

## “Study of Psychosocial Antecedents to Precipitation of Congestive Heart Failure in Cardiac Patients: A Prospective Observational Study”

Dr. Sumanta Kumer Saha<sup>1\*</sup>, Dr. S. Chakrabarty<sup>2</sup>, Dr. Tamanna Tabassum Moni<sup>3</sup>, Dr. Md. Rezaul Kadir<sup>4</sup>, Dr. Aliva Haque<sup>5</sup>, Dr. Sabiha Tabassum Mithila<sup>6</sup>

<sup>1</sup>Consultant, Department of Medicine, LABAID Specialized Hospital, Dhaka, Bangladesh

<sup>2</sup>Senior Consultant, Department of Clinical and Interventional Cardiology, Green Life Hospital Ltd, Dhaka, Bangladesh

<sup>3</sup>Medical Officer, Department of Medicine, LABAID Specialized Hospital, Dhaka, Bangladesh

<sup>4</sup>Clinical Assistant, Department of Medicine, LABAID Specialized Hospital, Dhaka, Bangladesh

<sup>5</sup>Medical Officer, Department of Medicine, LABAID Specialized Hospital, Dhaka, Bangladesh

<sup>6</sup>Medical Officer, Department of Medicine, LABAID Specialized Hospital, Dhaka, Bangladesh

DOI: [10.36348/sjimps.2023.v09i05.001](https://doi.org/10.36348/sjimps.2023.v09i05.001)

| Received: 21.03.2023 | Accepted: 30.04.2023 | Published: 05.05.2023

\*Corresponding author: Dr. Sumanta Kumer Saha

Consultant, Department of Medicine, LABAID Specialized Hospital, Dhaka, Bangladesh

### Abstract

**Introduction:** Psychosocial factors, such as stress, adversity, socioeconomic status, depression, and anxiety, are associated with overall health and with cardiovascular health in particular. Psychosocial risk factors have been frequently studied in relation to coronary heart disease. In observational studies, high levels of depression and anxiety have consistently been associated with incident coronary heart disease, whereas associations with hostility and social support have been mixed. However, psychosocial factors have been examined less often in HF. Among patients with HF, depression is the most commonly researched psychosocial risk factor. **Aim of the study:** The aim of this study was to determine the psychosocial antecedents to precipitation of congestive heart failure in cardiac patients. **Methods:** This was a prospective study and was conducted in the Department of Cardiology of Lugansk State Medical University (LSMU), Hospital No-01, Lugansk, Ukraine during the period from November, 2008 to September 2009. We included 120 patients with heart disease in our study. The patients were randomly divided into two groups – HF group (Patients who hadn't any heart failure, n=60) and No-HF group (Patients who had heart failure, n=60) **Result:** In total 120 patients from both the groups completed the study. In our study we found majority (35.83%) of our patients were aged 61-70 years and most of our patients were female (62%) compared to male (38%). We found the mean age was  $49.73 \pm 8.9$  years. Among all patients 76.67% were smoker, 70% had DM, 80% had history of hypertension, 31.67% had asthma, 59.17% had previous history of CVD and the mean duration of CVD was  $3.29 \pm 2.41$  years. The mean BMI was  $27.67 \pm 4.24$  kg/m<sup>2</sup>. TC, HDL & LDL was higher in no-HF group which indicates a lower risk of heart disease while Tg was higher in HF group indicating a great risk of heart disease. We also found CRP, albumin & fibrinogen was higher in HF group that indicates a greater risk of heart disease. Among all psychosocial factors, anger, anxiety, depressive symptoms, hostility and self-reported health were found higher in HF group compared to no-HF group. **Conclusion:** In our study, we found statistically significant relationships between psychosocial factors and incident HF. However, adverse levels of psychosocial factors played a role to be an indicator of HF development among cardiac patients. We found psychosocial risk factors such as anger, anxiety, depressive symptoms, hostility and self-reported health as an indicator of congestive heart failure among our cardiac patients.

