Effect of a nonpharmacological psychological stress management intervention on major cardiovascular events and mortality in patients with coronary artery disease: a systematic review and meta-analysis of randomized clinical trials

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Table 5. Patients, outcomes, follow-up, stress assessment and description of stress management interventions and control group according to the studies

Author, year	Study site	Patients (sample description)	Number of patients in IG	Number of patients in the GC	Outcomes	Follow-up time	Type of stress management intervention/treatment in GI	Number of sessions, time of each session and time period of the stress management intervention in GI	Type of intervention/treatment in CG	Stress assessment scale	Pre-intervention value in IG	Pre-intervention value in GC	Post-intervention value in IG	Post-intervention value in GC
Appels, Ad, et al., 2005(Appels et al., 2005)	Netherlands	710 Consecutive patients aged 35-68 years who felt exhausted after being successfully treated by percutaneous coronary intervention.	366	344	Primary outcomes were interview-defined exhaustion at 18 months, new cardiac events (defined as re-ICP, coronary artery bypass graft surgery, myocardial infarction, or cardiac death), and "de novo" injury.	2.1 years	The intervention was based on group therapy with a focus on reducing stressors leading to exhaustion and supporting recovery by promoting rest and making rest more efficient. Group discussions were used to identify stressors in the family and work domains and to assist patients in coping with these stressors. Recovery was promoted by discussing minimum and maximum length of rest time, doing relaxation exercises designed to make rest more efficient, encouraging physical exercise, and passing on homework assignments. The program included treatment of hostility, as aggressive coping with stressors is one of the causes of burnout. The counselors were experienced psychotherapists or clinical psychologists. As a rule, the meetings began with group discussions and ended with one or two relaxation exercises. However, the patients were allowed to skip the relaxation exercises if they did not want to interrupt a discussion.	The groups were composed of 6 patients. Partners were encouraged to attend the meetings. Sessions lasted 2 hours. The groups met weekly during the first 10 weeks and once a month during the following 4 months.	Usual care consisted of care provided regularly at all four centers. It included routine check-ups at all centers and referral to a physical rehabilitation program at one center.	Maastricht Questionnaire	13.1 ± 4.1	13.0 ± 4.0	Not informed	Not informed
Claesson, M, et al., 2005(Claesson et al., 2005)	Sweden	166 women with ischemic heart disease, aged less than 80 years, living in Västerbotten County, Sweden, who from 1996 onward had a primary or recurrent AMI, or had undergone coronary angioplasty or coronary artery bypass graft surgery (CABG), or with angina pectoris with coronary artery disease confirmed by angiography and treated noninvasively.	80	86	Psychological variables: self-rated stress behavior, vital exhaustion, depressive mood and quality of life. Major cardiovascular events: acute myocardial infarction, coronary artery intervention, angina or ischemic symptoms, stroke, and mortality.	1 year	There were 5 main components of the program with specific objectives: Education- Develop knowledge about basic anatomy and physiology of the cardiovascular system; manifestations and treatment procedures for ischemic heart disease; symptoms and signs of different stress reactions; and the relationship between stress and ischemic heart disease. Self-monitoring- Become more alert to body signals such as muscle tension, heart rate, and pain; perceive behavioral and cognitive cues; observe, reflect, and draw conclusions about behavioral contingencies. Skills training- Reduce negative affect by learning to express thoughts and emotions in a direct, honest, and caring manner; and learn to act, rather than merely react, to life's everyday problems. Cognitive restructuring-can be summarized as the development of self-talk to increase self-respect and self-esteem; the ability to deal with the unexpected; tolerance, acceptance, and respect for people different from oneself; trust in others; and positive emotions such as joy, enthusiasm, curiosity, optimism, and love. Spiritual development: A discussion of spiritual and life values to create a balance between work, family, health, pleasurable activities, spiritual interests; finding new interests; developing joy, enthusiasm and hope; accepting and giving love. Within the structure of the program, specific contents and themes were adapted to the typical experiences of women's everyday life. The examples and applications to everyday life experiences were requested through self-monitoring diaries.	Each treatment group consisted of 5 to 9 participants. The program consisted of 20 two-hour sessions over 1 year. Sessions were held weekly during the first 10 weeks.	Before randomization, all patients underwent 1 week of psychometric and laboratory tests, during which they also received general lifestyle advice on diet, physical training, and smoking cessation. During this week, the women received a 1-hour lecture on type A behavior and stress. They were informed and introduced to relaxation practices as well as relaxing qigong-type	Everyday Life Stress Scale	19.7 ± 9.6	18.8 ± 9.5	13.4 ± 6.4	16.1 ± 8.2

