

Role of Sense of Coherence in the Outcomes of Acute Myocardial Infarction Survivors: A 2-Year Follow-Up Study

Abstract

Background: Survivors of acute myocardial infarction (AMI) struggle with stressful consequences. Sense of coherence (SOC) seems to be associated with a person's capacity to face life incidents. This study aims to evaluate SOC's correlation with the major adverse cardiac events (MACE) among the AMI survivors. The study was designed and reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines and checklist. **Methods:** This study was part of the ST-elevation myocardial infarction cohort study in Isfahan (SEMI-CI) conducted on 724 AMI survivors followed for 2 years. The patients' demographics, medical history, and follow-up manifestations were recruited. The 13-item SOC questionnaire was utilized to evaluate the patients' SOC, and the Diagnostic Criteria for Psychosomatic Research (DCPR) questionnaire was used for psychosomatic disorder evaluation, including health anxiety, illness denial, irritable mood, and demoralization. MACE defined as non-fatal myocardial infarction (MI), non-fatal stroke, and atherosclerosis cardiovascular disease (ASCVD)-related death was recorded. **Results:** Logistic regression assessments showed that the SOC level was an independent predictor for the development of MACE (OR: 0.67; 95%CI: 0.40–0.85). This finding was confirmed by the controlling factors, including demographic data (OR: 0.60; 95%CI: 0.35–0.79), demographic factors and medical history (OR: 0.62; 95%CI: 0.36–0.86), the previous ones plus clinical follow-up assessments (OR: 0.59; 95%CI: 0.33–0.79), and all the evaluations plus psychosomatic factors (OR: 0.76; 95%CI: 0.42–0.92). Similar outcomes were achieved using SOC scores. **Conclusions:** Based on this study, SOC was an independent MACE predictor in a large population of AMI patients through a 2-year follow-up period.

Keywords: Cohort studies, ST elevation myocardial infarction, sense of coherence, survivors

Introduction

Acute myocardial infarction (AMI) is a life-threatening condition that poses great distress to many patients. It is demonstrated that approximately 20% of the patients develop clinical symptoms related to stressful conditions, such as acute stress disorder or post-traumatic stress disorder.^[1] Furthermore, the heart muscle functional insufficiency for coping with stressful conditions and essential requirement of alterations in the lifestyle, such as control of risk factors, medication intake, and behavioral changes, are the significant factors related to impairment in the daily life function and health-related quality of life^[2], while the health-related quality of life is itself associated with the sense of coherence (SOC).^[3]

Since 1993, Antonovsky raised a term, SOC, that refers to a global orientation regarding

the extent of an enduring, pervasive, and powerful feeling of confidence. SOC refers to three entities: 1) The stimuli from either internal or external environment in the course of living are structured, predictable, and explicable; 2) the person struggling with the stimuli has available resources for facing the demands posed by the stimuli; and 3) the required demands are the concerns of life, worth-investing, and worth-engaging.^[4,5] In general, SOC is defined as a person's overall view of life as a meaningful, manageable, and structured orientation and the capacity of responding to stressful conditions.^[6]

The stronger SOC leads to a better ability to cope with stressful conditions in life and regulate the emotions in these conditions, altogether help maintain good health.^[7] Therefore, those with stronger SOC are more likely to neglect stressors, automatically adapt to the required demands of a stimulus, represent more

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extents of confidence, and eventually, overcome these conditions.^[8] Given that, due to the thorough concept of SOC from living, it is demonstrated to be directly correlated with health-related quality of life, the condition that not only is affected by the incidence of AMI and its consequences, but also independently is associated with the risk of developing coronary heart disease (CHD), cardiac-related hospitalization, and major adverse cardiac events (MACE).^[9-12]

To the best of our knowledge, despite the studies assessing the significance of SOC as an independent determinant of health-related quality of life among patients with CHD, whether in particular subgroups of patients^[13,14] or those with especial cardiac treatment approaches,^[3,15] there is no study assessing the values of SOC for a prediction of MACE; therefore, this report is aimed to assess the association of SOC with MACE in a large population of AMI patients through a 2-year cohort study.

Materials and Methods

Study population

This census cohort study is part of the ST-elevated myocardial infarction cohort study in Isfahan (SEMI-CI) conducted on 867 patients with AMI admitted at cardiology

referral centers from September 2015 to October 2016.^[16] Figure 1 represents the details of the studied population.

