Health-related quality of life and associated factors in patients with myocardial infarction after returning to work: a cross-sectional study

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Abstract

Background Return to work following myocardial infarction (MI) represents an important indicator of recovery. However, MI can cause patients to feel pressure, loneliness and inferiority during work and even detachment from employment after returning to work, which may affect their quality of life. The aims of this study were to assess the health-related quality of life (HRQoL) of patients with MI after returning to work and to examine the potential influences on HRQoL.

Method This was a cross-sectional study. All participants were recruited from tertiary hospitals in China from October 2017 to March 2018. Multiple linear regression analyses were performed to explore factors related to HRQoL in patients with MI after returning to work.

Results The sample consisted of 326 patients. The mean total score of quality of life was 28.03±2.554. According to the multiple linear regression analysis, next factors were associated with HRQoL, i.e. age (P=0.039), income (P=0.000), co-morbidity (P=0.000), the time taken to return to work (P=0.003), number of stent installed (P=0.003), participation in cardiac rehabilitation (CR) (P=0.000), complete CR (P=0.000), health responsibility (P=0.000), nutrition (P=0.000), exercise (P=0.000), self-realization (P=0.000), stress response (P=0.000), objective support (P=0.000), subjective support (P=0.000), utilization of social support (P=0.028), coping (P=0.000) and yield (P=0.000).

Conclusions HRQoL of MI patients after returning to work is not satisfactory. Health behavior, coping strategies, social support are factors which can affect HRQoL. A comprehensive and targeted guide may be a means to improve HRQoL and to facilitate patients return to society.

Background

Globally, it is estimated that 17.5 million people die annually from cardiovascular disease, among which coronary artery disease is responsible for 7.5 million deaths(1). As reported, a high MI incidence rate was recorded in countries in high and low income level, with 750,000 in America(2), and 250000 in China(3). It is expected by 2020 that the number of patients with MI will increase by 75 million(4). In this day and age, percutaneous coronary intervention (PCI) has been widely used in MI treatment; effectively alleviating MI related symptoms and shortening the recovery period(5). PCI
could improve the prognosis of patients, facilitate patients early return to society, therefore maximizing their value of life(6). This is particularly important for young MI patients: the incidence of whom saw significant increase in recent years. Indeed, constituting the main components of social productivity, returning to work is the key to restore self-esteem and self-confidence(7).

We define returning to works as people who were employed before illness return to work without long-term absence(8). Occupational rehabilitation and reintegration are the ultimate goal of CR which is an important secondary prevention strategy for cardiovascular diseases(9). As well-acknowledged, effective occupational rehabilitation can not only reduce the economic burden on society, family and individuals(10), but can also be used as an indicator of a return to a normal life state. Successful workplace rehabilitation is of critically important for cost-effectiveness(11). All of these factors make the quality of life an important outcome measure for patients with MI after returning to work. Surely, maintaining a good HRQoL after returning to work is critically important for patients to cope with work pressure(12) and to coordinate the conflict between work and treatment(13). Taking this into account to help MI patients truly return to society and strength long-term social functions, a successful and effective treatment of MI should not only focus on prolonging the lifetime, but also paying attention to the HRQoL of patients after returning to work(14).

The rate of returning to work after MI is quite high. As shown by a recent study, approximately 63–94% patients in United States choose to return to work after MI within 6 months(15). However, as a traumatic event, MI could detrimentally affect the HRQoL both physically and mentally(16), leading to poor workplace rehabilitation (i.e. delayed returning to work, increased sick leave absence or even termination, resignation)(17). As observed, patients who returned to work after MI could continuously be affected by impaired heart function (i.e. angina), resulting in limited physical activity(18). On the other hand, people returning to work after MI are more likely to be affected by mental disorders such as depression, anxiety and experience ongoing stress, loneliness and inferiority(19, 20). In fact, only a few people returning to work after MI could continue their works normally.

In a recent study, 1680 patients with MI were followed up at 12 months after discharge. As recorded, while 86% of the patients eventually returned to work, most of them returned to work 3 to 6 months
after discharge, the HRQoL of these patients could be challenged by various factors\cite{14}, which have been explored previously by several independent studies. For example, a long-term cohort study of 69 patients with MI found that patients with good health behavior and displaying better compliance with treatment generally maintain high HRQoL\cite{21}. In another case, Şahan and colleagues found that when faced with health problems, patients’ decision-making and coping strategies could affect health outcomes\cite{22}. Other researches show that HRQoL could be detrimentally affected by poor coping strategies, low self-efficacy, insufficient disease management ability and poor communication\cite{23, 24}. In addition, it was also observed age, disease status, the time returned to work played pivotal roles in the HRQoL\cite{25, 26}.

Even though several studies have been conducted on the HRQoL and work status of patients with MI after returning to work, further investigation of such a topic is still imperative. Firstly, previous studies generally lacked an analysis of the non-demographic factors affecting the quality of life, or did not explore the relationship between the factors and the quality of life; secondly, reasons underlie the decline in quality of life of the patient has not been investigated; thirdly, the key factors contributed to the physical, psychological and social recovery of patients have not been explored, although physical and psychological problems (reasons for enhanced work pressure and social psychological barriers\cite{27, 28}) were commonly observed among patients who return to work after PCI\cite{29}. Indeed, given the chronic nature of MI, identifying the key factors related to the quality of life of patient with MI after returning to work, especially identifying factors manageable through guidance and intervention are urgent problems to be solved. In the current work, for the first time, via rational experimental design, the potential factors that contribute to or prevent the improvement of HRQoL of MI patients returning to work were systematically investigated. The findings of the study are expected to provide a practical guide to develop multidisciplinary solutions and interventions to further improve the overall treatment outcomes of MI.

