support or reject the effects of exercise intensity on HRQoL, exercise is crucial for successful interventional programmes.

Other behavioural interventions including patient education and counselling, psychological, and cognitive interventions also showed potential to improve QoL of patients with MI. Goal setting and goal attainment [34], telephone individual patient counselling [32], group counselling [33], and expressing writing [35] were found to positively affect QoL of MI.

The studies reviewed mainly used a generic tool to assess HRQoL in the target patient population. This is in line with the overall fact that specific instruments are less likely to be used than generic tools [29]. Generic tools have the advantage of being applied to a wider range of individuals from full health to death. This feature enables comparison of QoL scores across diseases and the normal population. Nevertheless, disease-specific measurements are apt for assessing HRQoL in a specific population [43]. These tools are more sensitive to treatment effects among a specific population group [44]. Although it is found that the SF-36 and the Mac New Quality of Life Questionnaire were found to be the most commonly used generic and disease-specific tools, respectively, for measuring HRQoL of patients with MI [45], the disease-specific instruments can better reflect the effects of interventions on HRQoL in this patient population. Thus, their use should be encouraged in studies that aim to follow the changes in HRQoL of MI over time or evaluate the effects of a particular intervention or treatment.

The findings of this review indicate that interventions usually improve some, not all, dimensions of the HRQoL, suggesting that a combination of interventions may be necessary to improve multiple dimensions of HRQoL. Additionally, there is a need for development of interventions that can result in a sustainable improvement in HRQoL of patients with MI. Long-term supportive programmes, as opposed to one-off interventions, might lead to a superior and long-lasting improvement in HRQoL of MI patients.

In this review, the studies evaluated CRP and other interventions with a range of duration from 1 to 18 months. Most interventions lasted a short term up to 6 months and usually showed positive effects on HRQoL of participants with MI [19]. Likewise, in a systematic review about QoL among CHD patients, most of the exercise-based cardiac rehabilitation programmes promised improvements with duration of programmes ranging from 1 to 12 months, where the frequency differed from one to seven sessions per week of 20–90 min length [37]. The included studies mostly examined the short-term effects of behavioural interventions on HRQoL of patients with MI and found positives results. The long-term effects of these interventions are unclear, however. Future studies should focus on evaluating the long-term effects of the cardiac rehabilitation programmes, counselling, and other behavioural interventions on HRQoL of patients with MI.

The effects of behavioural interventions on quality of life of MI patients were predominately studied on male participants. This is consistent with the fact that the incident rate of MI is higher in males than in females [46]. However, several studies reported that female patients showed more impaired HRQoL than their male counterparts within the first year after MI [47–50]. It is necessary to understand the reasons why women report poorer HRQoL than men and whether particular dimensions of HRQoL are more affected in women. This understanding is required to develop and test targeted invitations aiming to reduce gender disparities in the experience of QoL in patients with MI.

Since HRQoL is subjective, studies rely on self-report measurements and must be aware of potential bias based on self-assessment [13, 51]. In addition, there were several limitations such as the small sample size, the considerable proportion of excluded patients, and the absence of a blinded condition. For instance, the effectiveness of expressive writing has not yet been widely proved, and thus, assessment of various interventions should be conducted with a larger sample size of the patient population.

Limitations

Despite our comprehensive methods, it is difficult to ascertain how many studies we did not include in this review. Additionally, limiting our search strategy to English-language articles and excluding grey literature may have resulted in under-representation of research from regions outside English-speaking countries.

This narrative review cannot quantify the effect size of QOL interventions for patients with MI. Therefore, the review is not able to recommend what is the best intervention to improve QoL in these patients. A rigorously conducted meta-analysis is needed to determine the precise effects of the available interventions [52].

Conclusion

Most CRPs and other behavioural interventions improved the HRQoL of patients with MI. Interventions that help increase patients' functional and psychosocial wellbeing should be introduced before long after discharge from hospital to promote patients' overall health and quality of life.

Implications

Patients with MI should be encouraged to participate in programmes that can help promote their HRQoL.

Compliance with Ethical Standards

Conflict of interest Kyoungrim Kang declares that she has no conflict of interest. Leila Gholizadeh declares that she has no conflict of interest. Sally Inglis declares that she has no conflict of interest. Hae-Ra Han declares that she has no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

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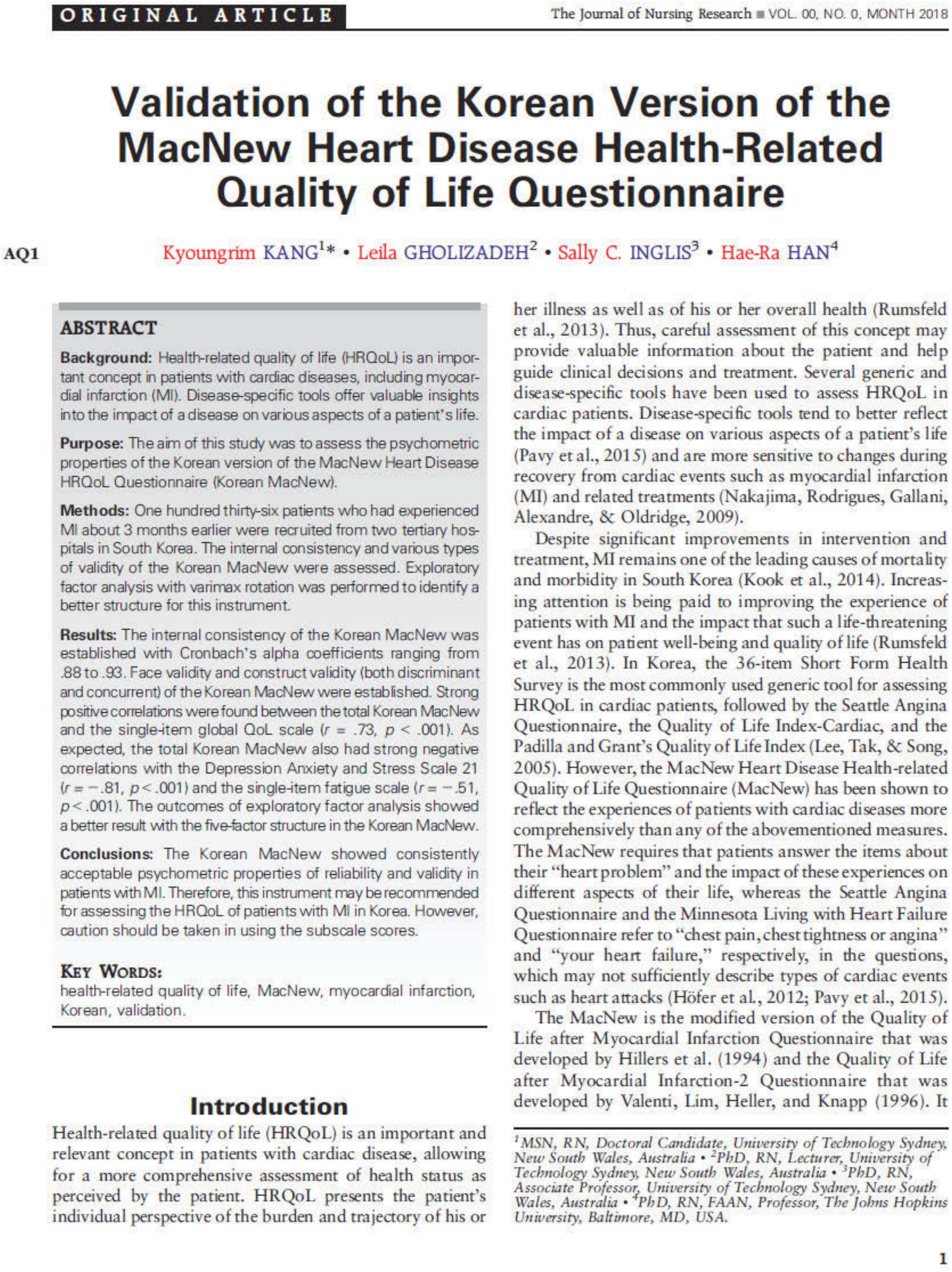
c. Validation of the Korean version of the MacNew heart disease health-related quality of life questionnaire



ORIGINAL ARTICLE

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Validation of the Korean Version of the MacNew Heart Disease Health-Related Quality of Life Questionnaire

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ABSTRACT

Background: Health-related quality of life (HRQoL) is an important concept in patients with cardiac diseases, including myocardial infarction (MI). Disease-specific tools offer valuable insights into the impact of a disease on various aspects of a patient's life.

Purpose: The aim of this study was to assess the psychometric properties of the Korean version of the MacNew Heart Disease HRQoL Questionnaire (Korean MacNew).

Methods: One hundred thirty-six patients who had experienced MI about 3 months earlier were recruited from two tertiary hospitals in South Korea. The internal consistency and various types of validity of the Korean MacNew were assessed. Exploratory factor analysis with varimax rotation was performed to identify a better structure for this instrument.

Results: The internal consistency of the Korean MacNew was established with Cronbach's alpha coefficients ranging from .88 to .93. Face validity and construct validity (both discriminant and concurrent) of the Korean MacNew were established. Strong positive correlations were found between the total Korean MacNew and the single-item global QoL scale (r = .73, $p < .001$). As expected, the total Korean MacNew also had strong negative correlations with the Depression Anxiety and Stress Scale 21 ($r = -.81$, $p < .001$) and the single-item fatigue scale ($r = -.51$, $p < .001$). The outcomes of exploratory factor analysis showed a better result with the five-factor structure in the Korean MacNew.

Conclusions: The Korean MacNew showed consistently acceptable psychometric properties of reliability and validity in patients with MI. Therefore, this instrument may be recommended for assessing the HRQoL of patients with MI in Korea. However, caution should be taken in using the subscale scores.

KEY WORDS:
health-related quality of life, MacNew, myocardial infarction, Korean, validation.

Introduction

Health-related quality of life (HRQoL) is an important and relevant concept in patients with cardiac disease, allowing for a more comprehensive assessment of health status as perceived by the patient. HRQoL presents the patient's individual perspective of the burden and trajectory of his or her illness as well as of his or her overall health (Rumsfeld et al., 2013). Thus, careful assessment of this concept may provide valuable information about the patient and help guide clinical decisions and treatment. Several generic and disease-specific tools have been used to assess HRQoL in cardiac patients. Disease-specific tools tend to better reflect the impact of a disease on various aspects of a patient's life (Pavy et al., 2015) and are more sensitive to changes during recovery from cardiac events such as myocardial infarction (MI) and related treatments (Nakajima, Rodrigues, Gallani, Alexandre, & Oldridge, 2009).

Despite significant improvements in intervention and treatment, MI remains one of the leading causes of mortality and morbidity in South Korea (Kook et al., 2014). Increasing attention is being paid to improving the experience of patients with MI and the impact that such a life-threatening event has on patient well-being and quality of life (Rumsfeld et al., 2013). In Korea, the 36-item Short Form Health Survey is the most commonly used generic tool for assessing HRQoL in cardiac patients, followed by the Seattle Angina Questionnaire, the Quality of Life Index-Cardiac, and the Padilla and Grant's Quality of Life Index (Lee, Tak, & Song, 2005). However, the MacNew Heart Disease Health-related Quality of Life Questionnaire (MacNew) has been shown to reflect the experiences of patients with cardiac diseases more comprehensively than any of the abovementioned measures. The MacNew requires that patients answer the items about their "heart problem" and the impact of these experiences on different aspects of their life, whereas the Seattle Angina Questionnaire and the Minnesota Living with Heart Failure Questionnaire refer to "chest pain, chest tightness or angina" and "your heart failure," respectively, in the questions, which may not sufficiently describe types of cardiac events such as heart attacks (Höfer et al., 2012; Pavy et al., 2015).

The MacNew is the modified version of the Quality of Life after Myocardial Infarction Questionnaire that was developed by Hillers et al. (1994) and the Quality of Life after Myocardial Infarction-2 Questionnaire that was developed by Valenti, Lim, Heller, and Knapp (1996). It

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is a valid and reliable questionnaire for assessing HRQoL in patients with a broad range of cardiac diseases, including angina, heart failure, and MI (Höfer, Lim, Guyatt, & Oldridge, 2004). The MacNew has been translated into a wide range of languages and is currently used in more than 50 countries. The psychometric properties of the tool have been validated in patients with MI and other cardiac conditions in 20 languages (MacNew.org, 2016). However, the Korean MacNew had not yet been validated. The aim of this study was to translate the MacNew into Korean and then assess the reliability, validity, and factor structure of the tool in terms of measuring HRQoL in Korean patients with MI.