**Keywords:** Psychosocial Antecedents, Congestive Heart Failure, Cardiac patients.

**Copyright © 2023 The Author(s):** This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

### INTRODUCTION

Psychosocial factors, such as stress, adversity, socioeconomic status, depression, and anxiety, are associated with overall health and with cardiovascular health in particular. In this issue there have been a group of articles that explore different aspects of the

complex relationships between psychosocial factors and cardiovascular health. Importantly, psychosocial factors have different prevalence among different demographic groups, and as such, may be key for addressing disparities in the development of cardiovascular disease (CVD) and its morbidity and mortality [1]. The mechanistic relationship between heart disease and

**Citation:** Sumanta Kumer Saha *et al* (2023). “Study of Psychosocial Antecedents to Precipitation of Congestive Heart Failure in Cardiac Patients: A Prospective Observational Study”. *Saudi J Med Pharm Sci*, 9(5): 275-281.

psychosocial factors and mental health remains uncertain but an increasing body of evidence supports a strong and clinically important causal link [2-6]. In exploring the clinical and economic importance of this relationship, psychosocial issues relevant to cardiovascular health can be categorized as (1) mood and mental health disorders, including depression and anxiety; (2) acute and chronic stress; and (3) social factors, including social support systems, socioeconomic status, and gender differences [7]. While substantial research has focused on characterizing the extent to which these factors influence the risk of cardiovascular disease and morbidity. Moreover, most work in this area has focused on the intersection of cardiovascular disease and depression [8]. Psychosocial risk factors have been frequently studied in relation to coronary heart disease. In observational studies, high levels of depression and anxiety have consistently been associated with incident coronary heart disease, whereas associations with hostility and social support have been mixed [9]. However, psychosocial factors have been examined less often in HF. Among patients with HF, depression is the most commonly researched psychosocial risk factor. Approximately 1 in 5 patients with HF meets the criteria for major depression, with a higher prevalence in patients with more severe HF [10]. Depression is also a predictor of repeated hospitalization in patients with HF and is an independent risk factor of cardiovascular and all-cause mortality in prevalent HF cases, although many early studies were cross-sectional or had short follow-up periods [11]. Fewer studies have examined whether depression is associated with incidence of HF [12-15]. Among those that have, the results have been mixed, although associations were stronger in populations at high-risk for HF [13, 14]. Few other psychosocial factors have been examined in relation to risk of incident HF. Anxiety has also been examined in association with incident HF, with mixed results, and anger has been modestly associated with incident HF in 1 study. Lack of social support has also been associated with greater incident HF risk, although as noted in a recent meta-analysis, several studies had short follow-up periods and the majority were composed mostly of men [11, 16]. It is still unknown whether psychological factors, such as persistent stress and animosity, are linked to the prevalence of HF. The connection between psychosocial variables and HF could be explained by a number of reasonable mechanisms. According to one theory, individuals with high levels of negative psychosocial influences may be more susceptible to HF-causing physiological changes of all kinds. Inflammation, endothelial dysfunction, platelet activity, hormones, and brain-derived neurotrophic factor are examples of potential biochemical pathways [17]. Another viable explanation is that individuals with psychosocial issues are less likely to follow dietary and behavioral recommendations, which increases their risk of contracting diseases like HF [18]. Additional data are required to clarify the relationship between

psychosocial characteristics and incident HF, particularly in varied populations of people who were healthy at baseline, as results from prior research have been conflicting and have mostly focused on depression.

Consequently, the purpose of this study was to ascertain whether psychosocial characteristics, such as hostility, anxiety, chronic stress, and depressive symptoms increase the incident HF.

### Objective of the Study

The main objective of the study was to determine the psychosocial antecedents to precipitation of congestive heart failure in cardiac patients.

## METHODOLOGY & MATERIALS

This was a prospective study and was conducted in the Department of Cardiology of Lugansk State Medical University (LSMU), Hospital No-01, Lugansk, Ukraine during the period from November, 2008 to September 2009. We included 120 patients with heart disease in our study. The patients were randomly divided into two groups – HF group (Patients who hadn't any heart failure, n=60) and No-HF group (Patients who had heart failure, n=60)

These are the following criteria to be eligible for the enrollment as our study participants: a) Patients aged upto 80 years old; b) Patients with heart disease; c) Patients with heart failure recently; d) Patients who were willing to participate were included in the study And a) Patients with uncontrolled DM, b) Patients with Coagulopathy; c) Patients with previous surgical history were excluded from our study.