The purpose of this study is to identify the influencing factors of HRQoL in patients with MI after returning to work and explore the correlations between these factors and HRQoL. In this study, health behavior (Factor A) was defined as healthy lifestyle and adherence to treatments; coping strategies
(Factor B) were defined as attitudes and methods to face problems and challenges; social supports (Factor C) were defined as supports from friends, colleagues and family; and (Factor X) was defined as HRQoL. Our hypotheses are: (1) patients who had better health behavior (Factor A) tend to have better HRQoL; (2) patients who had more positive coping strategies (Factor B) had better HRQoL, while those who had more negative outlook (Factor B) had worse HRQoL; (3) patients who had more and made better use of social supports had better HRQoL.

Methods

Design

This work presents a cross-sectional study to assess the HRQoL, Lifestyle, coping strategies and social support of patient with MI returning to work after hospital discharge.

The theoretical basis supporting this study is the Moos's crisis and coping model(30). The model demonstrates chronic disease as a life crisis for patients, which can change individuals' original cognition, and fundamentally changes their healthy behavior and coping strategies. Meanwhile, in the process of coping with chronic disease, individuals are influenced by many factors including social resources eventually all factors related can produce different health outcomes. The model provides the possible variables associated with this research.

Settings and Participants

A sample of 326 patients were recruited from three tertiary hospitals in Zhengzhou, China. Eligibility criteria for participation in the study were diagnosis of MI by the cardiologist within 2 years, current age between 18 and 60 years, treatment with concurrent thrombolysis or interventional therapy. Return to work defined as a patient was currently had payed employment and did not have long sick leave or extended absence from work. Exclusion criteria were inability to provide informed consent and complete questionnaires and those who had difficulty communicating.

The sample size was calculated based on G power 3.1.1 version with the effect size of 0.25, a desired significance level of 0.05 and a power of 0.80. The estimated minimal sample size was 144 participants. Among 500 patients with MI after returning to work. 389 were contacted and met the inclusion criteria, 42 of them refused to participate, in addition 21 patients did not complete all the
A total of 326 patients who met the inclusion criteria were included in this study.

**Procedure and data collection**

We presented this study to the nurse managers of each wards before collecting data and obtained their consent and support, the managers provided the list of names of potential participants from follow-up information systems. The principal investigator (PI) explained the purpose and processes of this study to all potential participants and then asked them if they were willing to participate. The PI also notified them that they had the right to withdraw at any time without giving any reason.

Data was collected from October 2017 to March 2018 by structured questionnaires. Participants were recruited through telephone call during follow-up. The questionnaires were completed by telephone inquiry or via the internet by sending a link to their mobile phones. We obtained every participant's demographic characteristics pertained to age, levels of education, marital status and so on. We also collected disease-related characteristics from every participant.

**Measures**

**Demographic Characteristics**

Sociodemographic and clinical data were collected from participants using a self-designed questionnaire and the patients' file.

**Short-Form Health Survey-8 (SF-8)**

The SF-8 questionnaire was used to assess patients' quality of life(31). It is a generic instrument measuring 8 aspects of health: general health, bodily pain, social functioning, emotional role, vitality, physical role, physical functioning, and mental health. Scores in each item range between 1 (worst) to 5 (best), and scores are presented after standardization through linear transformations. The higher score means better health condition. The Cronbach's α is 0.87~0.95, the test-retest reliability is 0.92, and the validity is 0.82.

**Health-Promoting Lifestyle ProfileⅡ(HPLPⅡ)**

HPLPⅡ is a specific and multidimensional self-reported scale used to evaluate health behavior(32), it consists of 6 domains: health responsibility, nutrition, exercise, self-actualization, interpersonal relationship and stress coping. Each item uses a 4-point scale to measure level of agreement with
each statement (1= never, 2= seldom, 3= sometimes, 4= always). A score is calculated for each domain, and the sum of scores corresponds to overall health behavior which ranges from 52 to 208. Higher scores indicate better healthy behavior. The Cronbach’s α is 0.80~0.91, the reliability is 0.89, and the validity is 0.86.

**Medical Coping Modes Questionnaire (MCMQ)**

MCMQ was used to measure the patients' coping strategies. It consists of 20 questions divided into 3 dimensions: facing (8 items), avoiding (7 items) and yielding (5 items). The responses to each question were rated on a scale of 1 to 4 (1= never, 2= seldom, 3= sometimes, 4= always)(33). The scores for each domain were totaled and analyzed, with higher scores of facing indicating more positive coping strategies while higher scores of avoidance and yield indicating more negative coping strategies. The Cronbach’s α of the 3 dimensions are 0.89, 0.87 and 0.90 respectively, the reliability is 0.90, and the validity is 0.84.

**Social Supporting Rating Scale (SSRS)**

Social support was assessed with the SSRS. It contains 10 items grouped into 3 dimensions which cover objective support, subjective support and the access to social support. The total score is the sum of the scores of each item. Higher total scores illustrate higher level of social support(34). The Cronbach’s α coefficient is 0.88~0.92, the reliability 0.92, and the validity 0.90.

**Statistical Analysis**

Data were analyzed by SPSS 21.0. Quantitative data were analyzed using descriptive statistics to calculate sample demographics and clinical variables. In the descriptive analyses, means and standard deviations were calculated for continuous data while frequency and percentages were computed for categorical variables.