Methods

Settings and Subjects

This study was implemented as part of a larger observational longitudinal study that aimed to examine changes in HRQoL after MI and to identify factors affecting HRQoL in the patient population with MI. The study was conducted at the cardiovascular centers of two major tertiary referral hospitals in the southern part of South Korea. Patients admitted to these centers were consecutively recruited from August 2015 to February 2016 and were followed up for 3 months after discharge. The inclusion criteria were patients who were (a) admitted to a cardiac department with a diagnosis of MI (either STEMI or NSTEMI), (b) able to understand and speak Korean, (c) living in Korea, and (d) able to understand the study and provide informed consent.

AQ2

Two hundred fifteen patients were screened in accordance with the inclusion criteria. One hundred fifty patients (69.8%) gave informed consent to participate and completed the study questionnaires at baseline and after 3 months. Of the screened patients, 65 were not recruited because of poor health conditions (*n* = 23), having declined without providing a reason (*n* = 19), inadequate hearing (*n* = 17), being discharged before enrollment (*n* = 5), or being unconscious (*n* = 1). The categories of poor health condition included experiencing dyspnea, pain on the site of intervention, severe tremors, and tiredness. By the time of the follow-up, four of the 150 participants had died and 10 were lost to follow-up. As a result, 136 participants completed the study questionnaires, including the Korean MacNew, at the 3-month follow-up.

Study Procedure

The ethics approval of each institutional review board was obtained before recruiting participants. After participants had signed the consent form, they were asked to complete the self-report questionnaires in the Korean language. Clinical data on the participants were retrieved from medical records. Nursing staff and cardiologists collaborated and provided counseling on recruiting study participants and collecting medical records. At 3 months after hospital discharge, either a follow-up telephone interview was carried out with each participant or participants were asked to complete the follow-up questionnaires in a face-to-face session when they attended the outpatient department as part of their routine care.

Measurements

The study questionnaires included key sociodemographic questions such as age, gender, marital status, and self-evaluated income (excellent, good, only fair, and poor) and questions about clinical characteristics, including recurrent MI (yes/ no) and physical activity (active/relatively active/not active).

This study used the Korean MacNew. The original MacNew consists of 27 items, which assess the perceived emotional (14 items), physical (13 items), and social functioning (13 items) status of cardiac patients over the previous 2-week period, with some items included in multiple subscales. Each item is scored on a 7-point Likert scale ranging from 1 to 7, with higher scores indicating better HRQoL. The total score of the MacNew is calculated as the average of the 27 items, and domain scores are the average of the items in each subscale, with a possible score range between 1 and 7. Missing items are excluded from scoring, and the 27th item may be excluded in the physical domain (Dixon, Lim, & Oldridge, 2002).

For the purpose of this study, the tool was translated into Korean following the guidelines suggested by Guillemin, Bombardier, and Beaton (1993). To obtain a quality translation, the principal researcher, who has significant experience translating English texts into Korean, first translated the instrument into Korean. Back-translation was then carried out by two bilingual experts who had not seen the questionnaire previously. Differences in the translations were discussed, and agreement was reached on the final version. The Korean MacNew was next reviewed for face validity by three Korean health professionals in the field of cardiovascular disease and five laypersons.

The Depression Anxiety and Stress Scale (DASS 21), the single-item fatigue scale, and the single-item global quality of life scale were used to assess the concurrent construct validity of the Korean MacNew. It was hypothesized that the MacNew total score would correlate significantly and closely with the DASS 21 (McDonnell, Mackintosh, Hillier, & Bryan, 2014). The DASS 21, the short form of the DASS 42, is designed to measure the severity of the core symptoms of depression, anxiety, and stress. This scale consists of 21 items, with each item scored from 0 = *does not apply to me at all* to 3 = *applies to me very much or most of the time*. Higher total scores on the DASS 21 represent greater emotional distress. Past research shows a strong positive relationship between the experience of depression and poorer HRQoL in patients with MI (McDonnell et al., 2014; Moryś, Bellwon, Höfer, Rynkiewicz, & Gruchała, 2016). The DASS 21 has been widely used in Asian countries, and a Korean version is available (Cha, 2014). This study further hypothesized that the MacNew total score would correlate significantly and closely with the single-item fatigue scale (Alsén &

Brink, 2013; Casillas, Damak, Chauvet-Gelinier, Deley, & Ornetti, 2006; Hwang, Liao, & Huang, 2014). The single-item fatigue scale is a valid tool with response options ranging from 0 = *no fatigue* to 10 = *greatest possible fatigue* (H. J. Kim & Abraham, 2017).

In addition, this study expected to find a significant correlation between the MacNew global scale with the single-item quality of life scale (de Boer et al., 2004), as both measure the same construct. The single-item quality of life scale has proved to be a valid tool with response options ranging from 0 = *the worst it has ever been* to 10 = *the best it has ever been* (de Boer et al., 2004). On the basis of past literature, this study hypothesized that the MacNew scores would correlate negatively with the DASS (McDonnell et al., 2014; Moryś et al., 2016) and the fatigue scores (Alsén & Brink, 2013; Casillas et al., 2006; Hwang et al., 2014), but positively with the single-item quality of life score (Alsén & Brink, 2013; de Boer et al., 2004; Wang, Thompson, Ski, & Liu, 2014).

Ethical Considerations

Ethical approvals were obtained from the relevant research ethics committees before commencement of the study (PNUH-IRB no. H-1505-008-029, PNUYH IRB no. 05-2015-072, and UTS HREC approval no. 2015000254). The researcher provided verbal and written information about the study and its objective to the participants and assured them of their voluntary participation, confidentiality, and privacy. Informed consent was obtained from all participants.

TABLE 1.

Sociodemographic and Clinical Characteristics of the Study Participants (N = 136)

Characteristic	*n*	%
Age (years; *M* and *SD*)	64.35	11.61
<65	67	49.3
≥65	69	50.7
Gender		
Female	36	26.5
Male	100	73.5
Marital status		
Married	119	87.5
Never married, separated, divorced, or widowed	17	12.5
Physical activity		
Active	39	28.7
Relatively active	29	21.3
Not active	68	50.0
Self-evaluated income		
Excellent	3	2.2
Good	15	11.0
Only fair	82	60.3
Poor	36	26.5
Recurrent MI		
Yes	30	22.1
No	106	77.9

Note. Age range is 21–86 years. MI = myocardial infarction.

Statistical Analyses

The follow-up data of 136 participants were analyzed for the present validation study using IBM SPSS Statistics 24. Characteristics of the participants were described in terms of frequencies, means, and standard deviations (Table 1). The psychometric properties of the Korean MacNew were assessed in accordance with the recommendations of the Scientific Advisory Committee of the Medical Outcomes Trust (2002). Specifically, two steps of factor analysis were conducted. First, partial confirmatory factor analysis (PCFA) with direct oblimin rotation (maximum likelihood) was performed to determine if the items loaded similarly to the theoretically clear structure in three factors of the original version (Valenti et al., 1996). Second, exploratory principal component factor analysis (EFA) with varimax rotation was carried out to identify a better structure for the Korean MacNew. Twenty-six items were included, and Item 27 was excluded in the factor analysis based on the original report (Valenti et al., 1996). The suitability of data for factor analysis was assessed by .30 and higher in the correlation matrix, the recommended value of .60 in the Kaiser–Meyer–Olkin value, and the significance ($p < .001$) in the Bartlett's test of sphericity. The values of evaluating the CFA model fit required higher than .950 of the normed fit index, comparative fit index, and Tucker–Lewis index as well as <.06 or <.08 of root mean square error of approximation and standardized root mean square residual.

The Cronbach's α coefficient was used to examine the internal consistency of the overall tool and of each dimension. The emotional subscale included Items 1–8, 10, 12, 13, 15, 18, and 23; the physical subscale included Items 1, 6, 9, 12, 14, 16, 17, 19, 20, 21, and 24–26; and the social subscale included Items 2, 11–13, 15, 17, and 20–26. The concurrent construct validity of the Korean MacNew was assessed by calculating the Pearson correlation coefficients of the total score of the MacNew with the DASS, with the single-item fatigue scale, and with the single-item global quality of life scale, respectively. The strength of the correlations was considered weak when $r = .10$–$.29$, medium when $r = .30$–$.49$, and strong when $r = .50$–1.0 (Pallant, 2016). Discriminant validity was determined via assessment of the ability of the Korean MacNew to discriminate between men and women, different age groups, and levels of physical activity. We hypothesized that the HRQoL of the participants would be poorer if they were female, older in age, and less active. Gender (Lim et al., 1993; Valenti et al., 1996) and age (H. M. Kim, Kim, & Hwang, 2015; Ogińska-Bulik, 2014; Valenti et al., 1996) have been used in previous studies to assess the discriminant construct validity of the

MacNew. In addition, evidence has shown that patients who are less physically active tend to have a poorer quality of life than their more active peers (Hawkes et al., 2013).

Results

The sociodemographic and clinical characteristics of the study participants are presented in Table 1. The sample had a mean (*SD*) age of 64.35 (11.61) years. Most of the sample were male (73.5%), were married (87.5%), and earned a "fair" level of income (60.3%). Moreover, most were experiencing MI for the first time (77.9%) and were physically not active or only relatively active (71.3%).

The PCFA with direct oblimin rotation was applied to help interpret the factor loading of each of 26 items of the MacNew on the three factors in the original version (Valenti et al., 1996), explaining 50.2% of the total variance (see Table 2). Most of the items loaded on the similar factor of the original study at more than .4, although six items loaded at between .3 and .4. Specifically, four of the 26 items in the Korean MacNew loaded on unexpected factors. Item 16 (aching legs) loaded on the social factor instead of the physical factor, whereas Item 21 (unsure about exercise), Item 22 (overprotective family), and Item 24 (excluded) loaded on the emotional factor rather than the physical or social factor. In addition, except for standardized root mean square residual (.055),

TABLE 2.
Partial Confirmatory Factor Analysis With Direct Oblimin Rotation of the Korean MacNew (N = 136)

		The MacNew Domain					
		Emotional		Physical		Social	
MacNew Item		Korean	Original	Korean	Original	Korean	Original
1	Frustrated	.78	.79				
2	Worthless	.49	.74			.47	.42
3	Confident	.43	.61				
4	Down in the dumps	.74	.86				
5	Relaxed	.57	.79				
6	Worn out		.59	.31	.52		
7	Happy with personal life	.49	.73				
8	Restless	.69	.81				
9	Short of breath			.44	.73		
10	Tearful	.38	.72			.37	
11	More dependent					.60	.62
12	Social activities	.30	.40		.46	.40	.52
13	Others/less confident in you	.63	.45				.66
14	Chest pain			.39	.72		
15	Lack of self-confidence		.67			.66	.47
16	Aching legs				.44	.41	
17	Sports/exercise limited			.78	.60		.61
18	Frightened	.52	.63				
19	Dizzy/light-headed			.44	.61		
20	Restricted or limited			.82	.64		.62
21	Unsure about exercise	.43			.47		.48
22	Overprotective family	.34					.69
23	Burden on others		.44	.31		.90	.66
24	Excluded	.37			.43		.74
25	Unable to socialize	.36		.39	.46		.68
26	Physically restricted	.78		.90	.60		.65
Variance explained (%)		39.1	28.1	6.7	17.2		21.4

other values of normed fit index (.784), comparative fit index (.879), Tucker–Lewis index (.843), and root mean square error of approximation (.082) did not meet the requirements in the three-factor structure.

To examine the factor structure of the Korean MacNew, the data on the 26 items were subjected to EFA. The inspection of the correlation matrix revealed the presence of many coefficients at higher than .30 and .89 of the Kaiser–Meyer–Olkin value and that Bartlett's test of sphericity reached significance ($p < .001$), supporting the factorability of the data. The results of rotation sums of squared loadings in the EFA presented the five-factor structure, explaining 64.9% of the total variance (Table 3). Half of the 26 items loaded on more than one factor, and the first three factors explained about 50% of the variance.