**Exposures:** Anger, anxiety, chronic stress, and depressive symptoms were measured via questionnaires administered at MESA Exam 1, which occurred in 2000-2002. Hostility was measured at Exam 2, which occurred in 2002-2004. [19-22] For all of the psychosocial measures, individual questions were summed to create scores, and higher scores represent more severe symptoms. Some of these measures have been found valid and reliable in older populations [23]. For the primary analysis, the psychosocial measures were categorized according to their distribution. For depression, we utilized the clinically relevant cut-point of 16 as an additional separate category. Exposures were also modeled continuously per interquartile range. Additionally, in exploratory analyses where we stratified according to self-reported health, dichotomous categorizations were used.

**Statistical Analysis:** All data were recorded systematically in preformed data collection form and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was performed by using SPSS (Statistical

Package for Social Sciences) for windows version 10. Probability value <0.05 was considered as level of significance.

## RESULT

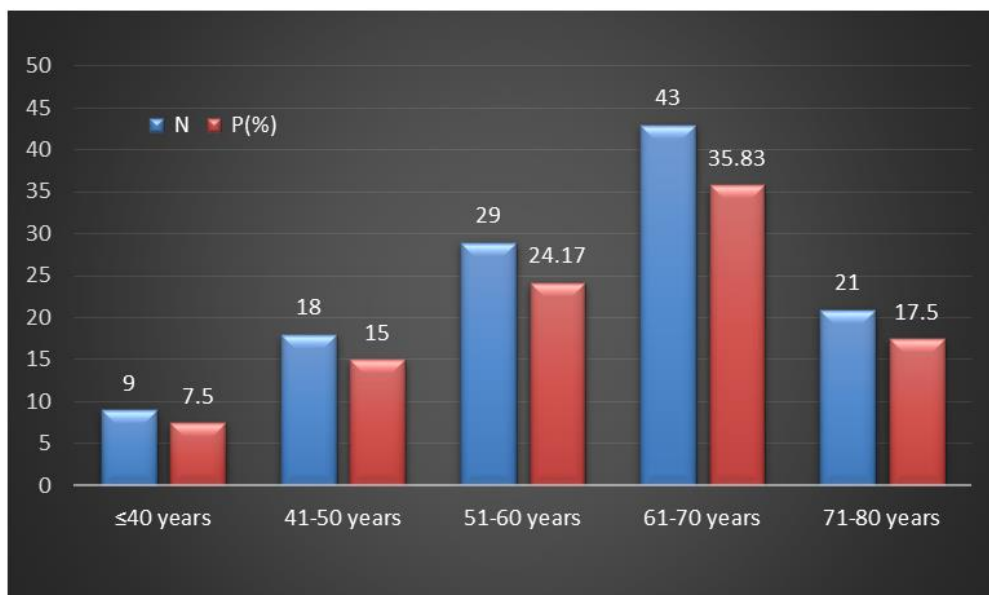


Figure 1: Age distribution of our study patients

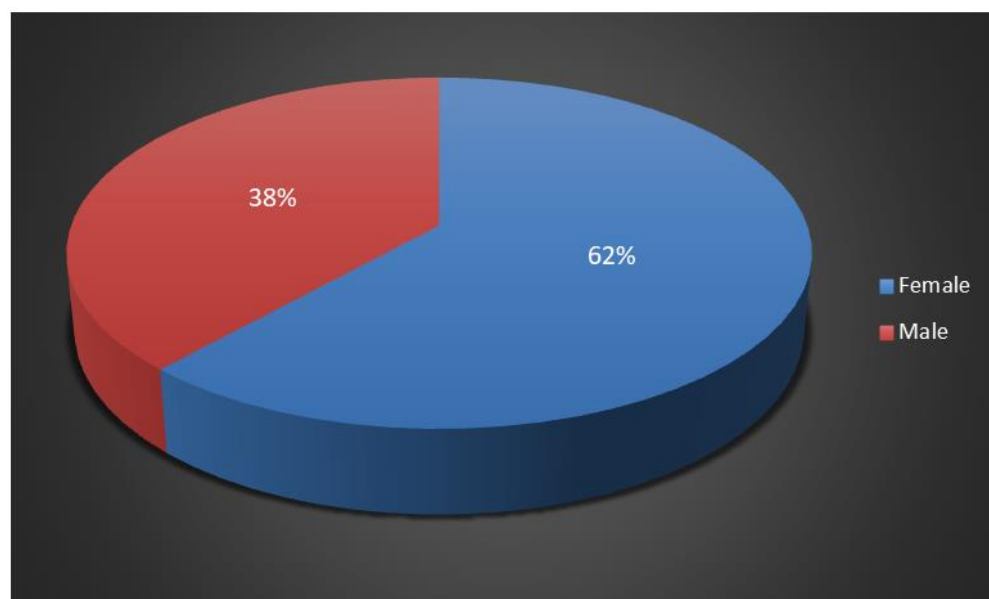


Figure 2: Gender distribution of our study participants

Table 1: Baseline characteristics of our study subjects

Baseline	N	P (%)	P-value
Mean age (years)	49.73 ± 8.9		0.186
Education			
Illiterate	19	15.83	0.412
Primary education	40	33.33	0.214
Secondary education	48	40.00	0.318
Higher above	13	10.83	0.169
Smoking	92	76.67	0.241
History of CVD	71	59.17	0.043
CVD duration	3.29±2.41		0.421
BMI (kg/m <sup>2</sup> )	27.67±4.24		0.614

Baseline	N	P (%)	P-value
Heart Rate (per minute)	86 ± 17		0.214