									exercises. Stress reactions and stress prevention were briefly mentioned during the lectures on physiology (with emphasis on ischemic heart disease) and exercise. After randomization the patients in the CG received usual clinical treatment. The patients assigned to the control group received care and follow-up of women with ischemic heart disease, including outpatient visits to cardiologists and cardiology nurses.					
Orth-Gomér, K, et al., 2009(Orth-Gomér et al., 2009)	Sweden	237 consecutive women aged 75 years or less, hospitalized for acute myocardial infarction, coronary artery bypass graft surgery or percutaneous coronary intervention	112	125	Survival- Total mortality	7.1 years	Education about risk factors, relaxation training techniques, self-monitoring methods, and cognitive restructuring, with emphasis on coping with stress exposure from family and work, self-care, and adherence to clinical guidelines. The intervention was delivered by 2 cardiology nurses trained by a clinical psychologist. The program content was focused on psychosocial risk factors in women and attempted to control behavioral risk factors, attenuate negative emotions, improve coping skills, reduce stress, and improve social support. The intervention methodology followed basic principles of cognitive-behavioral intervention programs: communication of knowledge on cardiovascular health, methods for self-monitoring, recognition of cognitive distortions, cognitive restructuring, skills training, and role playing. Topics ranged from the cardiovascular system and its pathophysiology to clinical and behavioral risk factors. Group educational sessions aimed to improve heart knowledge, healthier lifestyle, train skills and improve marital stress mastery, cope with serious illness, combat anxiety and depression, improve social relationships and social support. Metaphors were often	Initiated 4 months after hospitalization, intervention groups of 4 to 8 women met for a total of 20 sessions, each session lasting 2 to 2.5 hours, which were spread over one year. In all, 20 groups were held, each for a period of 1 year, and a total of 400 sessions were prepared, conducted, and monitored.	Usual clinical treatment	Everyday Life Stress scale	41.3 ± 8.6	40.5 ± 9.5	Not evaluated	Not evaluated

						used to illustrate and facilitate understanding of adverse behavioural contexts. These aimed to help the patient become aware of alternative interpretations in her own life context and facilitate reinterpretations of less threatening and emotionally charged life situations. Other topics were related to the negative emotional consequences of heart disease, hostility, depression, exhaustion, and stressful events at work and in the family, and were discussed along with strategies for coping with such emotions. Social relationships, social roles and social supports were highlighted, and traditional male and female roles at work and in the family were discussed. Finally, existential questions about life and death, strengths and weaknesses in each patient's personal life were raised.						
Gulliksson, M, et al., 2011(Gulliksson et al., 2011)	Sweden	362 consecutive women and men aged 75 years or younger who were discharged from hospital after a coronary heart disease event in the past 12 months (AMI, percutaneous coronary intervention, or coronary artery bypass graft surgery) residing in the hospital's primary catchment area and healthy enough to be referred to the general practitioner within 1 year of hospital admission; They could not have participated in similar programs and were required to be Swedish-speaking, willing to participate in the study, and agree to random group allocation.	192	170	All-cause mortality, hospitalization for recurrent cardiovascular disease, and recurrent acute myocardial infarction. Secondary outcomes were quality of life measures.	7.8 years	Participants in the intervention group received the usual clinical treatment and the Cognitive Behavioral Therapy (CBT) intervention program. The program has 5 main components with specific goals - education, self-monitoring, skills training, cognitive restructuring, and spiritual development - and is focused on stress management, coping with stress, and reducing the experience of daily stress, time urgency, and hostility. It is highly structured and standardized, and follows a treatment manual developed and evaluated in previous studies. Each session had a specific theme, working material, and homework assignment. Simple diaries were used for self-monitoring of behaviors and reactions. Behavioral exercises ("drills") were introduced early and monitored and discussed in all sessions. The session format was as follows: brief relaxation, reflections on the previous session, homework monitoring, introduction of new themes, and homework preparation. The communication style of the therapist was more oriented towards motivational rather than educational interviewing. No other interventions were allowed or provided. A team of experienced clinical psychologists and nurses, specialists and working with patients with coronary heart disease at Uppsala University Hospital, was used. They carried out the CBT sessions under the supervision of the team leader, who had developed the program. To ensure continuity, each group had the same group leader throughout the program.	The program was conducted in 20 two-hour sessions over 1 year with 5 to 9 participants per group, with separate groups for men and women.	Usual clinical treatment, defined as traditional efforts to optimize risk factors.	Maastricht Questionnaire (Vital exhaustion)	13.2 ± 8.4	13.4 ± 8.0	Not evaluated	Not evaluated