The internal consistency of the global scale was high, with a Cronbach's alpha coefficient of .93. In addition, coefficients of emotional, physical, and social subscales, allocated as the original study (Valenti et al., 1996), were examined as indicated by .92, .88, and .91, respectively.

The concurrent construct validity of the Korean MacNew was supported by showing strong negative correlations between the global MacNew and DASS 21 ($r = -.81$, $p < .001$) and between the global score and the single-item fatigue scale ($r = -.51$, $p < .001$). Furthermore, there were significant positive correlations between the total MacNew score and the single-item global quality of life scale ($r = .73$, $p < .001$).

The discriminant validity of the Korean MacNew was further supported by examining the discriminant function of the tool across different age groups, gender groups, and physical activity groups. Patients ≥ 65 years old showed lower HRQoL than those < 65 years old (5.34 vs. 5.74, respectively; $p = .002$). Moreover, the Korean MacNew discriminated well between female and male, with female patients showing poorer HRQoL than male patients (5.20 vs. 5.66, respectively; $p = .002$). The differences in the

TABLE 3.

Exploratory Principal Component Factor Analysis of the Korean MacNew (N = 136)

MacNew Item		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
23	Burden on others	.81				
15	Lack of self-confidence	.77				
2	Worthless	.71				
11	More dependent	.71				
10	Tearful	.63		.40		
4	Down in the dumps	.62		.58		
12	Social activities	.62	.40			
13	Others/less confident in you	.55			.46	
16	Aching legs	.54				.49
24	Excluded	.53	.45			
7	Happy with personal life	.52		.47		
26	Physically restricted		.84			
20	Restricted or limited		.82			
17	Sports/exercise limited		.76			
9	Short of breath		.59			
19	Dizzy/light-headed		.58			
14	Chest pain		.52			
25	Unable to socialize		.51			
1	Frustrated			.69	.42	
5	Relaxed			.58		
18	Frightened		.42	.47		.42
6	Worn out		.40	.46		
22	Overprotective family				.81	
8	Restless			.48	.58	
3	Confident	.50				.59
21	Unsure about exercise				.43	.54
Variance explained (%)		20.9	17.7	11.6	8.4	6.3

MacNew scores among patients who were more active, relatively active, and not active (5.82, 5.81, and 5.19, respectively; $p < .001$) were statistically significant, indicating that the discriminant concurrent validity for the Korean MacNew was well confirmed.

Discussion

The self-evaluation of patients regarding the impact of disease on their daily functionality and quality of life is important to facilitate patient-centered care and to improve disease and patient outcomes. HRQoL has been an important patient-reported health outcome in consideration of its prediction of mortality, recurrence of cardiovascular events, and rehospitalization among patients with cardiovascular diseases, particularly MI (Anker et al., 2014). The MacNew is one of the most popular disease-specific questionnaires for assessing HRQoL in cardiac patients (MacNew.org, 2016). The current study showed that the Korean MacNew is also reliable and valid for measuring HRQoL in patients with MI.

The Cronbach's alpha coefficients of the Korean MacNew in the current study were high, with .93 for the overall score and .92, .88, and .91 for the emotional, physical, and social subscales, respectively. These results are consistent with prior internal consistency studies, with the average internal consistency reliability coefficients for the total, emotional, physical, and social domains reported as .93, .92, .86, and .88, respectively, across 23 validation studies conducted on different language versions of the MacNew (Höfer et al., 2004, 2012; Pavy et al., 2015; Wang, Lau, Palham, Chow, & He, 2015). The concurrent construct validity and discriminate construct validity of the Korean MacNew were also supported. Therefore, the Korean MacNew showed high reliability and validity for assessing HRQoL in patients with MI.

When performing PCFA with the direct oblimin rotation solution to determine if items loaded similarly to the theoretically clear structure on the three factors in the original version (Valenti et al., 1996), all of the 26 items in the Korean MacNew met the threshold standard for item AQ3 retainment and most loaded on the same factors as in the original study. The physical and social factors explained only 6.7% and 4.4% of the variance, respectively, whereas the emotional factor explained 39.1% of the variance. A few items loaded on a factor that differed from the original validation study. Thus, EFA was implemented to identify a better structure for the Korean MacNew, with the results revealing that the 26 items of the Korean MacNew were likely grouped into five factors.

In general, the results of previous validation studies on both English-language (Dempster, Donnelly, & O'Loughlin, 2004) and non-English-language patients with cardiac disease failed to support the item loading pattern (Gramm, Farin, & Jaeckel, 2012) that was reported in the original study. For example, Dempster et al. (2004) established a five-factor solution that included the factors of emotion, restriction, symptoms, perception of others, and social with a population of cardiac patients in Ireland (Dempster et al., 2004). These findings imply that the factor structure of the MacNew may need to be reviewed further.

Overall, the results of the current validation study suggest that the Korean MacNew is a valid and reliable tool for assessing HRQoL in patients with MI. However, we recommend that only the total score for the Korean MacNew be used at this stage, unless future studies with bigger sample sizes provide more consistent results on the pattern of item loadings on the individual subscales. Our study sample size of 136 may not be large enough to produce reliable results. Although some authors suggest that five cases for each item are adequate for a factor analysis in most cases, the typical recommendation has been that the larger sample size, the better the reliability and validity of analysis results (Tabachnick & Fidell, 2013).

Conclusions

The Korean MacNew showed consistently acceptable psychometric properties of reliability and validity in patients with MI. Therefore, this instrument may be used to assess HRQoL in Korean patients with MI to develop a better understanding of the health conditions of patients after MI and to evaluate the effectiveness of interventions and related treatments based on actual patient experiences. However, caution should be taken in using the subscale scores.

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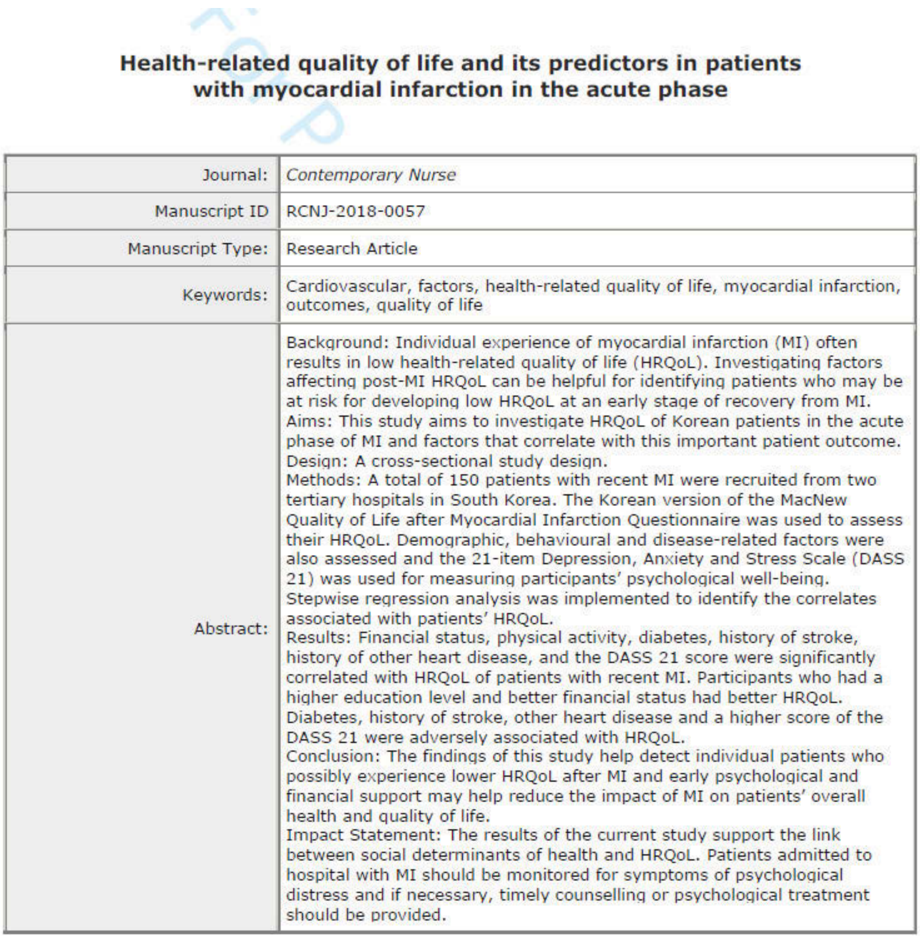
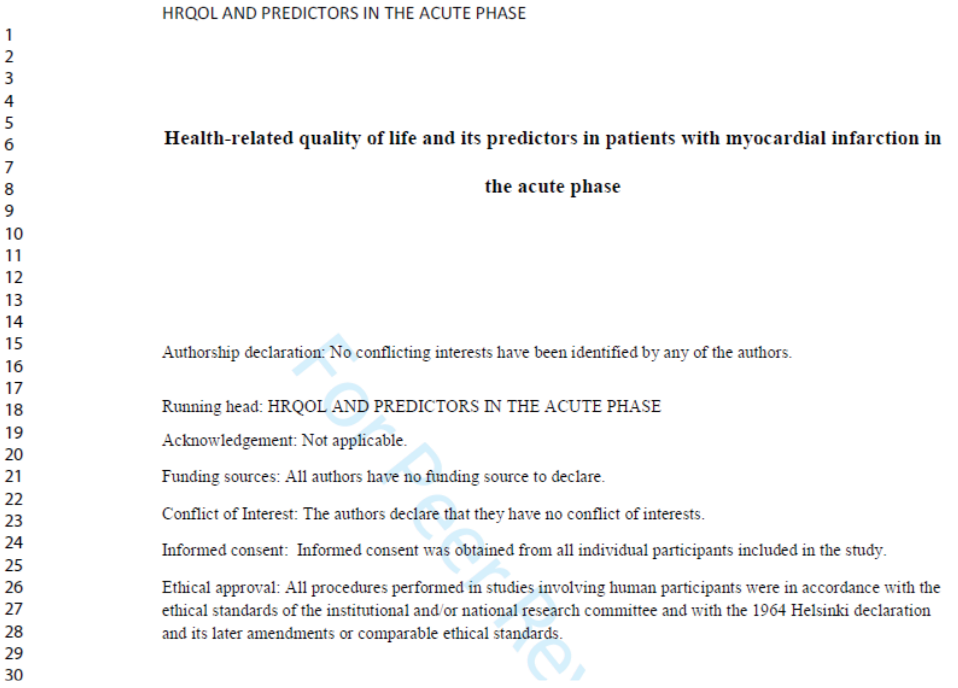
d. Health-related quality of life and its predictors in Korean patients with myocardial infarction in the acute phase



Health-related quality of life and its predictors in patients with myocardial infarction in the acute phase

Journal:	*Contemporary Nurse*
Manuscript ID	RCNJ-2018-0057
Manuscript Type:	Research Article
Keywords:	Cardiovascular, factors, health-related quality of life, myocardial infarction, outcomes, quality of life
Abstract:	Background: Individual experience of myocardial infarction (MI) often results in low health-related quality of life (HRQoL). Investigating factors affecting post-MI HRQoL can be helpful for identifying patients who may be at risk for developing low HRQoL at an early stage of recovery from MI. Aims: This study aims to investigate HRQoL of Korean patients in the acute phase of MI and factors that correlate with this important patient outcome. Design: A cross-sectional study design. Methods: A total of 150 patients with recent MI were recruited from two tertiary hospitals in South Korea. The Korean version of the MacNew Quality of Life after Myocardial Infarction Questionnaire was used to assess their HRQoL. Demographic, behavioural and disease-related factors were also assessed and the 21-item Depression, Anxiety and Stress Scale (DASS 21) was used for measuring participants' psychological well-being. Stepwise regression analysis was implemented to identify the correlates associated with patients' HRQoL. Results: Financial status, physical activity, diabetes, history of stroke, history of other heart disease, and the DASS 21 score were significantly correlated with HRQoL of patients with recent MI. Participants who had a higher education level and better financial status had better HRQoL. Diabetes, history of stroke, other heart disease and a higher score of the DASS 21 were adversely associated with HRQoL. Conclusion: The findings of this study help detect individual patients who possibly experience lower HRQoL after MI and early psychological and financial support may help reduce the impact of MI on patients' overall health and quality of life. Impact Statement: The results of the current study support the link between social determinants of health and HRQoL. Patients admitted to hospital with MI should be monitored for symptoms of psychological distress and if necessary, timely counselling or psychological treatment should be provided.