Systolic blood pressure (mm Hg)	135.24 ± 20.78		0.041
Diastolic blood pressure (mm Hg)	83.94 ± 10.69		0.062
Co-morbidities			
DM	84	70.00	0.149
HTN	96	80.00	0.215
Hypotension	39	32.50	0.124
CKD	41	34.17	0.056
Asthma	38	31.67	0.041

**Table 2: Comparison of Physiological characteristics among heart failure & no-heart failure patients**

Physiological characteristics	No-HF	HF	P-value
Total cholesterol (mg/dL)	194.3±35.7	189.7±35.4	0.048
HDL cholesterol (mg/dL)	51.1±14.9	48.6±13.9	0.012
LDL cholesterol (mg/dL)	117.3±31.4	114.71±32.0	0.126
Triglycerides (mg/dL)	131.1±87.4	140.9±118.1	0.242
C-reactive protein (mg/dL)	3.7±5.9	5.0±6.5	0.014
Albumin (mg/dL)	2.4±12.6	15.3±71.3	0.027
Fibrinogen (mg/dL)	345.9±73.6	370.5±78.3	0.015

**Table 3: Comparison of Psychosocial factors among heart failure & no-heart failure patients**

Psychosocial factors	No-HF	HF	P-value
Anger	14.2±3.5	14.8±3.7	0.030
Anxiety	15.1±4.2	15.9±4.5	0.007
Chronic stress	1.2±1.2	1.2±1.2	0.814
Depressive symptoms	7.3±6.9	7.6±7.6	0.502
Hostility	3.0±2.3	2.7±2.3	0.041
Self-reported health	3.3±0.9	3.6±0.9	0.021

Figure 1 shows majority (35.83%) of our patients were aged 61-70 years, followed by 24.17% & 17.5 % were aged 51-60 years & 71-80 years old respectively. There were 15% & 7.5% patients who were aged 41-50 years & ≤ 40 years old respectively.

Figure 2 shows majority of our patients were female (62%) compared to male (38%).

Table 1 shows the demographic characteristics of patients. We found the mean age was  $49.73 \pm 8.9$  years. Majority (44.92%) of our patients got primary education. Among all patients 76.67% were smoker, 70% had DM, 80% had history of hypertension, 31.67% had asthma, 59.17% had previous history of CVD and the mean duration of CVD was  $3.29 \pm 2.41$  years. The mean BMI was  $27.67 \pm 4.24$  kg/m<sup>2</sup>.