The over-18-year-old hemodynamically stable patients diagnosed as AMI due to the manifestations of ST-segment elevation myocardial infarction (STEMI) or new-onset left bundle branch block (LBBB) were included. The AMI occurrence during a balloon angioplasty procedure, the simultaneous presence of other major medical conditions (e.g., chronic kidney, liver, thyroid, and brain-related diseases), and major psychiatric disorders were considered the exclusion criteria.

The study population was included through convenience sampling from all of the patients who met the inclusion criteria. In this term, a trained nurse gathered the patients' medical and demographic information from the hospital medical archives and then interviewed them to fill the psychosomatic questionnaires. The study follows the guidelines for reporting cohort studies according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.

Ethical considerations and written consent

The university ethics committee approved the study proposal. After that, the study protocol was explained

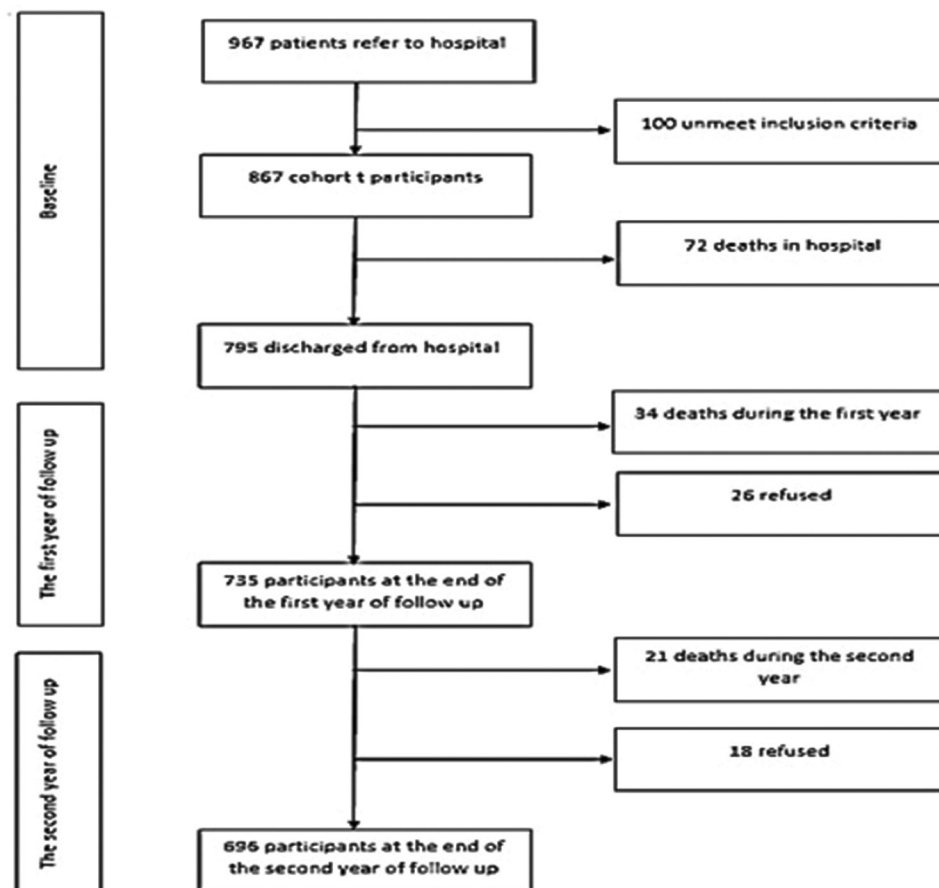


Figure 1: Consort diagram of the studied population within the 2-year follow-up

for the eligible patients, they were reassured about the confidentiality of their personal information, and eventually, written consent for participation in the study was obtained.

Primary assessments

An overview

The patients were primarily diagnosed as AMI due to the definitions, including manifestations of STEMI in two or more echocardiogram leads indicating a particular epicardial involvement territory or new-onset LBBB.

After the admission, all of the required interventions were performed as soon as possible. Then, the patients were admitted to the cardiac care unit (CCU) until achieving the desired stability in hemodynamic. Following this stability, we proposed our request to fill the questionnaires designed for the study.

The latter obtained information at discharge includes ejection fraction (EF) based on echocardiography, weight, height, body mass index (BMI), systolic (SBP), and diastolic blood pressure (DBP), and hyperlipidemia. The information on performed intervention, percutaneous coronary intervention (PCI), or coronary artery bypass grafting (CABG) was recorded in the checklist, as well.