Health-related quality of life and its predictors in patients with myocardial infarction in the acute phase

Authorship declaration: No conflicting interests have been identified by any of the authors.

Running head: HRQOL AND PREDICTORS IN THE ACUTE PHASE

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Conflict of Interest: The authors declare that they have no conflict of interests.

Informed consent: Informed consent was obtained from all individual participants included in the study.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

ABSTRACT

Background: Individual experience of myocardial infarction (MI) often results in low health-related quality of life (HRQoL). Investigating factors affecting post-MI HRQoL can be helpful for identifying patients who may be at risk for developing low HRQoL at an early stage of recovery from MI.

Aims: This study aims to investigate HRQoL of Korean patients in the acute phase of MI and factors that correlate with this important patient outcome.

Design: A cross-sectional study design.

Methods: A total of 150 patients with recent MI were recruited from two tertiary hospitals in South Korea. The Korean version of the MacNew Quality of Life after Myocardial Infarction Questionnaire was used to assess their HRQoL. Demographic, behavioural and disease-related factors were also assessed and the 21-item Depression, Anxiety and Stress Scale (DASS 21) was used for measuring participants' psychological well-being. Stepwise regression analysis was implemented to identify the correlates associated with patients' HRQoL.

Results: Financial status, physical activity, diabetes, history of stroke, history of other heart disease, and the DASS 21 score were significantly correlated with HRQoL of patients with recent MI. Participants who had a higher education level and better financial status had better HRQoL. Diabetes, history of stroke, other heart disease and a higher score of the DASS 21 were adversely associated with HRQoL.

Conclusion: The findings of this study help detect individual patients who possibly experience lower HRQoL after MI and early psychological and financial support may help reduce the impact of MI on patients' overall health and quality of life.

Impact Statement: The results of the current study support the link between social determinants of health and HRQoL. Patients admitted to hospital with MI should be monitored for symptoms of psychological distress and if necessary, timely counselling or psychological treatment should be provided.

Keywords: Cardiovascular; factors; health-related quality of life; myocardial infarction; outcomes; quality of life.

INTRODUCTION

Cardiovascular disease (CVD) remains the number one killer of both men and women worldwide (Go et al., 2014). Similar to the international trends, CVD is a serious health concern in Korea. As the second leading cause of death in the country, CVD mortality has steadily increased since 2004 (Shin et al., 2016). Among CVD patients, those who experience myocardial infarction (MI) are at higher risk of subsequent physical consequences such as malignant arrhythmias, reduced left ventricular function, and adverse psychological reactions (Hawkes et al., 2013). The physiological and psychological impact of MI, often with sudden onset and hospitalisation, negatively affect the overall health and health-related quality of life (HRQoL) of patients at the acute stage of post-MI (W. Wang, Thompson, Ski, & Liu, 2014).

The American Heart Association recommends HRQoL to be routinely assessed as a part of health status evaluation among patients with CVD (Rumsfeld et al., 2013). HRQoL is a subjective patient reported outcome that presents comprehensive assessment of patients' health status and the impact of a life threatening event such as MI on patients' overall health and well-being (Anker et al., 2014), leading to a better understanding of patients' experience and recovery from MI (Lidell et al., 2015). This multidimensional concept can be useful for predicting future cardiac events, rehospitalisation, mortality among MI patients and help inform treatment decisions (Rumsfeld, et al., 2013). The impact of the illness on HRQoL may be particularly evident in the early stages of MI, when patients are admitted to the cardiovascular centre shortly after MI. Those who are hospitalised less than a week following MI had significantly lower HRQoL than at the three-month follow-up (Uysal and Özcan, 2012).

There were many studies of correlates or predictors of HRQoL in patients with MI from various countries, yet the results were inconsistent throughout the variables. For instance, in a study, older age and being male predicted higher HRQoL (Arnold et al., 2013), whereas another study showed younger age and being female were related to better HRQoL (Oginska-Bulik, 2014). Moreover, depression more commonly appears in patients after MI than in the general population and worsens cardiovascular morbidity and mortality (Lichtman et al., 2008), while anxiety also negatively influences prognosis of MI, increasing mortality and cardiovascular risk (Rafael, Simon, Drótos, & Balog, 2014; Wenru Wang et al., 2016). However, the literature is scarce in relation to Korean patients' HRQoL and its predictors, particularly at the early stage of recovery from MI. Identifying factors influencing HRQoL can be helpful in detecting vulnerable patients who may have lower HRQoL in the early stages and developing strategies to reduce the impact of MI on patient experience and health status

(Hawkes, et al., 2013). This study aims to investigate HRQoL of Korean patients with MI in the acute phase and identify its predictors in this population.

METHODS

Design

This study adopted a cross-sectional study design with using questionnaires and medical records to assess participants' HRQoL and to identify its predictors among patients with MI in South Korea.

Participants and setting

The study was conducted at the cardiovascular centres of two major tertiary referral hospitals in the southern part of South Korea. Consecutive patients admitted to the cardiovascular centres were recruited from August 2015 to February 2016. They were asked to participate in the study if they: 1) were admitted to a cardiac department with a diagnosis of MI (either STEMI or NSTEMI); 2) were able to understand and speak Korean; 3) resided in South Korea; and 4) had the ability to understand the study and provide an informed consent. The patients' competence to sign the consent and complete the research questionnaires as well as cognitive status were assessed using the following steps (Caruana, 2016): 1) a nurse who was taking care of the patient confirmed that patient had the ability to provide an informed consent to the study; 2) all patients were asked to state their names at the time of screening; 3) each patient was asked to correctly state the colour when they were shown one of three coloured papers. Patients were excluded if they had cognitive impairment or were participating in other interventional studies, which could influence their HRQoL at the time this study was being conducted. However, no patients were involved in an interventional study.

Sample size was estimated before data collection, taking into account 15 variables, assumed to affect HRQoL in patients with MI based on previous literature. The formula by Tabachnick and Fidell (the number of cases needed > 50+8 x the number of independent variables) was used for sample size calculation (Pallant, 2016). The sample size expected was 170 participants. A total of 215 patients were screened for the study inclusion and exclusion criteria, of which 150 patients (69.8%) were enrolled in this study. Participants completed the study questionnaires about one week after experience of MI. Sixty-five patients did not participate in the study due to being unconscious (n=1), refusal due to poor health condition (n=23), inadequate hearing (n=17), declined without any reason (n=19), or discharged before enrolment (n=5). Patients who refused to participate in the study due to poor health condition mentioned reasons such as experiencing dyspnoea, pain at the site of intervention, severe tremor, or tiredness.

Study procedure

After the ethics approval of each Institutional Review Board was obtained, patients were recruited from two tertiary hospitals. In consultations with cardiologists and nurse managers at the participating hospitals, the study invitation letters were distributed to potential participants hospitalised in the units and they were invited to participate. The information letter outlined the aim of the research and the description of the process that the researcher followed to collect data. Study participants who signed the consent form completed self-report questionnaires in a place that was comfortable, private, quiet and free from distractions. A student investigator monitored the condition or stress of the participants while they were answering questions. Clinical data of the participants were obtained from medical records.

Research instruments

Demographical, behavioural and disease-related profile

A questionnaire was developed for the purpose of the study to collect information on demographical, behavioural and disease-related characteristics of the participants. For the selection of independent variables, previous articles on factors or predictors of HRQoL exclusively in patients with MI were thoroughly reviewed and the revised Wilson & Cleary model for HRQoL (Ferrans, Zerwic, Wilbur, & Larson, 2005) was adopted as an additional guidance.

The questionnaire included questions about age, gender, marital status, the level of education, current employment status, and perceived financial situation. Information on the health behaviour profile of the participants was also collected including physical activity level prior to MI, smoking, alcohol consumption, and medical history. Physical activity was measured as having 'at least 30 minutes moderate physical activity most or all days of the week', 'less than 30 minutes moderate physical activity less than 5 days in a week' or 'not physically active'. Smoking status was assessed as being a current smoker, a previous smoker or non-smoker. Participants were asked if they were regularly consumed alcohol prior to their recent hospital admission. The disease-related profile was collected from the medical records of the participants after obtaining their consent and included: ST-elevation (NSTEMI/STEMI), personal history of high blood pressure, diabetes, stroke, other heart disease, previous MI and other comorbidities. These variables were selected based on the results of a thorough review of the literature on factors affecting HRQoL of MI patients.

Psychosocial profile: Depression, Anxiety, and Stress Scale (DASS 21)

Psychological distress including depression, anxiety and stress have been found to be important factors affecting HRQoL of patients with MI (Hosseini, Ghaemian, Mehdizadeh, & Ashraf, 2014). Thus, the current study considered measuring and examining the impact of these variables on HRQoL of Korean patients, using the Depression, Anxiety, and Stress Scale (DASS 21). The DASS 21 is the short form of the DASS 42, consisting of 21 items with each scoring from 0 (never) to 3 (almost always) and the total score for this scale ranging from 0 to 63. Higher scores on the scale reflect worse psychosocial status (S. H. Lovibond, Lovibond, & Psychology Foundation of Australia, 1995). DASS 21 was well-validated (P. F. Lovibond and Lovibond, 1995) and has been widely used in Western and Asian countries (Oei, Sawang, Goh, & Mukhtar, 2013) including the Korean version of the tool available (Cha, 2014). The total DASS 21 score was used and the alpha coefficient of this scale was 0.87 in the current study.

Korean version of the MacNew

After a thorough review of the available assessment tools, the MacNew Quality of Life after Myocardial Infarction Questionnaire (MacNew) was used to assess HRQoL of MI patients in the present study (Dixon, Lim, & Oldridge, 2002). The MacNew is one of the most popular disease-specific tools used to measure HRQoL of MI patients (Kang, Gholizadeh, Inglis, & Han, 2016). The MacNew consists of 27 items, which address HRQoL in three areas: physical (13 items), emotional (14 items), and social (13 items) subscales (Dixon, et al., 2002; Hevey and Wilczkiewicz, 2014). Each item is scored on a seven-point Likert response format ranging from 1 to 7. In addition, the total score of the MacNew can be calculated as the mean scores of the 27 items with a range of 1 to 7. A higher score on the scale indicates better HRQoL (Dixon, et al., 2002).

The MacNew has proven to be a highly valid and reliable instrument. Its reliability has been established by a number of studies with Cronbach's alpha coefficients ranging from between 0.87 and 0.97 (Williams, O'Connor, Grubb, & O'Carroll, 2012; Wrzesniewski and Wlodarczyk, 2012). For the purpose of this study, the Korean version of the MacNew was employed following the procedure described by Guillemin, Bombardier & Beaton (Guillemin, Bombardier, & Beaton, 1993); however, a series of factor analyses showed different factor structures from the original study by Valenti et al. (1996). Therefore, it is recommended to use only a global score of the Korean MacNew at this stage. The psychometric properties of this Korean version are presented in a separate study (Kang, Gholizadeh, & Han, 2018). The alpha coefficient for the total Korean MacNew was 0.90.

Ethical considerations

Ethics approvals were obtained from the Institutional Review Boards of both study sites (IRB no. H-1505-008-029 and IRB no. 05-2015-072) and the Human Research Ethics Committees of the university (HREC Approval No. 2015000254) prior to recruitment. Participants were informed that participation was voluntary and that they could withdraw from the study anytime without penalty. All ethical considerations met the international ethical standards of privacy and confidentiality. All enrolled patients signed the informed consent form prior to participation.

Statistical analyses

SPSS for Windows 24.0 was used to analyse the data. We used descriptive statistics including means, standard deviations (SD), frequencies and percentages to summarise the sample characteristics. The normality of the MacNew score was assessed and found to have normal distribution. As a preliminary analysis, an independent t-test or one-way analysis of variance (ANOVA) was used to decide which variables had an association with HRQoL and which of them were put into the first step of the regression model. The presence of multicollinearity was checked by tolerance, by variance inflation factor (VIF) and by correlations between the independent variables. Values of tolerance were higher than 0.10 and values of VIF were less than 10, indicating the absence of multicollinearity. In addition, Pearson correlation coefficients showed values of lower than 0.90, indicating no violation of multicollinearity (Pallant, 2016). Stepwise regression analysis was applied to identify predictors associated with HRQoL of patients with MI until the final model was figured. The variables were selected for putting into the first step of stepwise analysis based on a p value of 0.05 or less at the level of the bivariate analyses and were then subjected to stepwise regression analysis. The most insignificant variables were removed gradually at different steps. The level of significance of all statistical analyses implemented was set at $p<0.05$ and two-tailed.