Table 2 shows the physiological characteristics among study patients. TC, HDL & LDL was higher in no-HF group which indicates a lower risk of heart disease while Tg was higher in HF group indicating a great risk of heart disease. We also found CRP, albumin & fibrinogen was higher in HF group that indicates a greater risk of heart disease.

In table 3 we found Psychosocial exposures acted as risk factors for heart failure patients. Among all psychosocial factors, anger, anxiety, depressive

symptoms, hostility and self-reported health were found higher in HF group compared to no-HF group.

## DISCUSSION

In our study we tried to determine the relation between psychosocial factors and congestive heart failure. In our study we found TC, HDL & LDL was higher in no-HF group which indicates a lower risk of heart disease while Tg was higher in HF group indicating a great risk of heart disease. We also found CRP, albumin & fibrinogen was higher in HF group that indicates a greater risk of heart disease.

Depression is a risk factor for morbidity and mortality in patients with coronary heart disease, especially following acute coronary syndrome [24-26]. Most studies reported depression as an important disorder that leads to an increase in cardiovascular events and CHD mortality. Depression is common among CHD patients; there is ample evidence that prevalence of depression is 20% higher in patients with heart failure than in healthy individuals [27-30]. Depression has been found to be a risk factor in the etiology of CHD [27, 28]. However previous research has had several potential limitations concerning causal inference. The greatest challenge in research on prospective association between depression and CHD is the possibility that both depression and subsequent



CHD are caused by subclinical manifestation of cardiovascular disease [31]. Balog *et al.*, studied depression symptoms associated with job stress and stress in marital relationships in women with and without coronary artery disease. They found that in women, marital stress is associated with depression symptoms and results in the intensification of CHD. Therefore, it appears that depression has a mediating role for marital stress that ultimately results in CHD [32].

**Anxiety** Although evidence suggests that anxiety has an adverse impact on prognosis in CHD patients independent of depression, the role of anxiety as an etiological risk factor is less clear.[31,33-35] In a systematic review, 12 studies evaluated clinical endpoints, such as myocardial infarction (MI) and cardiac death, 5 studies reported significant association, 3 studies reported marginally significant associations, and 4 studies reported no association between indexes of anxiety and cardiac patients [36]. Roest *et al.*, (2010) in their meta-analysis studied the connection between anxiety and the risk factors of coronary artery disease, and found that anxiety is an independent risk factor for CHD and cardiac deaths. However, the association between anxiety and CHD was somewhat less than the corresponding association between depression and CHD, but this connection was stronger than the relationship between anger and CHD occurrence [37]. A research showed that somatic symptoms of anxiety were associated with an increased risk of CHD in women. This finding lends support to the physiological pathway for the relation between psychological factors, anxiety in particular, and CHD [38]. A longitudinal research conducted by Janszky *et al.*, over a period of 37 years on 49321 young Swedish men aged 18-20 years evaluated the effects of anxiety and early depression on risk factors of coronary artery disease. This research indicated that anxiety independently predicted subsequent CHD events such as morbidity and mortality. In contrast, it found no support for such an effect concerning early onset of depression in men [39]. In another study, it was indicated that inner expression of anger with high level of anxiety is associated with high cardiovascular reaction, and inner expression of anger with low level of anxiety is associated with low cardiovascular reaction.[40] In addition to depression, other psychological factors such as anger, hostility and anxiety are associated with increase in risk factors of cardiovascular disease [41-44]. Studies on American and European populations have demonstrated that high levels of anger and hostility are predictive of coronary heart disease (CHD) mortality [45]. Moreover, a Japanese study indicated that higher levels of cynical hostility increased the risk of acute myocardial infarction syndrome (AMIs), and that anger control strategies could have some benefit in reducing the risk of AMIs in middle-aged Japanese men [46]. However, another review indicated that there was no evidence of such an association [27]. Besides some

studies demonstrated no clear association between hostility and CHD [47].

In this study we found psychosocial risk factors among heart failure patients was anger, anxiety, depressive symptoms, hostility and self-reported health which was higher in HF group compared to no-HF group.