Follow-up assessment

The patients were followed annually for 2 years through telephoning and invitation for an in-person visit with a cardiologist. At the appointment, the cardiologist assessed the patient's blood pressure (BP) and EF (by echocardiography) based on standard protocols and recorded in the study checklist. Besides, a thorough physical examination, the evaluation of drug history and adherence to the medications were assessed.

Besides, a trained nurse recruited information about medication adherence, and a trained physician gathered the data about MACE occurrence in the study population. The term "MACE" refers to atherosclerosis cardiovascular diseases (ASCVD) in coronary and cerebral vessels, including non-fatal myocardial infarction (MI), non-fatal stroke, and ASCV deaths. In the case of death, hospital records, verbal autopsies, and death certificates were utilized for recruiting further details. The consistency of death records with hospital medical documents was interpreted and confirmed by a panel consisting of two cardiologists and a neurologist.

Measurements

Demographic information

This study's obtained demographic information included age, gender, and marital status; all were recruited from the patient's medical records existed in the hospital. In cases with incomplete medical records, the demographic information was obtained through either telephoning or follow-up visits.

Medical history

The patients' clinical history, including the previous history of MI, diabetes mellitus, and hypertension, was gathered from the hospital medical records. The information about the involved epicardial territory(s) based on the coronary angiography and EF at discharge was recruited from the hospital's medical documents.

In addition, the severity of AMI was assessed by the consideration of the involved epicardial territory(s) (stenosis in more than 75% of the vessels) and the EF at discharge. Therefore, the AMI was more severe by increasing the numbers of involved epicardial territories and a more noticeable reduction in the EF.

Besides, the patient's BP and EF (through echocardiography) were re-evaluated based on the standard protocol in the 2-year follow-up visit, as well.

The diagnostic criteria for psychosomatic research

The Diagnostic Criteria for Psychosomatic Research (DCPR) questionnaire was used to assess the psychosomatic factors. This questionnaire includes a set of 12 clusters assessing different categories of psychosomatic manifestations: four clusters target perceiving and responding to health status; four assess the concept of somatization, and the latter four consider the consistent and frequent psychosomatic dimensions detected in medical patients. The original version of DCPR has shown the generally substantial interrater agreement for all 12 syndromes (all κ values >0.61) and perfect agreement for 9 of the assessed clusters ($\kappa > 0.81$).^[17,18]

In this study, we proposed four clusters, including health anxiety (four questions), illness denial (three questions), irritable mood (five questions), and demoralization (five questions). The results were interpreted qualitatively, whether a disorder is present or not.

Sense of coherence questionnaire

We used the 13-item questionnaire to evaluate the patients' SOC; Erikson and Lindstrom primarily validated the questionnaire in 2005. The 13-item SOC questionnaire is rated based on a 7-score Likert scale assessing three aspects of comprehensibility (five items), manageability (four items), and meaningfulness (four items). The responses to questions number 1, 2, 3, and 7 should be scored inversely. The questionnaire's final scores ranged from 13 to 91 in total, while the scores of each subscale, comprehensibility, manageability, and meaningfulness can be measured separately. The validated versions of the 13-item SOC questionnaire in the literature had the alpha Cronbach's ranging from 0.70 to 0.92.^[19] Mahammadzadeh and Colleagues^[20] validated the Persian version of this means in 2010 that revealed the remarkable Cronbach's alpha of 0.77.

In this study, we have made a reference range of 52 to divide the patients into the two groups of a low and high

SOC, as those with the scores above 52 are considered high, and the remaining ones as a low SOC.

Statistical analysis

The obtained data were entered into the Statistical Package for Social Sciences (SPSS; version 15.0, SPSS Inc., Chicago, IL, USA). The descriptive data were presented in mean, standard deviation, absolute numbers, and percentages. In order to compare the frequencies between the groups, the Chi-square test was utilized. The continuous variables were compared using the *t*-test.

Binary logistic regression analysis was applied to find the association between MACE and SOC level in crude (model 1) and adjusted models, including demographic factors, patients' medical history, clinical follow-up assessments, and contributing psychosomatic factors (health anxiety, illness denial, irritable mood, and demoralization). Linear logistic regression analysis with similar models was applied to assess the SOC score association with the mentioned factors. Odds ratios (ORs) and ORs per SD were reported with the corresponding 95% confidence intervals (95% CIs). *P* value of less than 0.05 was considered a significant level.