RESULTS

Participant characteristics

Table 1 shows the participants' demographic, behavioural, disease-related and psychosocial characteristics as well as the breakdown of the MacNew scores according to these characteristics. The mean age of the participants was 64.63 years (SD=11.48) ranging between 21 and 86 years. The majority of the participants were over 55 years old (n=120, 80.0%), male (n=107, 71.3%), and married (n=129, 86.0%). More than half of the participants (n=85, 56.6%) had an education level of high school or above, and 40 per cent (n=60) were currently employed. Participants mostly self-evaluated their financial situation as "only fair" or "poor" (n=129, 86.0%), and approximately half of them (n=77, 51.3%) were not physically active. One third of the participants (n=50, 33.3%) were current smokers and about 30% (n=43, 28.7%) consumed alcohol. Participants diagnosed with non-ST-elevation MI (NSTEMI) were 59.3% (n=89) and ST-elevation MI (STEMI) patients 40.7% (n=61). In terms of CHD risk factors, half of the participants (n=75, 50.0%) had hypertension and approximately one-third diabetes (n=47, 31.3%). Several patients had a history of stroke (n=8, 5.3%) and 25 patients (16.7%) had a history of other heart disease such as valve disease or heart failure. A history of previous heart attack was present in 24.7% of participants. More than a third (n=58, 38.7%) had other comorbidities, including kidney problems and thyroid illness. The average total score of the MacNew among the 150 participants was 120.29 (SD=22.53) or 4.46 (SD=0.83) calculated by taking mean scores over 27 items and the average total score on the DASS 21 was 17.05 (SD=9.26). Among the 17 factors presented in Table 1, two factors—ST-elevation and other comorbidities—were not related to HRQoL of this patient population. Thus, those were excluded from the regression model.

Predictors of HRQoL

Table 2 provides the bivariate relationships as intercorrelations among the independent variables, testing the multicollinearity of the variables used in the regression model. Initially, 15 variables were subjected to the stepwise regression analysis, including age, gender, marital status, the level of education, employment status and perceived financial status as demographic factors; physical activity, smoking and alcohol consumption as behavioural factors; hypertension, diabetes, stroke, other heart disease and previous MI as disease-related factors; and the DASS 21 total score as the psychosocial factor. Six variables—financial status, physical activity, diabetes, history of stroke, history of other heart disease, and the DASS score—were significantly correlated with HRQoL among patients with MI. At the second step, the three most insignificant variables—age, gender and employment status—were eliminated. Among the demographic factors, the level of education and financial status remained statistically significant and among the behavioural factors, only physical activity remained significant. Hypertension and previous MI were not significantly related to HRQoL among this patient group, while the DASS 21 score showed a significant association. At the third step, after removing the most insignificant factors, which included marital status, alcohol consumption and previous MI, seven of the nine factors were significantly related to HRQoL. At the fourth step, these two insignificant factors were eliminated. The results of this step showed that physical activity did not have statistically significant association with HRQoL among the participants. At the fifth step when physical activity was removed, the final model of the current study was attained and the R^2 was 0.486 (F=22.570, p=0.000), indicating that this model explained 48.6% of the variance in HRQoL. Of the six demographic factors, only the level of education and patient-perceived financial status had a prediction in HRQoL of patients in the early days after MI. Participants who had a higher education level (β=0.228, t=3.688, p=0.000) and who had perceived better financial status (β=-0.169, t=-2.705, p=0.008) had better HRQoL. None of the three behavioural factors could predict HRQoL in this patient population, whereas there were three significant factors among the disease-related factors. Diabetes (β=-0.210, t=-3.480, p=0.001), the personal history of stroke (β=-0.150, t=-2.458, p=0.015) and history of other heart disease (β=-0.193, t=-3.207, p=0.002) were adversely associated with HRQoL. The total score of the DASS 21 steadily showed a statistically significant prediction for HRQoL throughout the steps (β=-0.442, t=-7.224, p=0.000 in the final model). A higher score of the DASS 21 was closely related to worse HRQoL among the participants in the present study. The results of the stepwise regression analysis are shown in Table 3.

DISCUSSION

This study aimed to investigate HRQoL of patients in the acute phase of MI and to identify the factors that influence this patient outcome. The average age of the participants in this study was 64.63±11.48 years, which was older than other studies recently conducted in other countries such as the US (Arnold, et al., 2013; Chhatriwalla et al., 2015), Iran (Hosseini, et al., 2014), European countries (Lidell, et al., 2015), Hungary (Rafael, et al., 2014), and China (Wenru Wang, et al., 2016; W. Wang, et al., 2014); however, it was similar to the previous study among Korean post-MI patients, which reported the mean age of 64.95±10.91 (Kim, Kim, & Hwang, 2015). The present study paid close attention to the acute phase of recovery (less than a week since MI), while other cross-sectional studies focused on longer periods, for example, 13 days after MI (W. Wang, et al., 2014), up to six months (Lidell, et al., 2015), more than a 12-month lapse from MI (Kim, et al., 2015), 15 days to 30 months from diagnosis (Wenru Wang, et al., 2016), and 2.81±2.62 years of the average time since MI (Oginska-Bulik, 2014).

The results of stepwise regression analysis revealed that education level, self-evaluated financial status, diabetes, history of stroke, history of other heart disease and total DASS21 score were significant predictors related to HRQoL in the early days after MI. As shown in Table 3, the final model at the fifth step accounted for 48.6% of the variance explained. Among the variables significantly associated with HRQoL, the DASS showed the highest standardised coefficient (β=-0.442), indicating the strongest relationship with the patient's subjective health outcome. Next, the level of education (β=0.228) and diabetes (β=-0.210) had the second and third closest association, followed by other heart disease (β=-0.193), financial status (β=-0.169), and a history of stroke (β=-0.150).

Education and self-evaluated financial status remained the only independent correlates of HRQoL among the demographic variables. These results are in line with previous similar studies that assessed HRQoL in patients with MI (Pettersen, Reikvam, Rollag, & Stavem, 2008; Wrzesniewski and Wlodarczyk, 2012). Education can be referred as a proxy of individual resources and social support. People who have a higher level of education tend to be more aware of risk factors in their health and to derive more from health-related education than those who have a relatively lower education level. Also, longer education periods can lead to wider social resources including financial and psychosocial support (Zimmerman and Woolf, 2014). To elevate patients' education level, further studies on social support in this Korean population would be needed to improve HRQoL among MI patients from a long-term viewpoint.

In addition, another demographic factor, namely financial status, showed a significantly positive relation among MI patients in this study. It has been consistently found that a higher income could predict higher HRQOL in previous literature (Arnold, et al., 2013; Kim, et al., 2015; Wenru Wang, et al., 2016). Similarly, in a study conducted in the general population in Korea, affluent participants reported better HRQoL (Hong, 2011). These results confirm the important role of the financial factor in an individual's health and provide the evidence base for the social determinants of health, as declared by the World Health Organisation (WHO, 2011). Health professionals can advise post-MI patients who have financial difficulties to contact social support services to discuss their financial situation.

Diabetes patients and those who had a history of stroke or other heart disease also showed worse HRQoL at the early stage of MI recovery. These are chronic conditions that can significantly affect various aspects of the patients' health and thus negatively affect the HRQoL outcome. Diabetes also can increase the risk of cardiac morbidity and mortality (Uchmanowicz, Loboz-Grudzien, Jankowska-Polanska, & Sokalski, 2013). It was previously found that diabetic patients with either NSTEMI or STEMI tended to have worse HRQoL than non-diabetic patients at the early stage of recovery (Uchmanowicz, et al., 2013). Supporting patients to effectively manage their chronic disease is thus important for improving their health outcomes and HRQoL.

In accordance with the results of the current study, it can be assumed that MI patients with a history of other heart disease might be more seriously influenced by a recent heart attack. These patients persistently experience a life-threatening trajectory, increasing the risk of depression, anxiety, and fear in these patients (Son et al., 2012). These MI patients with a history of heart disease may need further psychological support and more attention to reduce the risk of future cardiac events and other heart-related comorbidities. Regular follow-ups encouraging the patients to participate in cardiac rehabilitation programs are important to improve patient and disease outcomes. Cardiac rehabilitation programs usually contain exercise, education and regular visits to cardiologists and can help patients more effectively manage their illness and recover HRQoL from MI (Anderson and Taylor, 2014; Choo, Burke, & Hong, 2007).

Many previous studies have shown that depression, anxiety and stress are closely associated with HRQoL after MI (Arnold, et al., 2013; Hawkes, et al., 2013; Hosseini, et al., 2014; Rafael, et al., 2014). Consistent with the literature, the present study confirmed that the patient's psychosocial profile including depression, anxiety and stress predicted lower HRQoL. These results suggest that health professionals should pay close attention to the psychosocial aspects of MI patients particularly at the early stage. Also, individual optimisation and cultural adjustment would be important aspects in consideration of depression intervention (Gholizadeh, Davidson, Heydari, & Salamonson, 2014). Korean people are less likely to seek a consultation from health professionals in terms of their psychological distress (Lee, Wachholtz, & Choi, 2014). Therefore, routinely screening and intervening the patient's psychosocial aspects cautiously based on this Korean culture should be added in the recovery stages of MI. Future research should focus on exploring the impact of early HRQoL scores on patients' recovery from MI, future cardiac events and mortality. It is also interesting to know whether early HRQoL scores could predict HRQoL scores later. Additionally, further studies on HRQoL among MI patients who have a history of stroke may be required to make up for the lack of studies in this population.

A limitation of this study was that the descriptive and cross-sectional study design could not explain the causal relationships, although the stepwise regression was able to explain the percentage of the variance and strength of the independent variables with the standardised coefficient values. Thus, more longitudinal or cohort studies may be required to develop better plans or transitional cares for recovery of HRQoL among patients with MI. Nevertheless, this study also has its own strengths. First, the focus was on the acute stage of recovery from MI. The research, which was focused on HRQoL in the early phase of the patients with MI, was inadequately done in the past. Second, considering the similarities between the current study and a previous study implemented in another city of Korea (Kim, et al., 2015), it can be assumed that the study participants are representative of the Korean population.

CONCLUSIONS

The results of the study suggest that lower HRQoL was significantly associated with lower education level and poor perceived financial status, having diabetes, having a personal history of stroke and other heart diseases, and a higher level of depression, anxiety and stress. The findings of this study help to detect individual patients who possibly experience lower HRQoL after MI. While some factors are unlikely to be modified, early psychological and financial support may help reduce the impact of MI on patients' overall health and quality of life.

Implications for clinical practice

The results of the current study support the link between social determinants of health (education and financial status) and HRQoL. Patients admitted to hospital with MI should be monitored for symptoms of psychological distress. In addition, if necessary, timely counselling or psychological treatment should be provided to reduce the impact of physiological factors on patient's outcomes and recovery.