After confirmed the eligibility of the assumptions for linear regression, multivariate analysis was performed to explore factors independently related to HRQoL using multiple regression. Independent variables were determined either by selecting normally distributed continuous variables that were related to HRQoL in line with former literature or based on theoretical reasons. Pearson correlation analysis was applied to analyze the correlation between patients' health behaviors, social support,
coping styles and HRQoL. For all statistical tests, a $p \leq 0.05$ was considered statistically significant.

**Results**

**Demographics of the Study Sample**

A total of 326 participants were included in the study. Men (69.3%) were more than women (30.7%). The ages of these patients ranged from 32 to 60 years. Most were Chinese (93.6%), and most patients had been married (with spouses) (86.8%). Around one third patients lived in the countryside (35%). **Table 1** presents other characteristics of the sample.

**Quality of life of patients after returning to work**

The mean scores of 8 items ranged between 2.22 and 4.09. The mean total score of HRQoL was (28.03±2.55), more than half of the surveyed patients who reported low scores (less than 25) suffered from poor HRQoL. Emotional roles (2.22±0.87) showed lowest score followed by mental health (2.38±0.88) and social functions (2.48±1.08)(**Table 2**).

**Health behaviors, social support, coping styles**

The mean total score of health behavior was 107.25±10.21. Most patients demonstrated a good interpersonal relationship with others (19.35±5.37) and they thought they had found their own value (19.75±4.91). Notably, most patients showed deficiency in health responsibility (15.70±3.54). The mean total score of social support was 32.07±4.21. Among the 326 patients, less than half of them had consulted health providers after discharge. In addition, fewer patients sought assistance from society and government. Furthermore, the patients were insufficient at identifying and using social resources (5.83±1.32). Patients tend to choose negative coping strategies with avoidance (22.58±2.98) or yield (14.15 ±3.10). (**Table 3**)

**Correlations between health behaviors, social support, coping styles and HRQoL**

Pearson correlations analysis of main variables indicated that: HRQoL was positively correlated with: health behavior, health responsibility, nutrition, exercise, self-realization, stress response, social support, objective support, subjective support and the utilization of social support$r=0.528$, $r=0.221$, $r=0.337$, $r=0.247$, $r=0.454$, $r=0.306$, $r=0.283$, $r=0.181$, $r=0.181$, $r=0.154 P \leq 0.01)$. However, there was no significant correlation between interpersonal relationship and HRQoL ($P \leq 0.05$). Meanwhile,
although HRQoL was positively correlated with facing \( r=0.300, P<0.01 \), it displayed a negative relationship with the yield \( r=-0.184, P<0.01 \). No significant association was found between avoidance and HRQoL \( P>0.05 \).

**Factors of patients' quality of life**

Multiple linear regression analysis was performed to examine HRQoL-related factors which affect HRQoL. All variables, including demographic characteristics, health behaviors, social support and coping strategies were entered as independent variables step by step. As shown in Table 4, next factors had been verified significant influence on HRQoL, including age, income, co-morbidity, the time taken to return to work, number of stents installed, whether to participate in or complete CR, health responsibility, nutrition, exercise, self-realization, stress response, objective support, subjective support, utilization of social support, coping and yield (Table 4). In addition, patients with better health behavior, more social support and positive coping strategies recorded significantly higher HRQoL.

**Discussion**

MI is a common condition associated with coping strategies, health behavior, social support and poor quality of life. We showed that almost half of the patients in this study reported poor quality of life. Patients with negative coping methods, unhealthy lifestyle, and less access to effective social resources revealed worse quality of life. According to our study, next most significant factors including family income, time taken to return to work, participation in and completion of cardiac rehabilitation (CR), health responsibilities, nutrition, exercise, self-realization, stress coping, objective support, subjective support, utilization of social support, and facing were positively associated with HRQoL, while age, co-morbidity, number of stents installed and yield demonstrated negative relation to HRQoL.

Of the 326 patients included in the study, around 30.7% were women, which is consistent with previous studies(35). It is acknowledged that most of the patients who returned to work were men, this may be related to the traditional Chinese customs, such as men need to take more family responsibilities and have powerful/prominent psychological characteristics and social roles.
In this study, more than half of the patients reported poor quality of life. According to this study, after returning to work, the body function, physical role and general health of patients were well recovered due to efficient treatment and rehabilitation with symptoms alleviated(11). This may be because patients may choose suitable work to adapt their physical functions and safety(12). However, social function, mental health and emotional role of these patients were unsatisfactory which was mainly because patients couldn’t coordinate the relationship between treatment and work(36). We also found that their abilities and achievements could not reach the pre-MI state, therefore some of them worried about lack of opportunities to promote and whether or not they could enjoy equal workplace-related rights any more. Furthermore, one third of the patients complained that they were not encouraged or affirmed by their families. On the contrary, family members always overprotect patients so that they prefer to pay too much attention to physical condition rather than mental and emotional disorders. Unfortunately, Chinese society still lacks concern and support for such patients, and what’s worse, there are no suitable policies, insurance and welfare systems implemented in mental and social health area(8). All these make patients become anxious, with feelings of inferiority, social degradation, or even depression; these factors collectively compromise the self-esteem of patients(37). At the same time, patients had to adapt to new lifestyles which may result in restrict social activities(38). As shown in this study, around 70% reported that they feared another MI, 23% found that they were more likely to lose their temper and complain. Once these situations lasted for a extend period, they would require long-term leave or be absent from work.