Schneider, RH., et al., 2012(Schneider et al., 2012)	United States of America	201 black men and women with angiographic evidence of at least 1 coronary artery with stenosis > 50%. Subjects were identified from the African American Heart Health Registry of the Medical College of Wisconsin and other Milwaukee area hospital databases. Each patient's physician gave permission for participation in the study.	99	102	The primary outcome was time to first event for the composite of all-cause mortality, nonfatal AMI or nonfatal stroke. The secondary clinical endpoint was time to first event for the composite of cardiovascular mortality, nonfatal AMI, nonfatal stroke, coronary revascularization, or hospitalization for ischemic heart disease-not AMI or heart failure. Additional secondary and intermediate end points included BP, smoking, alcohol, BMI, diet, exercise, and psychological stress.	5.4 years	The Transcendental Meditation (TM) program was used as a mind-body intervention for its influence on the physiological effects of stress and cardiovascular outcomes. TM was chosen considering its standardization, reproducibility, and validity. It is the main mind-body technique of Maharishi Ayurveda, a comprehensive traditional system of natural medicine. The TM technique is described as a simple, natural and effortless procedure that is practiced 20 minutes twice a day, sitting comfortably with eyes closed. During practice, it is reported that ordinary thought processes stabilize and a distinctive hypometabolic waking state, characterized by neural coherence and physiological rest, is obtained. Standard teaching materials and formats were used.	The Transcendental Meditation technique was taught in a 7-stage instructional course consisting of six 1.5- to 2-hour individual and group meetings taught by a certified Maharishi Foundation USA instructor. Thereafter, follow-up and maintenance meetings were held weekly for the first month, fortnightly for the next 2 months, and monthly thereafter until the remainder of the study phases.	The control intervention was a cardiovascular health education program designed to match the experimental intervention format for instructional time, instructor attention, participant expectancy, social support, and other nonspecific factors. Content was based on standard published materials. Instructors were professional health educators. Individuals in this group were advised to spend at least 20 minutes per day at home practicing heart-healthy behaviors, e.g., exercise, healthy meal preparation, and nonspecific relaxation. Care was taken to separate the two intervention groups to minimize contact and communication.	CESD Scale for depression, Cook-Medley Hostility Inventory, Anger Expression Scale	CESD Scale for depression: 13.8 (9.9) Cook-Medley Hostility Inventory: 5.2 (5.1) Anger Expression Scale: 26.0 (11.9)	CESD Scale for depression: 17.8 (11.7) Cook-Medley Hostility Inventory: 15.9 (5.3) Anger Expression Scale: 28.5 (11.3)	Not evaluated	Not evaluated
Rakowska, JM, 2015(Rakowska, 2015)	Poland.	81 male and female patients with a first diagnosis of nonfatal AMI (ICD-10 code 121) aged between 40 and	41	40	Perceived Stress Scale, Health Survey scores, reinfarction, and cardiac mortality rates.	2.5 years	Brief strategic therapy (BST) plus usual care was used. TEB was carried out by four trained and experienced clinical psychologists who were supervised in weekly meetings by a senior TEB therapist. The sessions were guided by the manual (Rakowska, 2000) based on principles described in two books by Weakland, Watzlawick and Fish (1974) and Fish, Weakland and Segal (1982).	10 one-hour individual sessions of TEB. The time between the initial evaluation and the beginning of the DBT intervention was 50 days.	Usual clinical treatment (medical treatment, information on risk factors and guidance on unhealthy	Perceived Stress Scale	24.60 ± 1.74	24.58 ± 1.75	22.05 ± 1.94	24.71 ± 1.79