### Limitations of the Study

Our study was a single centre study. We took a small sample size because of our short study period & limited resources. There are more risk factors of congestive heart failure among cardiac patients needs to be identified & evaluated. After evaluating once those patients we did not follow them up for a long term and have not known other possible interference that may happen in the long term with these patients.

## CONCLUSION AND RECOMMENDATIONS

In our study, we found statistically significant relationships between psychosocial factors and incident HF. However, adverse levels of psychosocial factors played a role to be an indicator of HF development among cardiac patients. We found psychosocial risk factors such as anger, anxiety, depressive symptoms, hostility and self-reported health as an indicator of congestive heart failure among our cardiac patients.

So, further study with a prospective and longitudinal study design including larger sample size needs to be done to identify more risk factors of heart failure among cardiac patients.

## REFERENCES

- Peterson, P. N. (2020). JAHA spotlight on psychosocial factors and cardiovascular disease. *Journal of the American Heart Association*, 9(9), e017112.
- Carney, R. M., Blumenthal, J. A., Stein, P. K., Watkins, L., Catellier, D., Berkman, L. F., ... & Freedland, K. E. (2001). Depression, heart rate variability, and acute myocardial infarction. *Circulation*, 104(17), 2024-2028.
- Ghiadoni, L., Donald, A. E., Cropley, M., Mullen, M. J., Oakley, G., Taylor, M., ... & Deanfield, J. E. (2000). Mental stress induces transient endothelial dysfunction in humans. *Circulation*, 102(20), 2473-2478.
- Krantz, D. S., Schaeffer, M. A., Davia, J. E., Dembroski, T. M., MacDougall, J. M., & Shaffer, R. T. (1981). Extent of coronary atherosclerosis, Type A behavior, and cardiovascular response to social interaction. *Psychophysiology*, 18(6), 654-664.
- Muller, J. E., Abela, G. S., Nesto, R. W., & Tofler, G. H. (1994). Triggers, acute risk factors and vulnerable plaques: the lexicon of a new