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Table 1. Preliminary analyses of HRQoL scores by participants' characteristics (n=150)

Demographic factors		n	%	MacNew (Mean± SD)	*t* / F	p
Age (years)	<55	30	20.0	130.27 ± 23.49	-2.678	0.008**
	55-64	43	28.7	123.72 ± 21.00		
	65-74	43	28.7	119.00 ± 20.06		
	75 ≤	34	22.6	108.76 ± 22.09		
Gender	Female	43	28.7	112.67 ± 21.31	5.824	0.001**
	Male	107	71.3	123.35 ± 22.37		
Marital status	Married	129	86.0	122.57 ± 21.56	3.163	0.002**
	Never married/Separated/Divorced/ Widowed	21	14.0	106.29 ± 23.77		
Level of education	Primary or less	40	26.7	110.25 ± 19.93	6.403	0.000**
	Middle school	25	16.7	115.44 ± 21.64		
	High school	54	36.0	123.89 ± 21.61		
	Undergraduate or more	31	20.6	130.87 ± 22.60		
Employment status	Employed	60	40.0	128.18 ± 19.41	3.648	0.000**
	Unpaid family workers/Retired / Unemployed	90	60.0	115.02 ± 23.01		
Financial status (Subjective)	Excellent / Good	21	14.0	138.10 ± 22.87	4.110	0.000**
	Only fair / Poor	129	86.0	117.39 ± 21.18		
Behavioural factors						
Physical activity	At least 30 minutes moderate physical activity most or all days of the week	42	28.0	128.57 ± 19.25	5.141	0.007**
	Less 30 minutes moderate physical activity less than 5 days in a week	31	20.7	121.71 ± 21.91		
	Not physically active	77	51.3	115.19 ± 23.24		
Smoking	Non-smoker	85	56.7	116.35 ± 23.34	3.531	0.032*
	Previous smoker	15	10.0	120.73 ± 19.16		
	Current smoker	50	33.3	126.84 ± 20.82		
Alcohol consumption	No	107	71.3	116.90 ± 22.93	-2.983	0.003**
	Yes	43	28.7	128.72 ± 19.27		
Disease-related factors						
ST-elevation	NSTEMI	89	59.3	118.04 ± 22.47	-1.478	0.141
	STEMI	61	40.7	123.56 ± 22.38		
Medical Characteristics	Hypertension: Yes	75	50.0	115.39 ± 22.63	-2.721	0.007**
	No	75	50.0	125.19 ± 21.47		
	Diabetes: Yes	47	31.3	112.45 ± 20.30	-2.953	0.004**
	No	103	68.7	123.86 ± 22.68		
	Stroke: Yes	8	5.3	100.88 ± 20.05	-2.551	0.012*
	No	142	94.7	121.38 ± 22.22		
	Other heart disease: Yes	25	16.7	108.64 ± 21.87	-2.902	0.004**
	No	125	83.3	122.62 ± 22.01		
	Previous MI: Yes	37	24.7	113.86 ± 22.74	-2.019	0.045*
	No	113	75.3	122.39 ± 22.15		
	Other comorbidities: Yes	58	38.7	116.43 ± 22.187	-1.675	0.096
	No	92	61.3	122.72 ± 22.516		
Psychosocial factors				Total	Pearson correlation	
DASS 21				17.05 ± 9.26	-0.520**	

DASS = Depression Anxiety and Stress Scale; HRQoL = Health-Related Quality of Life; MacNew = the MacNew Heart Disease Health-Related Quality of Life Questionnaire; NSTEMI = Non-ST Segment Elevation Myocardial Infarction; STEMI = ST Segment Elevation Myocardial Infarction.

* Significant at the level of $p<0.05$.

**Significant at the level of $p<0.01$.

Table 2. Correlations between independent variables

	Age	Gender	Marital status	Level of education	Employment	Financial status	Activity	Smoking	Alcohol	ST-elevation	Hypertension	Diabetes	Stroke	Other heart disease	Previous MI	Other comorbidities	DASS total
Age	1																
Gender	-.404**	1															
Marital status	.177*	-.254**	1														
Level of education	-.592**	.469**	-.240**	1													
Employment	.602**	-.367**	0.133	-.430**	1												
Financial status	.244**	-0.043	0.107	-.217**	.220**	1											
Activity	0.067	-0.102	0.159	-.161*	-0.016	0.132	1										
Smoking	-.484**	.464**	-.232**	.316**	-.414**	0.044	0.01	1									
Alcohol	-.382**	.304**	-0.128	.232**	-.385**	-.169*	0.051	.305**	1								
ST-elevation	-0.129	.195*	-0.06	0.138	0.011	0.021	-0.067	0.092	.195*	1							
Hypertension	0.159	-0.133	0.058	-0.11	0.082	0.058	-0.054	-.167*	-0.133	-0.149	1						
Diabetes	.173*	-0.144	0.017	-0.05	.199*	0.065	0.101	-0.047	-.174*	-0.062	0.158	1					
Stroke	0.132	-0.046	.161*	-0.083	.194*	0.096	-0.03	-0.037	-0.15	-0.136	0.119	-0.096	1				
Other heart disease	0.145	-0.112	0.129	-0.06	0.073	-0.026	0.087	-0.159	-0.046	-0.115	0.125	0.006	0.053	1			
Previous MI	.192*	-0.048	.215**	-0.081	.246**	0.142	-0.011	-.208*	-0.158	-.222**	.170*	0.08	0.071	.367**	1		
Other comorbidities	.335**	-0.102	0.035	-0.13	.173*	0.084	0.119	-.275**	-.201*	-0.156	0.137	0.083	0.055	.233**	.181*	1	
DASS total	0.04	0.013	.187*	-0.092	0.074	.177*	0.13	-0.036	-0.05	-0.022	0.084	0.037	0.069	0.046	0.159	-0.024	1

DASS = Depression Anxiety and Stress Scale; MI = Myocardial Infarction.

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 3. Collinearity test and backward elimination stepwise regression analysis

	Collinearity		Step 1			Step 2			Step 3			Step 4			Step 5		
Demographic factors	Tol.	VIF	*β*	*t*-value	*p*	*β*	*t*-value	*p*	*β*	*t*-value	*p*	*β*	*t*-value	*p*	*β*	*t*-value	*p*
Age	0.508	1.968	-0.019	-0.228	0.820	-	-	-	-	-	-	-	-	-	-	-	-
Gender	0.606	1.650	-0.007	-0.092	0.926	-	-	-	-	-	-	-	-	-	-	-	-
Marriage	0.809	1.237	-0.035	-0.528	0.598	-0.030	-0.465	0.643	-	-	-	-	-	-	-	-	-
Education level	0.548	1.826	0.142	1.770	0.079	0.158	2.395	0.018*	0.172	2.655	0.009**	0.213	3.454	0.001**	0.228	3.688	0.000**
Employment	0.562	1.780	-0.035	-0.444	0.658	-	-	-	-	-	-	-	-	-	-	-	-
Financial status	0.829	1.207	-0.163	-2.486	0.014*	-0.169	-2.664	0.009**	-0.169	-2.716	0.007**	-0.159	-2.557	0.012*	-0.169	-2.705	0.008**
Behavioural factors																	
Physical activity	0.886	1.128	-0.129	-2.032	0.044*	-0.126	-2.013	0.046*	-0.128	-2.088	0.039*	-0.113	-1.839	0.068	-	-	-
Smoking	0.594	1.685	0.076	0.987	0.325	0.089	1.321	0.189	0.100	1.565	0.120	-	-	-	-	-	-
Alcohol consumption	0.753	1.329	0.061	0.894	0.373	0.069	1.053	0.294	-	-	-	-	-	-	-	-	-
Disease-related factors																	
Hypertension	0.891	1.123	-0.086	-1.368	0.174	-0.083	-1.336	0.184	-0.078	-1.262	0.209	-	-	-	-	-	-
Diabetes	0.862	1.160	-0.170	-2.648	0.009**	-0.177	-2.870	0.005**	-0.184	-3.034	0.003**	-0.201	-3.348	0.001**	-0.210	-3.480	0.001**
Stroke	0.888	1.126	-0.128	-2.032	0.044*	-0.135	-2.189	0.030*	-0.146	-2.415	0.017*	-0.155	-2.573	0.011*	-0.150	-2.458	0.015*
Other heart disease	0.828	1.208	-0.187	-2.859	0.005**	-0.187	-2.890	0.004**	-0.161	-2.666	0.009**	-0.184	-3.074	0.003**	-0.193	-3.207	0.002**
Previous MI	0.742	1.348	0.089	1.283	0.202	0.082	1.223	0.224	-	-	-	-	-	-	-	-	-
Psychosocial factors																	
DASS total	0.905	1.105	-0.429	-6.842	0.000**	-0.428	-6.950	0.000**	-0.423	-6.985	0.000**	-0.431	-7.064	0.000**	-0.442	-7.224	0.000**
			R^2 = 0.524, adjusted R^2 = 0.471			R^2 = 0.523, adjusted R^2 = 0.481			R^2 = 0.514, adjusted R^2 = 0.483			R^2 = 0.498, adjusted R^2 = 0.474			R^2 = 0.486, adjusted R^2 = 0.465		
			F = 9.845 (p = 0.000)			F = 12.525 (p = 0.000)			F = 16.464 (p = 0.000)			F = 20.151 (p = 0.000)			F = 22.570 (p = 0.000)		

β = Standardised β; DASS = Depression Anxiety and Stress Scale; MacNew = the MacNew Heart Disease Health-Related Quality of Life Questionnaire; Tol = Tolerance; VIF = Variance Inflation Factor.
* Significant at the level of p<0.05.
**Significant at the level of p<0.01.

e. Predictors of health-related quality of life in Korean patients with myocardial infarction: A longitudinal observational study

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Predictors of health-related quality of life in korean patients with myocardial infarction: a longitudinal observational study

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ABSTRACT

Background: Experience of myocardial infarction (MI) negatively affects different aspects of health-related quality of life (HRQoL).
Objectives: This study aimed to examine trends in HRQoL of MI patients and to identify demographic, clinical and psychosocial predictors of HRQoL at three months.
Methods: A total of 150 patients in South Korea were completed the study questionnaires at baseline. After three months from discharge, 136 participants completed follow-up questionnaires, including the Korean version of the MacNew Quality of Life after Myocardial Infarction Questionnaire (MacNew).
Results: HRQoL significantly improved over three months. Younger age, ST-elevation MI, and higher LVEF, lower level of depression, better understanding of the illness and higher perceived social support at baseline were associated with better HRQoL at three months.
Conclusion: Providing adequate information about the illness and social support as well as reducing negative psychological experiences in early days after MI may improve HRQoL of MI patients.

Introduction

Experience of myocardial infarction (MI) poses a threat to health-related quality of life (HRQoL).[1] Within the first year after MI,[2] about 20% of patients experience persistent symptoms including fatigue, sleep disturbance and shortness of breath as well as reoccurrence of MI, stroke, or death.[3] It is common that patients after MI report lower HRQoL scores than those without MI; however, HRQoL scores improve in most patients over time.[4] The results of a longitudinal study conducted by Eriksson et al.[5] showed that patients' HRQoL, measured by the Short Form 36 Health Survey Questionnaire (SF-36), was lower than their partners and those without the experience of MI at a one-month follow-up. However, HRQoL of MI patients showed improvement with higher scores than their partners or those without MI over time, at seven months, 13 months, and 25 months from MI. Similarly, another study found that improvement of HRQoL in patients with MI was statistically significant from four weeks to six months, as measured with both the Medical Outcomes Short Form-12 (SF-12) and the Seattle Angina Questionnaire (SAQ).[6]

Multiple factors were reported to affect HRQoL of patients after MI.[4] These factors included female gender, living alone and low education level and higher depression, anxiety and stress. Disease-related factors such as severity of MI and the associated symptoms were also found to be negatively associated with HRQoL post-MI. In addition, MI affects different aspects of HRQoL, including the physical, emotional and social functioning of patients. Patients' psychological experiences including depression, anxiety, stress, level of social support, perception of the disease, and self-efficacy are also associated with HRQoL.[7]

Assessment of HRQoL can supplement the traditional measures of health outcomes as this subjective report represents the patient-centred health status individually in broader aspects. It can also be assumed that diminished HRQoL negatively affects morbidity and mortality in cardiac patients as well as in those without heart disease.[4] Studying this multi-dimensional concept thus could lead to a broader understanding of patients' recovery status.[8] Understanding those factors that contribute to HRQoL post-MI, particularly modifiable factors, can open a window of opportunities to improve recovery experience and disease outcomes of patients post-MI. Although some studies have examined the relationships between different demographic, clinical and psychological factors

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and HRQoL after MI, few studies have investigated the predictors of HRQoL using robust statistics to enable development of reliable models. These studies are particularly scarce in Asian countries including South Korea.

The purposes of the current study were to examine the trends in HRQoL of patients and to identify the role of different demographic, clinical and psychosocial variables in predicting HRQoL of these patients at the three-month follow-up.