Results

General information

In this study, eligibility of 967 cases with AMI was evaluated, among which 100 ones unmet the inclusion criteria; therefore, 867 ones entered into the study, among which 72 ones died at hospital admission. Among the 795 discharged ones, 735 ones remained in the study within the first year of follow-up, 26 ones refused to refer for the annual follow-up visit, and 34 deaths occurred. Within the second year of follow-up, 696 ones fulfilled the study, 18 ones refused to participate in the annual visit, and 21 deaths occurred [Figure 1]. Eventually, the recruited information of 724 ones was complete and eligible for participation in this study; the final analysis was made for these persons.

The total score of SOC in the studied group was calculated as 51.88 ± 6.39 . The comparison of SOC score between the two groups experienced MACE and who did not reveal statistically remarkable higher scores among those without MACE (52.43 ± 6.08 versus 50.35 ± 6.54 ; *P* value = 0.031).

Comparing the patients with low versus high SOC in terms of demographic characteristics, clinical history, follow-up evaluations, and psychosomatic factors is demonstrated in Table 1. Based on this table, high SOC was remarkably correlated with male gender (*P* value < 0.001) and higher EF at discharge (*P* value = 0.01). In contrast, psychosomatic factors, including health anxiety (*P* value = 0.003), irritable mood (*P* value = 0.001), demoralization (*P* value = 0.006), and major cardiovascular events (*P* value = 0.021) had reverse association with SOC. The latter factors, including

marital status, age, current smoking, BMI, PCI intendant, CABG intendant, the previous medical history, numbers of involved epicardial territories, follow-up clinical evaluations, and illness denial, were not associated with the status of SOC (*P* value > 0.05).

SOC association with MACE

The assessment of SOC level merely as a predictor for the development of MACE using logistic regression showed significant association (OR: 0.67; 95%CI: 0.40–0.85), the finding that was confirmed by controlling factors, including demographic data (OR: 0.60; 95%CI: 0.35–0.79), demographic factors and the medical history (OR: 0.62; 95%CI: 0.36–0.86), the previous ones plus clinical follow-up assessments (OR: 0.59; 95%CI: 0.33–0.79), and those above plus psychosomatic factors (OR: 0.76; 95%CI: 0.42–0.92). Figure 2 demonstrates the SOC level's value for MACE's prediction through univariate and multivariate logistic regression analyses.

Another assessment of this study regarding the predicting values of SOC score for MACE incidence revealed similar associations, as demonstrated in Table 2.

Discussion

A SOC is an issue demonstrating a comprehensive view of a personal idea about the facts of life and how to face internal and external stressors^[21]; therefore, it seems rational to be affected by cross-cultural factors.^[22] To the best of our knowledge, this study is the first one in Iran's community assessing the role of SOC on MACE among those with AMI. The primary outcomes of our study showed that SOC was an independent determinant of MACE among the patients struggling with CHD through a 2-year follow-up study. This independent role was not only regardless of the demographic factors, medical and clinical manifestations, but also psychosomatic factors, which are probably related to the incidence of CHD.

We found that males represented better SOC than females, while age and marital status were the factors that did not affect SOC. Gender-based comparison of SOC is a matter of debate; however, despite all of the controversies, most of the studies are in line with us, representing more vulnerability of females facing a disease.^[23–25] The assessment of SOC regarding age has shown contradictory results, as well. Several studies in the literature have represented a steady SOC along with the life, as a fact that a person's belief about comprehensibility, meaningfulness, and manageability would not alter throughout the life, while the others have opposed this theory. Some of the authors believed in the improved SOC by aging,^[3,26] and the others represent a deterioration of it through a life span, by the emergence of diseases in particular.^[27]

This study believes that higher SOC is directly associated with reduced cardiovascular event incidence and long-term

Table 1: Association of sense of coherence status with demographic and clinical factors and the incidence of major cardiovascular events