- frontier. *Journal of the American College of Cardiology*, 23(3), 809-813.
6. Rozanski, A., Blumenthal, J. A., & Kaplan, J. (1999). Impact of psychological factors on the pathogenesis of cardiovascular disease and implications for therapy. *Circulation*, 99(16), 2192-2217.
  7. Everson-Rose, S. A., & Lewis, T. T. (2005). Psychosocial factors and cardiovascular diseases. *Annu. Rev. Public Health*, 26, 469-500.
  8. Wang, P. S., Simon, G., & Kessler, R. C. (2003). The economic burden of depression and the cost-effectiveness of treatment. *International journal of methods in psychiatric research*, 12(1), 22-33.
  9. Hemingway, H., & Marmot, M. (1999). Evidence based cardiology: psychosocial factors in the aetiology and prognosis of coronary heart disease: systematic review of prospective cohort studies. *BMJ: British Medical Journal*, 318(7196), 1460.
  10. Rutledge, T., Reis, V.A., & Linke, S.E., (2006). Greenberg BH, Mills PJ. Depression in heart failure a metaanalytic review of prevalence, intervention effects, and associations with clinical outcomes. *Journal of the American College of Cardiology*. (48) 1527–37.
  11. MacMahon, K. M., & Lip, G. Y. (2002). Psychological factors in heart failure: a review of the literature. *Archives of internal medicine*, 162(5), 509-516.
  12. Williams, S. A., Kasl, S. V., Heiat, A., Abramson, J. L., Krumholz, H. M., & Vaccarino, V. (2002). Depression and risk of heart failure among the elderly: a prospective community-based study. *Psychosomatic medicine*, 64(1), 6-12.
  13. Abramson, J., Berger, A., Krumholz, H. M., & Vaccarino, V. (2001). Depression and risk of heart failure among older persons with isolated systolic hypertension. *Archives of internal medicine*, 161(14), 1725-1730.
  14. May, H. T., Horne, B. D., Carlquist, J. F., Sheng, X., Joy, E., & Catinella, A. P. (2009). Depression after coronary artery disease is associated with heart failure. *Journal of the American College of Cardiology*, 53(16), 1440-1447.
  15. Kamphuis, M. H., Kalmijn, S., Tijhuis, M. A., Geerlings, M. I., Giampaoli, S., Nissinen, A., ... & Kromhout, D. (2006). Depressive symptoms as risk factor of cardiovascular mortality in older European men: the Finland, Italy and Netherlands Elderly (FINE) study. *European Journal of Preventive Cardiology*, 13(2), 199-206.
  16. Cené, C. W., Loehr, L., Lin, F. C., Hammond, W. P., Foraker, R. E., Rose, K., ... & Corbie-Smith, G. (2012). Social isolation, vital exhaustion, and incident heart failure: findings from the Atherosclerosis Risk in Communities Study. *European journal of heart failure*, 14(7), 748-753.
  17. Huffman, J. C., Celano, C. M., Beach, S. R., Motiwala, S. R., & Januzzi, J. L. (2013). Depression and cardiac disease: epidemiology, mechanisms, and diagnosis. *Cardiovascular psychiatry and neurology*, 2013.
  18. Kop, W. J., Synowski, S. J., & Gottlieb, S. S. (2011). Depression in heart failure: biobehavioral mechanisms. *Heart failure clinics*, 7(1), 23-38.
  19. Spielberger, C. D., & Gonzalez, H. P. (1980). *Preliminary professional manual for the test anxiety inventory: (" test attitude inventory")*: Tai. consulting psychologists press..
  20. Bromberger, J. T., & Matthews, K. A. (1996). A longitudinal study of the effects of pessimism, trait anxiety, and life stress on depressive symptoms in middle-aged women. *Psychology and aging*, 11(2), 207.
  21. Radloff LS. The CES-D Scale. A self-report depression for research in the general population. *Appl Psychol Measurement*. 1977; 1:385–401.
  22. Greenglass, E. R., & Julkunen, J. (1991). Cook-Medley hostility, anger, and the Type A behavior pattern in Finland. *Psychological reports*, 68(3\_suppl), 1059-1066.
  23. Sawyer Radloff, L., & Teri, L. (1986). 6/Use of the center for epidemiological studies-depression scale with older adults. *Clinical Gerontologist*, 5(1-2), 119-136.
  24. Frasure-Smith, N., Lespérance, F., & Talajic, M. (1995). Depression and 18-month prognosis after myocardial infarction. *Circulation*, 91(4), 999-1005.
  25. Brezinka, V., & Kittel, F. (1996). Psychosocial factors of coronary heart disease in women: a review. *Social science & medicine*, 42(10), 1351-1365.
  26. Creed, F. (1999). The importance of depression following myocardial infarction. *Heart*, 82(4), 406-408.
  27. Glassman, A. H., & Shapiro, P. A. (1998). Depression and the course of coronary artery disease. *American Journal of Psychiatry*, 155(1), 4-11.
  28. Krantz, D. S., & McCeney, M. K. (2002). Effects of psychological and social factors on organic disease: a critical assessment of research on coronary heart disease. *Annual review of psychology*, 53(1), 341-369.
  29. Kuper, H., Marmot, M., & Hemingway, H. (2002). Systematic review of prospective cohort studies of psychosocial factors in the etiology and prognosis of coronary heart disease. In *Seminars in vascular medicine* (Vol. 2, No. 03, pp. 267-314). Copyright© 2002 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel.:+ 1 (212) 584-4662.
  30. Musselman, D. L., Evans, D. L., & Nemeroff, C. B. (1998). The relationship of depression to cardiovascular disease: epidemiology, biology, and