Methods

Overview of the design

This study used a longitudinal observational design to examine the trends in changes of HRQoL, from baseline to three months, in patients with MI in South Korea and to identify factors predicting HRQoL of the patients at three months post-MI. The majority of infarct healing occurs within 3–4 months of MI[9] and most patients can resume their pre-illness activities including returning to work within three to six months after MI, positively affecting their emotional well-being.[10] Therefore, as the patients' functioning status improves, improvement in HRQoL is also expected.

Treatment of acute myocardial infarction (AMI) in South Korea includes reperfusion strategies using pharmaceutical interventions, percutaneous coronary intervention (PCI) or coronary artery bypass graft. More than 90% of patients with acute MI undergo drug-eluting stenting and there is no gender difference in the initial treatment of AMI. However, prescription of medical therapy for secondary prevention has been reported to be suboptimal.[11] After discharge from hospital, patients visit an outpatient clinic two or three times within the first month and then once or twice a month for the next three months.

Human subjects

Participants were recruited from the comprehensive cardiovascular centres of two tertiary hospitals in the southern part of South Korea. They were asked to complete study questionnaires at baseline (within one week after MI) and at three-month follow up.

Inclusion/exclusion criteria

Inclusion criteria required admission with a diagnosis of either ST-elevation myocardial infarction (STEMI) or non-ST elevation myocardial infarction (NSTEMI), ability to understand and speak Korean, be a Korean resident, ability to understand the study procedure and give an informed consent. Patients were excluded if they had cognitive impairment or if they were participating in other interventional studies that might have affected the results of the current study. Patients' cognitive status, capacity to provide consent, and to understand the study questionnaires were assessed prior to enrolment in accordance with the Fan et al.'s two step approach.[12] A charge nurse in each study site firstly confirmed the patient's ability to participate in the study, and then each patient was asked to state their full name and answer which colour they had seen among one of three sheets of coloured paper. After the cognitive assessment, patients who signed the consent form were subsequently enrolled in the study.

Rationale for the sample size

The formula of 'N > 50 + 8* the number of independent variables'[13] was used to calculate the study sample size. Using this formula, a sample size of 138 was needed to allow for inclusion of 11 independent variables into the regression model.

Procedures

The Institutional Review Boards of the participating hospitals (PNUH IRB no. H-1505-008-029 and PNUYH IRB no. 05-2015-072) and the Human Research Ethics Committee of the involving university (UTS HREC Approval No. 2015000254) approved the ethics of the study. Potential participants were provided with information about the study verbally and in writing in Korean. Participations who were interested in the study gave consent and were enrolled in the study. The confidentiality privacy and volunteer participation were maintained throughout the study. Participants were assured that their participation was completely voluntary and that they could withdraw at any time they wished. The individual's participation was not disclosed to others and the data collection was held individually in a room where the patients' privacy could be protected. Follow-ups were scheduled according to participants' preferences to minimise inconvenience. Data collection was completed by the principle investigator whose first language is Korean (KK). Two cardiologists and several nurse managers were consulted to discuss strategies for participant recruitment, study questionnaires, and ethical considerations. Fig. 1 describes the process of screening, enrolment and follow-up of the study participants. A total of two hundred and fifteen consecutive patients were screened for the study inclusion criteria from August 2015 to February 2016; of whom 17 patients were excluded due to poor hearing, five patients were discharged before enrolment, and one patient was unconscious. The remaining eligible patients were invited to participate in the study. Among those who were invited to the study, 23 patients declined to participate because of perceived poor health condition, including dyspnoea, pain and tremor and 19 patients declined the invitation without giving a specific reason.

A total of 150 patients (69.8%), who provided informed consent were enrolled in the study and completed the study questionnaires at baseline (within one week after MI) and at the three-month follow-up. The participants were asked to complete the questionnaires by themselves or the researcher read out the

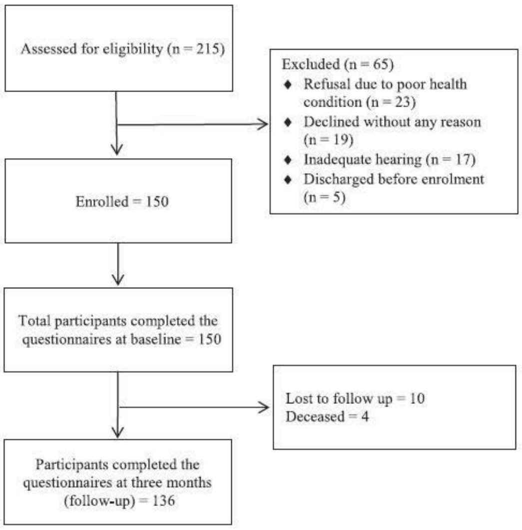

Fig. 1. Flow diagram of participants with MI from screening, recruitment, withdrawal to completion.

questions to the participant, obtained, and recorded their responses. Of the 150 participants at baseline, ten were lost to follow-up and four passed away. As a result, 136 participants completed the three-month follow-up questionnaires. The three-month follow-up questionnaires were completed in a face-to-face session at an outpatient department during a routine follow-up check-up. Some participants who did not have enough time to complete the three-month follow-up questionnaires at the outpatient department or the researcher failed to meet them at their follow-up appointment completed the follow up questionnaires over the telephone.

Variables and measures

Variables and conceptual framework

A thorough review of previous literature[7] and the revised Wilson & Cleary model for HRQoL[14] guided the selection of independent variables for the study. The participants' baseline psychosocial status (depression, anxiety, stress, illness perception, and social support), demographic factors (age, gender, education level and subjective financial status), and clinical factors (type of MI and LVEF) were examined for their contribution to HRQoL of the participants at the three-month follow-up.

Demographic and clinical profiles

Information on demographical profiles of the participants was collected, which included: age, gender, marital status, education level, employment status and self-assessed financial situation (categorised as excellent/good/only fair/poor). Information on participants' clinical profiles included: type of MI (STEMI/NSTEMI), smoking (non-smoker/previous smoker/current smoker), alcohol consumption (yes/no), LVEF, history of high blood pressure, diabetes, stroke, other heart diseases, previous MI and other comorbidities. This information was collected from the medical records of the participants after obtaining their consent.

Psychosocial profile

*Depression, anxiety, and stress*Among psychosocial factors studied in previous literature, depression, anxiety and stress has been the most commonly examined factors negatively affecting HRQoL of patients with MI.[15–17] We used the Korean version of the DASS 21[18] to assess the participant's physiological status. The DASS 21 is the short form of the DASS 42, consisting of 21 items with each item scoring from 0 (never) to 3 (almost always) and the total score for the scale ranging from 0 to 63, with higher scores indicating greater depression, anxiety and stress.[19] The measurement can be divided into three dimensions of depression, anxiety and stress. Each dimension encompasses seven items with the total scores of the subscales ranging from 0 to 21.[19]

DASS 21 is a valid tool. In the original study, the internal consistencies of the subscales have been reported as 0.91 for depression, 0.84 for anxiety and 0.90 for stress (Lovibond & Lovibond 1995). In a Korean study using the Korean version of the DASS 21, the alpha coefficients were ranged from 0.72 to 0.81 for the subscales of depression, anxiety and stress.[20] In the current study, the alpha coefficient for the total scale was 0.86, and for the subscales of depression 0.85, anxiety 0.52, and stress 0.80. We included the total scores of the DASS 21 in the regression analysis.

*Illness perception*The available evidence suggested that patients with more positive illness perceptions following MI showed better quality of life.[21] Thus, this study examined participants' understanding of their MI, using a single item extracted from the Brief Illness Perception Questionnaire (B-IPQ). This item was scored on a Likert type scale ranging from 0 ("don't understand at all") to 10 ("understand very clearly").[22] The Korean version of the item was prepared for the purpose of this study.

*Social support*The ENRICHD Social Support Inventory (ESSI) has been developed to measure the social support of patients with coronary heart disease, in particular, patients with MI. This questionnaire consists of seven items addressing different types of social support including structural, instrumental, and emotional support. Response rate for all the items ranges from 1 (none of the time) to 5 (all the time), except for item 7, which is scored 4 for "yes" or 2 for "no".[23] The seven items can be summed as the total score ranging from 8 (no support) to 34 (maximum level of support).[24] The validation studies of the scale on the cardiac patient population have shown high internal consistencies, with alpha coefficients ranging from 0.88 to 0.94.[24] A Korean version of the scale was prepared for the purpose of this study and the alpha coefficient of the study sample was 0.93. The ESSI was firstly translated into Korean by the principal researcher whose first language is Korean, and then reviewed by two health professionals and two laypersons who were Korean native speakers.

Health-related quality of life

The MacNew Quality of Life after Myocardial Infarction Questionnaire (MacNew) is a disease specific valid tool to measure HRQoL of patients with MI. For the purpose of this study, the tool was translated into Korean language and validated on a sample of Korean patients with MI. The MacNew includes 27 items with responses ranging from 1 to 7 on a seven point Likert scale. The items of this instrument fall into three physical (13 items), emotional (14 items) and social dimensions (13 items),[25,26] although loadings of items onto each construct vary slightly across studies. The total mean score and each domain can be calculated as a mean score with a range between 1 and 7, with higher scores representing better HRQoL. The minimal important difference (MID) on the global MacNew and the three subscales is determined by 0.50 points as a significant change.[25] The reliability of the total MacNew has been well established in a plethora of previous studies, with Cronbach's alpha coefficients ranging from 0.85 to 0.94.[27–29] The Cronbach's alpha coefficient of the Korean MacNew in the current study was also high at 0.90 for the total scale, and 0.86, 0.85 and 0.88 for the emotional, physical and social subscales, respectively.

Statistical analysis

Data were analysed using SPSS version 24.0 (SPSS Inc., Chicago, IL, USA). A descriptive analysis of participants' characteristics was performed using means, standard deviations (SD), frequencies and percentages. The MacNew scores were normally distributed, thus paired-samples t-tests were used to examine changes between baseline MacNew and three-month follow-up scores. Tolerance, variance inflation factor (VIF) and correlations between the independent variables were analysed for multicollinearity. The results were indicated the absence of multicollinearity with a tolerance value of higher than 0.10, a VIF value of below 10 or Pearson correlation coefficients of lower than 0.90.[13] Thus, 11 independent variables were included in the backward stepwise regression model. At each elimination step, one or two most insignificant factors were removed from the model until only significant predictors remained. The level of statistical significance of analyses was set at $p < 0.05$ (two-tailed).

Results

Participant characteristics

The mean age of participants at baseline was 64.63 (SD = 11.48) years, with a range of 21 to 86 years. Most of the participants were

Table 1
Participants' demographic and clinical characteristics at baseline (n = 150)

Demographic factors		n	%
Age (years)	<55	30	20.0
	55–64	43	28.7
	65–74	43	28.7
	75≤	34	22.6
Gender	Female	43	28.7
	Male	107	71.3
Marital status	Married	129	86.0
	Never married/Separated/ Divorced/Widowed	21	14.0
Level of education	Primary or less	40	26.7
	Middle school	25	16.7
	High school	54	36.0
	Undergraduate or more	31	20.6
Employment status	Employed	60	40.0
	Unpaid family workers/Retired / Unemployed	90	60.0
Financial status (Subjective)	Excellent / Good	21	14.0
	Only fair / Poor	129	86.0
Clinical factors			
Type of MI	STEMI	57	41.9
	NSTEMI	79	58.1
Smoking	Non-smoker	85	56.7
	Previous smoker	15	10.0
	Current smoker	50	33.3
Alcohol consumption	Yes	43	28.7
	No	107	71.3
Medical Characteristics	Hypertension: Yes	75	50.0
	No	75	50.0
	Diabetes: Yes	47	31.3
	No	103	68.7
	Stroke: Yes	8	5.3
	No	142	94.7
	Other heart disease: Yes	25	16.7
	No	125	83.3
	Previous MI: Yes	37	24.7
	No	113	75.3
	Other comorbidities: Yes	58	38.7
	No	92	61.3

LVEF = Left Ventricular Ejection Fraction; MI = Myocardial Infarction; NSTEMI = non-ST elevation myocardial infarction; SD = Standard Deviation; STEMI = ST-elevation myocardial infarction.

aged 55 years or older (n = 120, 80.0%), male (n = 107, 71.3%), married (n = 129, 86.0%) and educated at a middle school level or higher (n = 110, 73.3%). Forty per cent of the participants (n = 60) were employed at the time of enrolment, but only 14.0 % (n = 21) perceived their financial situation as 'excellent' or 'good'. The mean value of LVEF was 50.86% (SD = 10.80) with a range from 17% to 70%. One third of the patients in this study (n = 50, 33.3%) were current smokers and 28.7% of them (n = 43) answered 'yes' to the drinking question. The demographic and clinical characteristics of the participants at baseline are presented in Table 1.