	High sense of coherence <i>n</i> =344	Low sense of coherence <i>n</i> =380	<i>P</i>
Demographic factors			
Sex (male) <i>n</i> (%)	314 (91.3)	306 (80.5)	0.0001
Marriage (married) <i>n</i> (%)	335 (99.1)	372 (99.7)	0.18
Age, mean (SD)	58.8 (12.1)	57.9 (11.7)	0.57
Medical history			
Current smoking <i>n</i> (%)	146 (42.4)	157 (41.3)	0.79
Body mass index <i>n</i> (%)	26.4 (4.2)	26.7 (3.8)	0.26
PCI intended <i>n</i> (%)	324 (94.2)	361 (95.0)	0.95
CABG intended <i>n</i> (%)	2 (0.6)	2 (0.5)	0.92
Previous history of myocardial infarction <i>n</i> (%)	38 (11.0)	54 (14.2)	0.20
History of diabetes mellitus <i>n</i> (%)	97 (28.2)	109 (28.8)	0.88
Hyperlipidemia <i>n</i> (%)	98 (28.5)	115 (30.3)	0.67
History of hypertension <i>n</i> (%)	105 (30.6)	140 (36.8)	0.07
Number of involved epicardial territories <i>n</i> (%)			
1	159 (46.3)	196 (51.6)	0.28
2	126 (36.6)	112 (29.5)	
3	58 (16.9)	71 (18.9)	
Ejection fraction at discharge, mean (SD)	39.1 (11.2)	37.0 (12.2)	0.01
Atrial fibrillation at discharge <i>n</i> (%)	6 (1.7)	2 (0.5)	0.12
Clinical follow-up assessment			
Systolic blood pressure after 2-year follow-up mean (SD)	125.3 (17.7)	126.5 (11.4)	0.80
Ejection fraction after 2-year follow-up mean (SD)	45.7 (11.2)	46.7 (11.6)	0.75
Psychosomatic factors			
Health anxiety <i>n</i> (%)	13 (3.5)	35 (9.5)	0.003
Illness denial <i>n</i> (%)	36 (10.5)	50 (13.3)	0.26
Irritable mood <i>n</i> (%)	44 (12.8)	84 (22.2)	0.001
Demoralization <i>n</i> (%)	26 (7.6)	53 (14.0)	0.006
Major cardiovascular events			
Major cardiovascular events <i>n</i> (%)	42 (10.2)	70 (18.4)	0.021

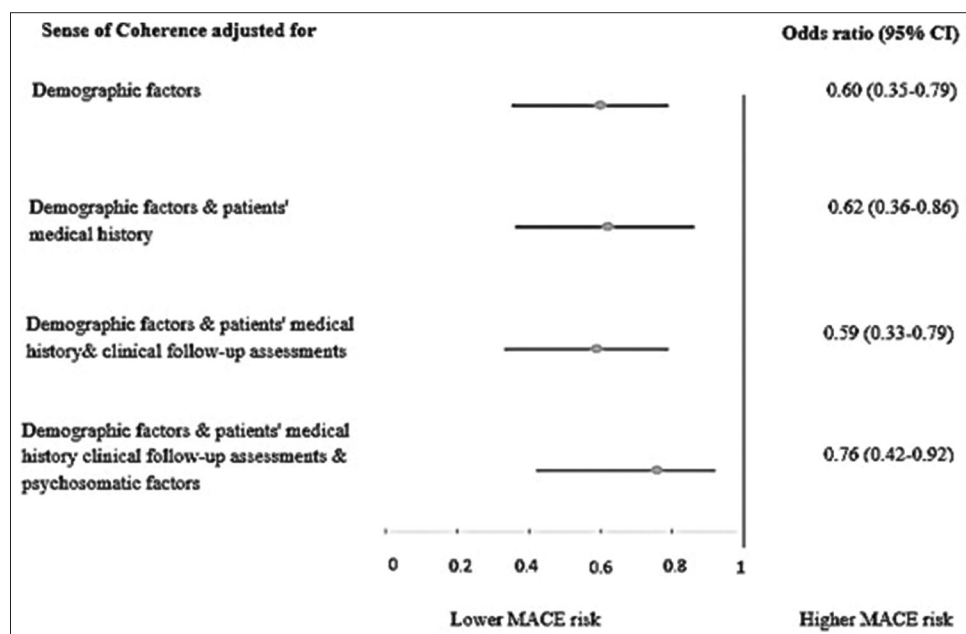
**Figure 2: Correlation of sense of coherence level with major cardiovascular events based on multivariate logistic regression analyses**

Table 2: Multivariable linear regression assessment of sense of coherence score for the prediction of major adverse cardiovascular event incidence

	OR (95% CI)	OR (95% CI) per SD
Crude model	0.94 (0.89-0.98)	5.75 (5.45-6.00)
Model 1	0.95 (0.91-0.99)	5.81 (5.57-6.06)
Model 2	0.95 (0.91-0.98)	5.81 (5.57-6.00)
Model 3	0.96 (0.94-0.99)	5.87 (5.75-.06)
Model 4	0.95 (0.93-0.99)	5.81 (5.69-6.06)