We found that there was a negative correlation between HRQoL and the time taken to return to work. This result was consistent with Jalil et al.(36). The time to return to work determines whether the patient has enough time to adapt and recover. Due to this, the earlier the return to work the more unlikely patients to complete CR. Resulting in inefficient heart function and body function restoration. In a short period, such patients may find it difficult to manage disease or form good health behaviors, and can find themselves in a insufficient situation cope with adverse consequences. For patients, they need time to accept the change of life style; 21.8% whom returned to work early said they expected to gradually adapt to the state of coexistence with disease. However, for economic reasons they had
to return to work as soon as possible. A study followed up patients three years after MI indicated that patients who had a harmonious relationship with the disease were more likely to efficiently identify and evaluate the risk factors. At this moment, they had a better understanding of the disease and had a high compliance with recovery exercises(39). It seems that it requires a relatively long period of time before potential risk factor become under control and patients become capable of managing their health.

According to previous study, CR could improve cardiac function and activity tolerance of patients which contribute to better prognosis and HRQoL(40). In this study, the HRQoL of the patients who participated in CR was significantly higher than those who did not. Our analysis suggested that through individualized exercise prescription, CR can improve patients' body function and assist in recovery of physical strength. Meanwhile, cardiovascular risk factors could be well-controlled through health guidance and behavioral intervention carried out during CR; additionally, CR can reduce patients' negative emotions and alleviate the effects caused by negative emotions which result in mental and social adaptability. In this study, only 63.2% of patients participated in CR. The reasons for not participating included early return to work caused time and energetic restrictions, or lived too far from the rehabilitation center, etc. Moreover, the adherence of CR in this study needs to be improved for less than 40% of patients completed CR. However, the completion of CR is a critical element to ensure the benefit of CR(41). The reasons for low compliance in this study were the same as those for low participation; in addition, most patients gave up continuing to complete rehabilitation because the benefits of CR did not seem obvious in short-term. Hence the development of community-based or home-based CR programs is necessary; CR led by multidisciplinary team may be beneficial when solving these difficulties. Besides, medical staff should emphasize the long-term benefits of CR and arrange the projects reasonably.

It turned out that unhealthy lifestyle and behavior have a negative impact on HRQoL. Health behaviors represented individuals' attitudes towards decision-making. After a cardiac event, heart symptoms still appeared occasionally and patients were disturbed by persistent risk factors(42); therefore, patients needed to follow behaviors that may be different from their previous habits to
avoid adverse cardiac events. Eva Barquero et al (21) performed a long-term cohort study of 69 patients with acute coronary syndrome. The results revealed that poor health behaviors or low compliance with health behaviors were highly associated with the reduction of HRQoL. The reasons may lie in the fact that patients with good health behaviors have more confidence to overcome difficulties and are more open to actively learn new knowledge and try suitable methods for disease management. The first step to maintain good health behavior is for patients to take responsibility for their health. For this reason, Tangri et al analyzed the health behaviors of 86 MI patients and indicated the health responsibility of patients depends on the awareness of health responsibility (38).

Our results suggested that significant differences in health behaviors emerged despondent on patients taking/not taking health responsibility. Notably, according to our study, most patients did not take corresponding responsibilities. As shown, 52% of the 326 patients in the study did not know what health responsibilities meant, and some even had never taken this issue into account. This suggested that the sense of health responsibility was very weak among these patients so that they did not realize the importance of healthy behaviors. It was also found that they were reluctant to participate in exercise. It was not only because they did not know what exercises suit their health conditions, but also because of the lack of knowledge about how to ensure safety during exercise. This indicated that a gradual health behavior plan assisted by health providers or other patients without extra burden should be put into practice. It is equally important that safe and effective rehabilitation exercises being recommended.

HRQoL is also affected by the lack of social support or ineffective resource control. Adamczyk et al (43) investigated 551 patients undergoing a CR program. Among them, 274 reported a low level of social support accompanied by a significantly lower HRQoL score. Social support affects the style and attitude of how patients cope with and manage disease. In addition, Mollon et al (44) showed that cardiac patients who can't allocate social resources were more likely to suffer a worse HRQoL, On the contrary, patients who can arrange social resources better showed relieved pressure and reduced emotional disorders. The familial supports can make patients seek help more actively; Therefore, enables them to acquire more methods/strategies to solve difficulties. In this study, we identified that
patients with deficient social support had a worse HRQoL especially in some domains such as social function and emotional role. The emotional role is a subjective measure or the limitations in work or regular daily activities, while the social function is an assessment of physical and emotional problems in normal social activities. As demonstrated, of the 326 patients who returned to work, 69.2% had at least one emotional disorder with: anxiety, loneliness and irritability were most commonly observed. At the same time, we also found that care, support and affirmation from families and society were highly required, in sight of this, it is imperative for the health provider to help patients to identify available social support and to break barriers to use social resources. More broadly, it is suggested that the colleagues and supervisors of patients treat them equally and arrange the workload reasonably according to their health conditions. Families and friends should not prevent patients from returning to work. Besides, it's advocated that the whole society should pay more attention to these patients and develop supportive policies.

Another key factor related to HRQoL is coping strategies. Kureshi et al(45) had investigated the patients with coronary heart disease after returning to work and found that the patients could not face the disease positively. In most cases, they were reluctant to supervise and evaluate health conditions, resulting in the failure to record and deal with the symptoms in time, or to follow the doctor's instructions. Elena’s study showed patients adopt ways of avoidance instead of seeking professional guidance actively(37). U Euler et al(46) had confirmed that when there was conflict between disease and work, patients coped with tolerance, and could not communicate well. Positive coping strategies can alleviate stress and promote communication. Although positive coping style cannot improve patients' physical function directly, it can have a significant affect thorough the improvement in mental state and health behavior. This study also showed patients who were easily yield got poor HRQoL. This is understandable, yield weakened patients' health responsibility, which may further contribute to poor compliance to healthy behaviors. Moreover, if patients always yield and take an avoid attitude towards difficulties, their consciousness of disease prevention could be weak, which leads to negative effect when they manage disease. In turn, all these factors could eventually cause adverse cardiac events. Therefore, health providers should take targeted strategies
to improve the patients' coping strategies. In such way, the patients can face disease and work with an optimistic and positive attitude.