Changes in HRQoL

The changes in total scores of HRQoL and the subscales from baseline to three-month follow-up are shown in Table 2. Overall, the results indicate that HRQoL of the participants showed statistically significant improvements in all the dimensions of the MacNew with a mean difference of 0.98 for emotional, 1.11 for physical, and 1.06 for social dimensions. The total score of the MacNew also improved significantly from baseline to three-month follow-up, with the mean difference of 1.03.

Predictors of HRQoL at three-month follow-up

Table 3 shows the results the backward elimination stepwise regression analysis. The first model of the stepwise regression included a total of 11 variables – age, gender, the level of education, perceived financial status, type of MI (STEMI/NSTEMI), LVEF, depression, anxiety, stress, illness perception, and social support. Of these variables, age, LVEF, depression, stress, illness perception, and social support were statistically significant. At the next step, the two least significant variables – education level and perceived financial status – were eliminated, resulting in gender, type of MI and anxiety to become statistically insignificant predictors. Gender and anxiety, as the least significant predictors were removed from the model at the third step, resulting in type of MI becoming a statistically significant predictor, while stress showed the least correlation with HRQoL. Following the removal of stress in the next step, all the six remaining variables showed statistically significant correlations with HRQoL at three months post-MI. These predictors included age, type of MI, LVEF, depression, illness perception and social support. Younger age (β=-0.216, t=-2.715, p = 0.008) was closely associated with better HRQoL at three months. Being diagnosed with STEMI (β=-0.163, t=-2.119, p = 0.036) or having higher LVEF at baseline (β = 0.207, t = 2.606, p = 0.010) were significant predictors of higher HRQoL at three months. Higher score of depression at baseline (β=-0.201, t=-2.644, p = 0.009) was closely associated with lower HRQoL at three months. In addition, patients' better understanding of their illness (β = 0.213, t = 2.755, p = 0.007) or perceived higher social support at baseline (β = 0.199, t = 2.515, p = 0.013) were significant predictors of better HRQoL at three months. The final model of the current study explained 27.4% of the variance in HRQoL (adjust R2 = 0.241, F = 8.129, p = 0.000).

Discussion

The results of our study suggested that HRQoL of patients with MI improved significantly within the first three months after MI. Predictors of better HRQoL at three months included younger age, STEMI diagnosis, higher LVEF, illness perception, perceived social support, and lower depression symptoms at baseline.

Oginska-Bulik[30] found that younger patients with MI had higher quality of life. This can be explained by higher physical functioning in younger patients after MI.[31] Moreover, younger patients are likely to be treated more intensively in consideration of their physical status.[32]

We found that patients diagnosed with STEMI had higher HRQoL at three months post-MI compared to those with NSTEMI. This

Table 2
Changes in the MacNew scores of the participants over three months (n = 136)

Variables (range)	Baseline		Follow-up		Mean difference (95% CI)	*t*	*p*
	Mean	SD	Mean	SD			
MacNew total	4.51	0.81	5.54	0.78	1.03 (0.88, 1.17)	13.896	0.000
Emotional	4.42	0.82	5.40	0.85	0.98 (0.81, 1.14)	11.617	0.000
Physical	4.43	0.99	5.55	0.85	1.11 (0.95, 1.27)	13.834	0.000
Social	4.83	0.93	5.89	0.82	1.06 (0.89, 1.23)	12.356	0.000

MacNew = MacNew Quality of Life after Myocardial Infarction Questionnaire; SD = Standard Deviation.
Notes: The MacNew scores are the average of responses over relevant items.

Table 3
Predictors of HRQoL at three-month follow-up using the backward elimination stepwise regression analysis

	Collinearity		Step 1			Step 2			Step 3			Step 4		
	Tol.	VIF	β	*t*-value	*p*	β	*t*-value	*p*	β	*t*-value	*p*	β	*t*-value	*p*
Demographic factors														
Age	0.738	1.354	−0.175	−2.034	0.044*	−0.180	−2.239	0.027*	−0.206	−2.602	0.010*	−0.216	−2.715	0.008**
Gender	0.758	1.318	0.098	1.148	0.253	0.112	1.390	0.167	–	–	–	–	–	–
Education level	0.543	1.840	0.035	0.352	0.726	–	–	–	–	–	–	–	–	–
Financial status	0.726	1.377	0.095	1.097	0.275	–	–	–	–	–	–	–	–	–
Clinical factors														
Type of MI	0.887	1.128	−0.124	−1.571	0.119	−0.133	−1.706	0.090	−0.166	−2.188	0.031*	−0.163	−2.119	0.036*
LVEF	0.827	1.210	0.195	2.391	0.018*	0.180	2.277	0.024*	0.204	2.601	0.010*	0.207	2.606	0.010*
Psychosocial factors														
Depression	0.603	1.660	−0.252	−2.637	0.009**	−0.238	−2.527	0.013*	−0.272	−3.253	0.001**	−0.201	−2.644	0.009**
Anxiety	0.581	1.722	−0.111	−1.142	0.256	−0.101	−1.048	0.297	–	–	–	–	–	–
Stress	0.678	1.476	0.203	2.253	0.026*	0.193	2.165	0.032*	0.165	1.946	0.054	–	–	–
B–IPQ 7	0.823	1.215	0.191	2.345	0.021*	0.179	2.309	0.023*	0.205	2.674	0.008**	0.213	2.755	0.007**
ESSI	0.723	1.383	0.244	2.803	0.006**	0.224	2.797	0.006**	0.227	2.849	0.005**	0.199	2.515	0.013*
			$R^2 = 0.320$, adjusted $R^2 = 0.260$			$R^2 = 0.314$, adjusted $R^2 = 0.265$			$R^2 = 0.295$, adjusted $R^2 = 0.257$			$R^2 = 0.274$, adjusted $R^2 = 0.241$		
			$F = 5.312$ ($p = 0.000$)			$F = 6.397$ ($p = 0.000$)			$F = 7.659$ ($p = 0.000$)			$F = 8.129$ ($p = 0.000$)		

β = Standardised β; B–IPQ 7 = Brief Illness Perception Questionnaire 7th item; ESSI = ENRICHD Social Support Instrument; LVEF = Left Ventricular Ejection Fraction; Tol = Tolerance; VIF = Variance Inflation Factor.

* Significant at the level of $p < 0.05$.

** Significant at the level of $p < 0.01$.

finding seems also consistent with other research which showed STEMI patients had higher overall HRQoL than those with unstable angina or NSTEMI.[33] Few studies have compared HRQoL between patients with STEMI and NSTEMI, although disease prognosis is different between these two conditions. Patients diagnosed with STEMI are likely to have relatively low mortality at the early stage; however, NSTEMI patients tend to have a better health condition in the long-term period.[33] As this study focused on the early stage of recovery from MI, higher HRQoL scores in patients with STEMI are expected. Besides, baseline LVEF was one of significant predictors of HRQoL at three months post-MI. This finding is in line with previous studies, which showed that patients with lower LVEF had poorer HRQoL later.[34,35] However, a recent study in Korea[36] found that LVEF was not statistically associated with HRQoL in patients with heart failure. LVEF was regarded as the severity of MI[37] as this value has been frequently used for measuring cardiac function in clinical practice. However, the association between LVEF and HRQoL has not been adequately studied in patients with MI.[38]

In addition to the demographic and clinical predictors, three psychosocial factors could be predictive of HRQoL at three months post-MI. Consistent with the results of previous studies,[16,39–41] we found that depression symptoms at baseline were predictive of inferior HRQoL at three months. This finding support the results of another Korean study that cardiac patients with depression symptoms reported decreased HRQoL, irrespective of their gender.[31] Moreover, depression has been consistently identified as an independent predictor, adversely associated with all dimensions of HRQoL – emotional, physical and social – in MI patients in different countries.[15,40,41]

We found that patients' better understanding of their illness at early stages after MI predicted better HRQoL at three months. This finding is in line with the results of a prospective study, which reported higher HRQoL scores at six months in patients with more positive illness perception at early stages post-MI.[39] Overall, research on the relationship between illness perception and HRQoL post-MI is scant and further research is needed to better understand the role of patient illness perception on recovery from MI.

In the present study, perceived social support was a predictor of HRQoL at the three-month follow-up. This finding supports the results of the Park et al.[31] study which reported a positive relationship between social support and HRQoL at one month post-MI. We did not investigate if the role of social support on HRQoL after MI differently affected men and women; however, Park et al. reported that social support had stronger impact on HRQoL of Korean women with MI than on men.[31] A possible explanation of these results may be that Korean people are less likely to visit mental health professionals or clinics, but cope with their problems by depending on their family or friends.[42] The major features of Korean culture can be referred to as familism[43] and the communal culture with high solidarity.[44] Moreover, people in South Korea have negative attitudes towards mental health services.[45] These cultural features may influence the patient's reliance on close personal relationships for dealing with their mental health, particularly negative emotions, including depression, a major health crisis, interpreting health status and information. Studies focusing on the relationship between social support and HRQoL in patients with MI outside South Korea, have reported similar results. Specifically, researchers in Australia found that at six-month follow-up acute MI patients who scored higher in the ESSI showed better HRQoL.[32] In addition, the influence of perceived social support tended to last up to 12 months after MI when HRQoL.[46,47] However, perceived overprotection was negatively associated with HRQoL at nine months.[48]

The findings of this study have important implications for health care professionals who are endeavouring to improve patient disease experience and recovery after MI. Comprehensive supportive care is needed to improve the general health status of MI survivors. As found in our model of backward elimination regression analysis, interventions to improve HRQoL in patients post-MI should focus on modifiable predictors including social support, illness perception, and depression management.

Depression is an independent predictor of poor prognosis and mortality after MI. The American Heart Association recommends that all patients with cardiovascular disease should be assessed for depression symptoms and treated if needed.[49] Korea has the highest suicide rate in the world.[50] This fact may reflect Korean people generally tend to have negative attitudes toward using professional mental health services and thus use them infrequently.[45] Thus, patient counselling, education, and treatment of depression should be combined with usual care in the early stage of recovery from MI.

Further, the relationship between illness perceptions and patient outcome has been well documented across different patient groups, including patients with cardiac disease.[39] Therefore, interventions to alter illness perceptions, especially perceptions of consequences, may be useful in improving HRQoL following an MI.

Perceived social support was another significant predictor of HRQoL in patients with MI at three months. Social support as measured in this study imply the patients' perceived emotional support, informational support, and instrumental support they received from others.[23] Based on questions of the ESSI, helping in household tasks, giving advice and trust would increase patient's perception of the social support.[23] Therefore, exploring means to support patients emotionally, physically, and financially in early days after MI can be important in helping the patients to improve their HRQoL, overall health and well-being. Yet, perception of overprotection has been shown to have adverse effect on MI patients' sense of well-being. Interventions utilising self-help groups for patients with MI may increase perceived social support and thus HRQoL.[31] In consideration of the Korean values of familism and communal culture, interventions featuring of group support for patients post MI may be more effective than individual strategies.

The findings of this study should be interpreted with the consideration of several limitations. First, the final model of regression explained only 27.4 per cent of the total variance for HRQoL at three months after MI. This result leads to the fact that HRQoL of MI patients is affected by multiple factors worth investigating by future research. Second, our study used a relatively small sample size, considering the multifactorial nature of HRQoL, future studies should use larger samples to allow for more comprehensive investigation of associated predictors. In addition, we included both patients who suffered a first-time MI and patients with recurrent MI. It is recommended that future studies compare HRQoL between the two groups.

Conclusions

The results of this study in the Korean population confirm that HRQoL of patients with MI improves over time. At three months post-MI, patients with a higher HRQoL are those who are younger, diagnosed with ST-elevation MI, have higher LVEF, lower level of depression, a better understanding of their illness and higher perceived social support. The findings indicate that interventions in the form of psychological counselling, patient education, and social support have the capacity to improve patient recovery and HRQoL post-MI.

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