- treatment. *Archives of general psychiatry*, 55(7), 580-592.
31. Lett, H. S., Blumenthal, J. A., Babyak, M. A., Sherwood, A., Strauman, T., Robins, C., & Newman, M. F. (2004). Depression as a risk factor for coronary artery disease: evidence, mechanisms, and treatment. *Psychosomatic medicine*, 66(3), 305-315.
  32. Balog, P., Janszky, I., Leineweber, C., Blom, M., Wamala, S. P., & Orth-Gomé, K. (2003). Depressive symptoms in relation to marital and work stress in women with and without coronary heart disease. The Stockholm Female Coronary Risk Study. *Journal of Psychosomatic Research*, 54(2), 113-119.
  33. Rothenbacher, D., Hahmann, H., Wusten, B., Koenig, W., & Brenner, H. (2007). Symptoms of anxiety and depression in patients with stable coronary heart disease: prognostic value and consideration of pathogenetic links. *Eur J Cardiovasc Prev Rehabil*, 14(4), 547-54.
  34. Shibeshi, W. A., Young-Xu, Y., & Blatt, C. M. (2007). Anxiety worsens prognosis in patients with coronary artery disease. *Journal of the American College of Cardiology*, 49(20), 2021-2027.
  35. Strik, J. J., Denollet, J., Lousberg, R., & Honig, A. (2003). Comparing symptoms of depression and anxiety as predictors of cardiac events and increased health care consumption after myocardial infarction. *Journal of the American College of Cardiology*, 42(10), 1801-1807.
  36. Grace, S. L., Abbey, S. E., Irvine, J., Shnek, Z. M., & Stewart, D. E. (2004). Prospective examination of anxiety persistence and its relationship to cardiac symptoms and recurrent cardiac events. *Psychotherapy and psychosomatics*, 73(6), 344-352.
  37. Roest, A. M., Martens, E. J., de Jonge, P., & Denollet, J. (2010). Anxiety and risk of incident coronary heart disease: a meta-analysis. *Journal of the American College of Cardiology*, 56(1), 38-46.
  38. Nabi, H., Hall, M., Koskenvuo, M., Singh-Manoux, A., Oksanen, T., Suominen, S., ... & Vahtera, J. (2010). Psychological and somatic symptoms of anxiety and risk of coronary heart disease: the health and social support prospective cohort study. *Biological psychiatry*, 67(4), 378-385.
  39. Janszky, I., Ahnve, S., Lundberg, I., & Hemmingsson, T. (2010). Early-onset depression, anxiety, and risk of subsequent coronary heart disease: 37-year follow-up of 49,321 young Swedish men. *Journal of the American College of Cardiology*, 56(1), 31-37.
  40. Farhadi, M. (2009). Styles of expressing anger and trait anxiety levels in response to cardio-vascular [PhD Thesis]. *Tehran, Iran: University of Tehran*.
  41. Zafar, M. U., Paz-Yepes, M., Shimbo, D., Vilahur, G., Burg, M. M., Chaplin, W., ... & Badimon, J. J. (2010). Anxiety is a better predictor of platelet reactivity in coronary artery disease patients than depression. *European heart journal*, 31(13), 1573-1582.
  42. Januzzi, J. L., Stern, T. A., Pasternak, R. C., & DeSanctis, R. W. (2000). The influence of anxiety and depression on outcomes of patients with coronary artery disease. *Archives of internal medicine*, 160(13), 1913-1921.
  43. Todaro, J. F., Shen, B. J., Niaura, R., Spiro III, A., & Ward, K. D. (2003). Effect of negative emotions on frequency of coronary heart disease (The Normative Aging Study). *The American journal of cardiology*, 92(8), 901-906.
  44. Rozanski, A., Blumenthal, J. A., Davidson, K. W., Saab, P. G., & Kubzansky, L. (2005). The epidemiology, pathophysiology, and management of psychosocial risk factors in cardiac practice: the emerging field of behavioral cardiology. *Journal of the American college of cardiology*, 45(5), 637-651.
  45. Sundquist, K., Lindström, M., Malmström, M., Johansson, S. E., & Sundquist, J. (2004). Social participation and coronary heart disease: a follow-up study of 6900 women and men in Sweden. *Social Science & Medicine*, 58(3), 615-622.
  46. Izawa, S., Eto, Y., Yamada, K. C., Nakano, M., Yamada, H., Nagayama, M., ... & Nomura, S. (2011). Cynical hostility, anger expression style, and acute myocardial infarction in middle-aged Japanese men. *Behavioral Medicine*, 37(3), 81-86.
  47. Rozanski, A., Blumenthal, J. A., & Kaplan, J. (1999). Impact of psychological factors on the pathogenesis of cardiovascular disease and implications for therapy. *Circulation*, 99(16), 2192-2217.