Model 1: Sense of coherence and demographic factors. Model 2: Model 1 and patients' medical history. Model 3: Model 2 and clinical follow-up assessments. Model 4: Model 3 and psychosomatic factors (full-adjusted)

adverse outcomes. This fact has been proposed by several other studies in the literature assessing the incidence of cardiovascular diseases,^[22] the exposure to cancers,^[28] the exposure to chronic medical disorders, such as diabetes mellitus and hypertension, and even all-cause mortality.^[29,30] In other words, SOC is a psychosomatic resource for struggling with the involved conditions; it induces a cascade of responses from the brain to both physical and mental stimuli. Consequently, the person would realize the necessity of activating bodily responses and emotionally and instrumentally adaptation.^[4,21] Therefore, patients with a better status of SOC can find out that structured and predictable stress has occurred, and they should manage the available resources for the confrontation with this condition. Accordingly, a strong SOC can appropriately prompt the CHD patients to face health-related arisen disorder, believe that they can adapt to the new condition, and motivate them to observe the health-related behaviors.^[31,32] Thus, consistent with Silarova and colleagues,^[33] we assume that observance of health-related behaviors contributing to cardiovascular health was one reason for the less MACE among the high SOC patients.

A latter finding of this study showed that health anxiety, illness denial, irritable mood, and demoralization, as well as MACE, were all remarkably more prevalent among those with a low SOC. SOC is a term that depicts a comprehensive view about how to struggle with life stressors, such as CHD; therefore, SOC is an indicator of health-related quality of life. Those patients with better SOC were more concerned about their health but had a more positive view of their disease. In this way, they would find a comprehensible, meaningful, and manageable perception of CHD,^[34] which in turn poses 1) a more influential conception of the real condition caused by the disease instead of inappropriate worrisome about the health, 2) an acceptance of the disease which can lead to the better compliance toward medication and observant of the rules, 3) controlling of the mood disturbances, such as excessive anxiety or depression, and 4) proper confrontation with the disease and its consequences instead of sense of hopelessness and helplessness.^[28,35] Nevertheless, we

found that SOC was an indicator for MACE independent of the mentioned psychosomatic factors (health anxiety, illness denial, irritable mood, and demoralization) using logistic regression evaluations. Two points of view can interpret this finding; at first, SOC is a psychosomatic process related to the personal mental-health impressions and, therefore, health-related quality of life. Based on Galletta and colleagues' theory, SOC directly affects mental components of health and, consequently, affects physical health indirectly.^[23] Thus, those with higher SOC are more optimistic and active for coping with the CHD-associated complications to promote their health,^[22] a fact that leads to reduced MACE. The second theory targets the metabolic changes following exposure to a chronic non-communicable condition, such as all AMI complications. Lower SOC along with a chronic medical condition is correlated with psychosomatic disturbances that in turn ignites neuroendocrine mediations for a long term^[36,37]; a process that causes a breakdown in the homeostasis of the cellular oxidative metabolism, accompanied by the mitochondrial dysfunction, intensified inflammatory process, endothelial damage, acceleration in atherogenesis, and, eventually, MACE.^[38,39]

Limitations and strength

Failure to assess factors, such as medical adherents, physical activity, dietary habits, and the other psychological factors as the confounders of MACE due to SOC, is a remarkable limitation of this study. Also, we obtained our data through questionnaires that may be influenced by different personal perceptions as a source of bias.

Our study's most impressive strength is its large population and its cohort conduction as the most reliable type of study design.

Conclusions

In summary, we found that SOC was an independent factor for predicting MACE in a large population of AMI patients through a 2-year follow-up period. These findings were in line with the studies in the literature assessing the correlation of SOC with CHD; however, for the first time, this report has controlled the psychosomatic factors, including health anxiety, illness denial, irritable mood, and demoralization for the evaluation of the role of SOC in MACE. Furthermore, by considering the cross-cultural differences, this study was the first one performed in Iran's community.

Ethics approval and consent to participate

The Ethics Committee of the Isfahan University of Medical Sciences approved the study proposal. After that, the study protocol was explained for the eligible patients, they were reassured about the confidentiality of their personal information, and eventually, written consent for participation in the study was obtained.

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Conflicts of interest

There are no conflicts of interest.

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