**Advantages and limitations**

To our understanding, this is the first study that has investigated the effects of healthy behavior, coping strategies and social support on HRQoL of patients with MI after returning to work. It is necessary to highlight some limitations. Some participants rejected to attend or did not complete the whole investigation. Which means that the results could be biased. The possible reason is that the patients did not have enough time to complete the survey due to time constraints after returning to work. It should be noted that most of the patients in the study come from urban areas (cities); but according to the epidemiological characteristics of MI the incidence in rural areas is higher. Since rural medical resources are limited and rural patients' education level is generally low, future research should focus on these patients. Meanwhile, all the questionnaires used in this study are self-report questionnaires, while the measurement depended on the accuracy of patients' answers. The interrelationship between the factors affecting HRQoL had not been explored. However, some variables may be moderator variables, which need to be further verified. One thing that can't be ignored were the sample that were selected from three hospitals in one area without systematic sampling methods, which means the possibility of selection bias. Therefore, the results might be unsuitable to be extended.

**Relevance to clinical practice.**

The existence of various physical and mental problems with MI patients after returning to work is greatly compromised the HRQoL of such a group of people. Via systematically investigating the key factors that affect the HRQoL, this work allows health care providers to not only identify and evaluate these factors and analyze the relationship between factors, but also develop targeted interventions, thereby promoting the life quality of MI patients who returned to work.

**What does this paper contribute to the wider global clinic.**

This work will contribute to the knowledge about the key factors and predictors of HROoL, thereby providing a foundation for further understanding of direction of cardiac rehabilitation and the factors
that patients should pay attention to during social rehabilitation. The findings of this study will provide scientific guidance to health care providers to develop multidisciplinary solutions and interventions to improve HRQoL of MI patients who returned to work.

Implications
This study provided data on HRQoL of patients with MI after returning to work and pointed out HRQoL needed to be improved. Furthermore, the factors related to HRQoL were comprehensively analyzed to provide the basis for health providers to further develop targeted interventions. The results of the study are equally important to clinical practice and the findings are important for promoting continuous care in patients with MI. Health provider should pay attention to the factors identified in this study and consider the following strategies: (1) provide individualized health education for patients through feasibly; (2) help patients adhere to good health behaviors and improve their health responsibilities to further enhance activity endurance and maintain a balanced diet; (3) help to appeal supports from public and government, provide a good working environment and promote patients’ access to social support; (4) emphasize and solve psychological and emotional disorders and promote effective communication; (5) ensure the safety of occupational rehabilitation training and carry out integrated management; (6) guide patients to adopt more positive coping styles and to keep optimistic attitudes. Additionally, the findings provide a theoretical basis for the development of targeted interventions to improve the quality of life. Lastly, the findings provide a basis for further understanding the direction of cardiac rehabilitation and the key factors of social rehabilitation.

Conclusions
HRQoL of patients with MI who returned to work should be improved. Our findings suggested that health behavior, social support, and coping strategies were influencing factors on HRQoL of such patients. Good health behavior, sufficient social support and positive coping style are related to good quality of life. Therefore, health providers should develop targeted and continuous interventions according to these factors which can improve HRQoL and promote long-term social function. At the same time, the importance of vocational rehabilitation should be emphasized.

Abbreviations
MI: Myocardial Infarction; HRQoL: Health-related quality of life; CR: Cardiac Rehabilitation; SF-8: Short-Form Health Survey-8; HPLPⅡ: Health-Promoting Lifestyle ProfileⅡ; MCMQ: Medical Coping Modes Questionnaire; SSRS: Social Supporting Rating Scale.

Declarations

**Ethics approval and consent to participate**

This study was approved by the Institutional Review Board (IRB No.2018-LW-016). Written informed consent was obtained from participants included in the study. All participants were informed that any personal information obtained in this study would remain confidential.

**Consent for publication**

Not applicable.

**Availability of data and materials**

The data generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author who was an organizer of the study.

**Conflict of interest**

No conflict of interest has been declared by the authors.

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**Authors’ contributions**

DRF, WPP, CCY and WT contributed to the conception of the study, drafting and critical revision of the manuscript, and provided final approval of the manuscript, MLX contributed to solving statistic problems, Leon M. Larcher contributed to language editing.

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References

1. M S, D S, N B. Organizational update: the world health organization global status report on noncommunicable diseases 2014; one more landmark step in the combat against stroke and vascular disease. STROKE. 2015;9(46):121-9.

2. Members WG, Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, et al. Heart Disease and Stroke Statistics-2016 Update: A Report From the American Heart Association. CIRCULATION. 2016;133(4):38-47.

3. STEVENS, PENRVA, JZ L, LZ L, G L, R G. Estimating the future burden of cardiovascular disease and the value of lipid and blood pressure control therapies in China. BMC HEALTH SERV RES. 2016;1(16):175-84.

4. Mokdad, H. A. Burden of cardiovascular diseases in the Eastern Mediterranean Region, 1990–2015: findings from the Global Burden of Disease 2015 study. INT J PUBLIC HEALTH. 2018;1(63):1-13.