		65 years. Inclusion criteria were: having a diagnosis of first nonfatal myocardial infarction; having increased levels of perceived stress in connection with psychosocial stress-related problems; and willingness to receive psychological help to control psychosocial stress-related problems. Planned exclusion criteria were severe mental problems (e.g., alcohol dependence or psychosis).					The concept, based on cybernetics, is that stress-related psychosocial problems are maintained by well-intentioned but ineffective "solutions" (behaviors aimed at preventing problems from occurring or solving problems when they do occur). A frequently used ineffective solution leads to exacerbation of the problem in a vicious cycle. A small initial change in the ineffective solution can initiate a beneficial cycle in which a less frequently used ineffective solution leads to a decrease in the intensity of the problem. The general strategy of psychosocial problem solving is to prevent people from using their ineffective problem maintenance solutions by having them behave in the opposite way to the ineffective one. First, the most disruptive and stress-generating problem and problem-maintenance behaviors were identified by the patient. Next, the behavior opposite to the patient's problem maintenance behavior was identified by the therapist. (This opposite behavior has the potential to prevent the patient from using their problem maintenance behavior.) A goal of therapy was identified by the therapist by asking the patient what the first sign of improvement would be. Next, patients were asked to behave in a manner opposite to their problem-maintenance behaviors to block that their behavior. Typically, these tasks were presented as homework assignments. From the patients' point of view, they were asked to behave in a counterintuitive manner. If such behavior was seen by a patient as unacceptable, then the reframing technique was used. The therapist, using the patient's beliefs, would convince the patient that this counter-intuitive approach made sense and would be beneficial. In the case of patients with high levels of resistance to being influenced, paradoxical intention was applied. They were asked by therapists to continue their problem behavior or their problem-maintaining behavior in the hope that they would choose to do the opposite of what was asked. When a patient's problem was resolved, the therapist used relapse techniques to prevent recurrence of the problem. These techniques have three goals. First, to assign positive meaning to the temporary recurrence of the problem in order to mitigate the patient's fear of missing an improvement (such fear expectancy might lead the patient to use the problem-keeping behavior again, which could produce the problem again). Second, understand that using the problem maintenance behavior again would produce the problem again, so that the patient has a sense of control over the problem. Third, recognize that the patient owes the solution to the problem to his own effort, to increase his confidence in dealing with personal problems in the future.		behaviour change).					
Blumenthal, JA., et al., 2016(Blumenthal et al., 2016)	United States of America	151 outpatients with coronary artery disease aged between 36 and 84 years. Indications for cardiac rehabilitation	76	75	The primary outcome was a psychometric composite measure of stress. Secondary outcomes included	3.2 years	Patients received the same comprehensive Cardiac Rehabilitation intervention as the control group plus Stress Management Training (SMT). TME was adapted from a previous work of the authors that combined education, group support and cognitive-behavioral therapy. The TME intervention is based on a cognitive-behavioral model in which stress is conceptualized as an imbalance between high demands (often environmental, but can also be self-imposed) and more limited coping	The intervention was conducted in 12 weekly 1.5-hour sessions in groups of 4 to 8 participants.	Patients practiced aerobic exercise 3 times per week for 35 minutes at a level of 70% to 85% of their heart rate	1. Beck Depression Inventory II (BDI-II) 2. State-Trait Anxiety	1. BDI-II: 8.1 (7.7) 2.STAI-S: 35.1 (11.8) 3.PROMIS Anger:	1. BDI-II: 9.0 (9.0) 2.STAI-S: 36.3 (11.8)	1. BDI-II: -3.5 (-5.0 to -2.1) 2.STAI-S: -5.6 (-7.4	1. BDI-II: -2.6 (-4.1 to -1.2) 2.STAI-S: -2.6 (-4.5

		included recent acute coronary syndrome, stable angina with angiographic evidence of coronary artery disease, and recent coronary revascularization (coronary artery bypass graft surgery or percutaneous coronary intervention).			biomarkers of CAD and adverse cardiovascular events: all-cause mortality, fatal and nonfatal myocardial infarction, coronary or peripheral artery revascularization, stroke/transient ischemic attack, and unstable angina requiring hospitalization.		resources. Therefore, the intervention is directed at reducing demands and increasing coping skills. Initial sessions aim to establish rapport, promote group cohesion and social support, and provide a scientific basis for the importance of stress as a risk factor for adverse cardiovascular events. Strategies for reducing demands are presented, including prioritization, time management, establishing personal values, and avoiding stressful situations. Subsequent sessions focus on modifying responses to situations that cannot easily be changed. Several sessions are devoted to training in progressive muscle relaxation techniques and the use of visual imagery to reduce stress. Emphasis is placed on the importance of cognitive appraisals in affecting stress responses, with recognition of irrational beliefs and cognitive distortions such as overgeneralization, catastrophizing, and all-or-nothing thinking. Later sessions focus on the importance of effective communication, including topics of assertiveness and anger management. Instruction in problem-solving strategies is also provided in which participants are encouraged to apply the skills they have learned to solve everyday problems. Methods included brief lectures, group discussion, role-playing, instruction in specific behavioral skills, and weekly homework assignments.		reserve, as determined at the time of the initial treadmill test. Patients also received cardiovascular disease (CD) education, nutritional counseling based on American Heart Association guidelines, and 2 classes dedicated to the role of stress in CD.	Inventory (STAI) 3.Patient-Reported Outcomes Measurement Information System (PROMIS) Anger 4.General Health Questionnaire 5.Perceived Stress Scale	16.1 (5.5) 4.General Health Questionnaire: 12.6 (5.9) 5.Perceived Stress Scale: 15.3 (8.2)	3.PROMIS Anger: 16.2(6.1) 4.General Health Questionnaire: 12.3 (6.0) 5.Perceived Stress Scale: 15.4 (7.9)	to -3.7) 3.PROMIS Anger: -2.0 (-3.0 a -1.0) 4.General Health Questionnaire: -4.8 (-5.8 to -3.7) 5.Perceived Stress Scale: -4.2 (-5.4 to -3.0)	to -0.7) 3.PROMIS Anger: -1.0 (-2.1 a 0.0) 4.General Health Questionnaire: -3.3 (-4.4 to -2.2) 5.Perceived Stress Scale: -2.6 (-3.9 to -1.3)

IG= Intervention group; GC= group control;