5. Naito R, Miyauchi K, Konishi H, Tsuboi S, Daida H. Temporal Trends in Clinical Outcome After Percutaneous Coronary Intervention 1984-2010 - Report From the Juntendo PCI Registry. CIRC J. 2015;80(1):93-101.

6. Han S, Gyung-Min P, Yong-Giun K, Mahn-Won P, Ho HS, Seung-Whan L, et al. Trends, Characteristics, and Clinical Outcomes of Patients Undergoing Percutaneous Coronary Intervention in Korea between 2011 and 2015. KOREAN CIRC J. 2018;48(4):310-20.

7. Latil F, Iliou MC, Boileau C, Pietri JX, Lechien C, Ha-Vinh P, et al. Returning to work after an acute coronary syndrome: When waiting is wasting. Ann Cardiol Angeiol.
8. Inchul J, Bum PJ, Ryoul KH, Jin-Ha Y, Jong-Uk W, Jaehoon R. Impacts of Return-to-Work Type and Period on Job Retention in Workers with Occupational Injuries and Diseases. J Kor Med Sci. 2018;33(1):2-12.

9. Sunamura M, Ter Hoeve N, van den Berg-EMons RJ, Boersma E, Geleijnse ML. Cardiac rehabilitation in patients with acute coronary syndrome with primary percutaneous coronary intervention is associated with improved 10-year survival. Eur Heart J Qual of Care & Clin Out. 2018;65(19):1065-77.

10. Y B. Assessing the Costs and Benefits of Return-to-Work Programs. Mathe Pol Res Re. 2015;5841(317):356-9.

11. Reibis, Salzwedel, Falk, Völler. Return to Work after Acute Myocardial Infarction. Circ Cardio Qual Out. 2017;142(8):617-24.

12. Lamberti M. Work-related outcome after acute coronary syndrome: Implications of complex cardiac rehabilitation in occupational medicine. Int J Occupa Med and Envir Hea. 2015;4(29):649-57.

13. Biering, T L. Effect of Psychosocial Work Environment on Sickness Absence Among Patients Treated for Ischemic Heart Disease. J OCCUP REHABIL. 2015;25(4):776-82.

14. Dreyer RP, Vaughan DV. Return to Work After Acute Myocardial Infarction. Circulation Cardiovascular Quality & Outcomes. 2018;11(6):4806-12.

15. Zhou Y, Li J, Du S, Du X, Fu C, Cao C, et al. Cardiac rehabilitation knowledge in patients with coronary heart disease in Baoding city of China: A cross-sectional study. Int J Nur Sci. 2017;4(1):24-8.

16. Dreyer RP, Xu X, Zhang W, Du X, Strait KM, Bierlein M, et al. Return to Work After Acute Myocardial Infarction: Comparison Between Young Women and Men. Circ Cardiovasc Qual Outcomes. 2016;9(1):45-56.
17. Babić, Zdravko, Pavlov, Marin, Oštrić, Mirjana, et al. Re-initiating professional working activity after myocardial infarction in primary percutaneous coronary intervention networks era. Int J Occupa Med and Envir Hea. 2015;6(28):999-1010.

18. Abbasi M, Neishaboury M, Koohpayehzadeh J, Etemad K, Meysamie A, Asgari F, et al. National Prevalence of Self-Reported Coronary Heart Disease and Chronic Stable Angina Pectoris: Factor Analysis of the Underlying Cardiometabolic Risk Factors in the Fourth Round of the SuRFNCD-2011. Global Heart. 2018;13(2):73-82.

19. Haveraaen LA, Skarpaas LS, Aas RW. Job demands and decision control predicted return to work: the rapid-RTW cohort study. BMC PUBLIC HEALTH. 2017;17(1):154-62.

20. Haider W, Lisa K, Gregg F, Eric P, Tracy W. Adverse Change in Employment Status After Acute Myocardial Infarction. Circ Cardiovasc Qual Outcomes. 2018;11(6):4528-40.

21. Barquero E, Simon O, Bailly K, Patier J, Mansourati J. Return-to-work after an acute coronary syndrome treated by percutaneous coronary intervention and cardiac rehabilitation: long-term cohort evaluation. Arch Cardio Dis Supple. 2016;8(3):266.

22. Ç Ş, Demiral Y, Kılıç B, Aslan Ö. Changes in Employment Status after Myocardial Infarction among Men. Balkan Med J. 2016;33(4):419-25.

23. Salomonsson S, Santoft F, Linds Ter E, Ejebby K, Ljótsson B, St LR, et al. Cognitive-behavioural therapy and return-to-work intervention for patients on sick leave due to common mental disorders: a randomised controlled trial. Occupa and Envir Med. 2017;30(8):714-21.

24. de Jonge P, Zuidersma M, Bültmann U. The presence of a depressive episode predicts lower return to work rate after myocardial infarction. Gen Hos Psy. 2015;36(4):363-7.

25. Gutierrez J, Alloubani A, Mari M, Alzaatreh M. Cardiovascular Disease Risk Factors: Hypertension, Diabetes Mellitus and Obesity among Tabuk Citizens in Saudi Arabia. O Cardio Med J. 2018;12(1):41-9.
26. Tella NC, Arnaiz CS, Gatius JR, Torres OY, Santiago LG. Assessment of the length of sick leave in patients with ischemic heart disease. Bmc Cardio Dis. 2017;17(1):32-9.

27. Gaglia MA, Torguson R, Lipinski MJ, Gai J, Koifman E, Kiramijyan S, et al. Frequency of Angina Pectoris After Percutaneous Coronary Intervention and the Effect of Metallic Stent Type. AM J CARDIOL. 2016;8(25):206-14.

28. Cassese S, Byrne RA, Tada T, Pinieck S, Joner M, Ibrahim T, et al. Incidence and predictors of restenosis after coronary stenting in 10 004 patients with surveillance angiography. HEART. 2014;100(2):153-9.

29. Li J, Loerbroks A, Bosma H, Angerer P. Work stress and cardiovascular disease: a life course perspective. J OCCUP HEALTH. 2016;58(2):216-9.

30. Oleson M, Shadick MG. Application of Moos and Schaefer's (1986) model to nursing care of elderly persons relocating to a nursing home. J ADV NURS. 1993;18(3):479-85.

31. Turner-Bowker DM, Bayliss MS, Ware JE, Kosinski M. Usefulness of the SF-8? Health Survey for comparing the impact of migraine and other conditions. Qua L Res. 2003;12(8):1003-12.

32. Pullen C, Walker SN, Fiandt K. Determinants of Health-Promoting Lifestyle Behaviors in Rural Older Women. Fam & Com Hea. 2007;24(2):49-72.

33. Yang D, Ye J, Zhou F. Relationship between uncertainty in illness, mood state and coping style in patients with temporomandibular disorders. International Journal of Nursing Sciences. 2015;4(2):361-5.

34. Garg M, Bliven B, Jones P, Spertus JA. Low perceived social support influences quality of life of female patients undergoing coronary revascularization. J AM COLL CARDIOL. 2002;39(2):437-42.

35. Boyer NM, Laskey WK, Cox M, Hernandez AF, Peterson ED, Bhatt DL, et al. Trends in
Clinical, Demographic, and Biochemical Characteristics of Patients With Acute Myocardial Infarction From 2003 to 2008: A Report From the American Heart Association Get With The Guidelines Coronary Artery Disease Program. J AM HEART ASSOC. 2012;32(25):4628-37.

36. Mirmohammadi SJ, Sadr-Bafghi SM, Mehrparvar AH, Gharavi M, Shokouh P. Evaluation of the return to work and its duration after myocardial infarction. ARYA Athero. 2014;10(3):137-40.

37. Fiabanelnes E, Giorgi, Stefano M, CanduraPiergiorgio, Argentero. Return to work after coronary revascularization procedures and a patient’s job satisfaction: A prospective study. Int J Occupa Med and Envir Hea. 2015;76(6):1-10.

38. Tangri N, Ferguson TW, Whitlock RH, Rigatto C, Komenda P. Long term health outcomes in patients with a history of myocardial infarction: A population based cohort study. PLOS ONE. 2017;12(7):182-90.

39. Spertus J, Bhandary D, Fonseca E, Bhalla N, Manzi MA, Hoetzer G, et al. Contemporary Incidence Of Recurrent Cardiovascular Events 1 To 3 Years After Myocardial Infraction: Longitudinal Us Analysis From NCDR Registries Linked With All-Payer Claims Database. J A Col of Cardio. 2018;71(11):24-32.

40. Ter HN, Sunamura M, Stam HJ, Boersma E, Geleijnse ML, van Domburg RT, et al. Effects of two behavioral cardiac rehabilitation interventions on physical activity: A randomized controlled trial. INT J CARDIOL. 2018;255(31):221-8.

41. QR P, A P, T L, PS P, R B, AR A, et al. Cardiac Rehabilitation Utilization During an Acute Cardiac Hospitalization: A NATIONAL SAMPLE. J CARDIOPULM REHABIL. 2019;39(1):19-29.

42. Jortveit J, Halvorsen S, Kaldal A, Pripp AH, Govatsmark RES, Langørgen J. Unsatisfactory risk factor control and high rate of new cardiovascular events in
patients with myocardial infarction and prior coronary artery disease. BMC Cardio Dis. 2019;19(1):566-79.

43. Adamczyk K. An Investigation of Loneliness and Perceived Social Support Among Single and Partnered Young Adults. Cur Psy. 2016;33(52):879-89.

44. Mollon L, Bhattacharjee, Sandipan. Health related quality of life among myocardial infarction survivors in the United States: a propensity score matched analysis. Hea and Qua L Out. 2017;15(1):235-43.

45. Kureshi F, Shafiq A, Arnold SV, Gosch K, Breeding T, Kumar AS, et al. The prevalence and management of angina among patients with chronic coronary artery disease across US outpatient cardiology practices: insights from the Angina Prevalence and Provider Evaluation of Angina Relief (APPEAR) study. Clin Cardio. 2017;9(23):863-75.

46. Euler U, Wegewitz UE, Schmitt J, Adams J, Seidler A. Interventions to support return-to-work for patients with coronary heart disease. COCHRANE DB SYST REV. 2013;2013(9):275-87.

Tables

Table 1  Sociodemographic and Clinical Variablesn=326
| Variables                  | Frequency | %     | Variables                  | Frequency | %     |
|----------------------------|-----------|-------|----------------------------|-----------|-------|
| Education Level            |           |       | Number of stent            |           |       |
| Junior school and below    | 10331.6   | 31.6  | 1                          | 21365.3   | 65.3  |
| High school                | 14745.1   | 45.1  | 2                          | 298.5     |       |
| College and above          | 7623.3    | 23.3  |                            |           |       |
| Occupation                 |           |       | Time returned to work      |           |       |
| Farmer                     | 8827      | 27    | 3M                         | 7121.8    | 21.8  |
| Worker                     | 13541.4   | 41.4  | 6M                         | 3197.9    | 9.6   |
|                            |           |       | 1Y                         | 128       | 39.3  |
|                            |           |       |                            |           |       |
| Medical insurance          | Yes       | 3197.9| Quit                       | 128       | 39.3  |
|                            | No        | 72.1  | Light                      | 752       | 23.3  |
| Work Intensity             | Light     | 10732.8| Medium                    | 6820.6    | 20.8  |
|                            | Medium    | 21967.2| Heavy                     | 4212.6    | 13.2  |
| Income(Yuan)               | 1000/M    | 4112.6| Drink                      | 1243.4    |       |
|                            | 10013000/M| 8325.4| Quit                       | 206.1     |       |
|                            | 30015000/M| 15948.8| Light                     | 962.6     |       |
|                            | 5001/M    | 4313.2| Medium                    | 491.5     |       |
| Participate in cardiac rehabilitation | Yes | 20663.2| Heavy                     | 3711.4    |       |
|                            | No        | 12036.8| Co-morbidity              | 6018.4    |       |
| Complete cardiac rehabilitation | Yes | 12839.3| 1                         | 17553.7   |       |
|                            | No        | 19860.7| 2                         | 7623.3    |       |
|                            |           |       | ≥3                        | 154.6     |       |

Table 2 Quality of Life Outcome scores n=326
| Items                | Average Score \( \bar{x} \pm s \) | Rank |
|----------------------|------------------------------------|------|
| General health       | 3.49±0.81                          | 3    |
| Body function        | 4.09±0.29                          | 1    |
| Physical Role        | 3.61±0.59                          | 2    |
| Body Pain            | 3.18±0.88                          | 5    |
| Vitality             | 3.23±0.75                          | 4    |
| Social function      | 2.48±1.08                          | 6    |
| Emotional Role       | 2.22±0.87                          | 8    |
| Mental Health        | 2.38±0.88                          | 7    |

Table 3: Scores of Health Behaviors, Social Support, Coping Styles \( n=326 \)

| Items                               | mean score \( \bar{x} \pm s \) |
|-------------------------------------|---------------------------------|
| Health Responsibility               | 15.70±3.54                      |
| Nutrition                           | 17.48±4.01                      |
| Exercise                            | 16.18±2.97                      |
| Self-realization                    | 19.75±4.91                      |
| Interpersonal Relationship          | 19.35±5.37                      |
| Coping with Stress                  | 16.83±3.29                      |
| Total Score of Health Behavior      | 107.25±10.21                    |
| Objective Support                   | 8.24±2.13                       |
| Subjective Support                  | 18.00±3.31                      |
| Utilization of Social Support       | 5.83±1.32                       |
| Total Score of Social Support       | 32.07±4.21                      |
| Facing                              | 17.51±3.37                      |
| Avoidance                           | 22.58±2.98                      |
| Yield                               | 14.15±3.10                      |
Table 4 Factors related to patients' quality of life

| Independent variable                  | B   | SB  | t     | P    |
|---------------------------------------|-----|-----|-------|------|
| Constant                              | 7.388 | 1.576 | 4.688 | 0.000 |
| Age                                   | -0.354 | 0.170 | -2.077 | 0.039 |
| Nationality                           | 0.195 | 0.334 | 0.584 | 0.560 |
| Marital Status                        | -0.150 | 0.108 | -1.386 | 0.167 |
| Residence                             | 0.145 | 0.087 | 1.669 | 0.096 |
| Level of Education                    | -0.155 | 0.129 | -1.198 | 0.232 |
| Payment                               | -0.045 | 0.193 | -0.234 | 0.815 |
| Occupation                            | -0.097 | 0.076 | -1.276 | 0.203 |
| Working Intensity                     | -0.051 | 0.213 | -0.238 | 0.812 |
| Income                                | 0.513 | 0.100 | 5.139 | 0.000 |
| Co-morbidity                          | -0.440 | 0.107 | -4.094 | 0.000 |
| Stent Number                          | -0.359 | 0.122 | -3.023 | 0.003 |
| Time Taken to Return to Work          | 0.235 | 0.078 | 3.022 | 0.003 |
| Participate in Cardiac Rehabilitation | -1.777 | -0.336 | -8.697 | 0.000 |
| Complete Cardiac Rehabilitation       | -1.409 | -0.270 | -6.595 | 0.000 |
| Smoke                                 | 0.072 | 0.080 | 0.904 | 0.367 |
| Drink                                 | 0.001 | 0.075 | 0.007 | 0.994 |
| Health Responsibility                 | 0.172 | 0.022 | 7.695 | 0.000 |
| Nutrition                             | 0.178 | 0.020 | 8.776 | 0.000 |
| Exercise                              | 0.165 | 0.028 | 5.939 | 0.000 |
| Self-realization                      | 0.165 | 0.017 | 9.924 | 0.000 |
| Cope with Stress                      | 0.172 | 0.024 | 7.088 | 0.000 |
| Objective support                     | 0.175 | 0.037 | 4.682 | 0.000 |
| Subjective support                    | 0.167 | 0.024 | 6.956 | 0.000 |
| Utilization of social support         | 0.134 | 0.061 | 2.202 | 0.028 |
| Coping                                | 0.133 | 0.024 | 5.553 | 0.000 |
| Avoidance                             | 0.024 | 0.027 | 0.889 | 0.375 |
| Yield                                 | -0.165 | 0.026 | -6.419 | 0.000 |

R=0.855R² =0.731Adjusted R² =0.706F=28.843P<0.001

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