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Effects of cognitive behavioral therapy on depression, anxiety, sleep and quality of life for patients with heart failure and coronary heart disease. a systematic review of clinical trials 2010 – 2020

Aspasia Pizga, Panagiotis Kordoutis, Stamatoula Tsikrika, Ioannis Vasileiadis, Serafeim Nanas, Eleftherios Karatzanos

SYSTEMATIC REVIEW

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Abstract

Background: There is a growning evidence that CBT (Cognitive Behavioral Therapy) improves mental health of patients with chronic illnesses but its effectiveness is not well established in patients with heart diseases. The present systematic review was conducted to evaluate the effects of CBT in heart failure (HF) and coronary heart disease (CHD) patients.

Methods: Pubmed, Cohraine and Google Scholar were searched for studies with randomized controlled trials. Studies were required to assess the effectiveness of CBT in depression, anxiety, sleep and quality of life of patients suffering from heart failure and coronary heart disease. SStudies identified were independently screened by two reviewers and critically appraised using the PedroScale.

Results: Sixteen randomized controlled trials were included in the review. The majority of the studies indicated that CBT therapy was effective treatment for reducing depression and anxiety and can also be beneficial for sleeping disorders and improve quality of life of patients with heart failure and coronary heart disease. Althought face to face CBT therapy seems to be clinicaly effective, internet-based CBT therapy was not superior to a guided web-based discussion forum.

Conclusions: CBT can improve psychological health and quality of life of cardiac patients and further enhance benefits of rehabilitation programs. Findings suggest that face-to-face CBT is superior to usual care and it can be incorporated in cardiac rehabilitations programs. Future studies are needed to identify the effectiveness of internet-based CBT on cardiac patients and address the factors that will increase treatment adherence.

Keywords: Psychological interventions, cardiovascular diseases, quality of life, cardiac rehabilitation.

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INTRODUCTION

Cardiac patients' psychological state has long been a subject of interest for researchers, mainly because these patients present with high rates of anxiety [1-2] depression[3-6], sleep disorders[7] and poor quality of life.[8] Mental health is associated with risk factors for the development of cardiovascular disease[9-12] or as a modifiable factor following a heart attack that impairs quality of life (QoI).[13-14] There are findings indicating that more than one fifth of all patients with coronary heart disease are depressed, and up to one third of them report elevated depressive symptoms, rate that is at least 4 times greater than in the general population[15-18.] In addition, cardiac patients with depression have double the risk for a second heart attack, as well as twice as high mortality rates.[19] Because of the direct relation between depression and coronary artery disease, the American Heart Association in its 2014 position statement recommended depression as one of main risk factors for acute coronary syndrome survivors.[20] According to INTERHEART, stress was referred as the third most important risk factor for coronary events, following abnormal lipids and smoking, and accounts for approximately 30% of the population's attributable risk of acute MI.[21] The activation of stress pathways have been implicated in a neurochemical mechanism that links stress depression and coronary heart disease.[22] Perceived stress, [23, 24] anxiety[25, 26] and poor sleep quality[27] seem to be related with cardiovascular events. Mental health disorders such as anxiety, depression and sleeping disorders may increase the possibility of adopting lifestyle behaviors, such as smoking, physical inactivity, unhealthy diet and alcohol consumption, that affect cardiac function.[28]

Overall, literature suggests that psychological factors affect manifestation or triggering of pathology, as well as patient adjustment and quality of life. The understanding that environmental and biological factors could trigger or sustain cardiovascular disease enhances control over it and improves chances of a more effective treatment. Metanalysis of Samartzis et al (2013) psychosocial indicated that interventions tend to improve the QoL of CHF patients. Psychological treatment including psychoeducation of both patients and caregivers, encouragement, problem solving techniques, stress management, positive thinking, lifestyle changes, was very beneficial in decreasing the level of patients' anxiety[29]. Moreover, Kroustalli et al 2019 found that a patient-centered multidisciplinary approach can be beneficial for patients with heart failure. It is vital for patient's prognosis and quality of life to participate in effective psychological interventions.[30]

Within the scope of comprehensive care for patients suffering from CHD and HF, cognitive behavioral therapy seems to be a promising intervention and can be applied both in the general population, as a learning tool for those seeking to manage stressful live situations and in patients with chronic mental and physical illness. Cognitive behavioral therapy is a psycho-social intervention based on the principles of behavioral and cognitive psychology. In contrast to the psychanalytic and psychodynamic approaches that seek the subconsious or unconsious reasons underlying, CBT is more "action oriented" form of therapy. Its main goal is to improve mental health. Plenty of reviews indicate that CBT sessions can play an effective role on the treatment of stress disorders, mild depression, chronic pain and psychosomatic conditions.[31-36] Therapist and client work together as a team[37] to identify the problems and develop personal coping strategies, to achieve a positive attitude, to overcome distorted beliefs and to adopt more effective behaviors. CBT techniques include cognitive restructuring, problem solving exercises, psychoeducation, graded exposure, successive approximation writing, negative filtering, time management, role playing and relaxation techniques. In addition, CBT techniques seem to have a significant value for promoting physical health and coping with physical illnesss, especially when combined with proper medication.[37]

The primary purpose of the current study is to review research literature of the past decade on the effects of cognitive behavioral therapy on depression, anxiety, sleep and quality of life for patients with CHD and HF. Further, we intend to investigate which of the three methods (face to face approach, telephone or iCBT) will benefit the most cardiac patients.

METHOLOGY

Searching strategy

A search of randomized trials was conducted on Pubmed, Google scholar, Cochrane Central Register databases. Keywords "Cognitive behavioral therapy", "Heart failure", "Coronary heart disease", "Depression", "Anxiety", "Sleep", "Quality of life" in appropriate combinations depending on the capabilities provided by the database. The following is an example of search in Pubmed: (Cognitive behavioral therapy) AND (Heart failure or Coronary heart disease) AND (depression OR stress OR quality of life OR sleep).

A secondary search was also conducted using the references of the articles yielded by the initial search. Our research comprises articles that were published between 2010 and 2020, reported on cognitive behavioral therapy in participants suffering from heart failure and coronary heart disease.

Inclusion and exclusion criteria

We included relevant studies if they met the following criteria: (1) they should be written in English, (2) the study design should be a randomized controlled trial, (3) the population examined should have a clinical diagnosis of heart failure or coronary heart disease, 4) should include Cognitive Behavioral Therapy techniques as the main psychological intervention, 5) the CBT interventions involved should be face to face telephone or internet based sessions, as part of cardiac rehabilitation program or home-based medical care, 6) comparators should include usual care and other interventions such us exercise, medication or no treatment and attention control. The search was limited to papers published between 2010 and December 2020.

We excluded studies if they met one of the following criteria: (1) infant population (2) data extracted from abstracts or letters (3) interventions described as "cognitive therapy" (4) studies employing other types of psychological interventions. (Table1). The selection criteria of articles the review are summarized in figure 1.

Assessment of quality of trials

Two reviewers independently assessed the quality of the included trials with the PEDro scale [38]. On the basis of the Delphi list described by Verhagen et al, the PEDro scale is widely used and has demonstrated evidence of validity in assessing trial quality[39]. In accordance with the PEDro guidelines, indicators of methodological rigor were scored as either present (1) or absent (0). A score of 0 to 10 was obtained by summation of scores for the PEDro criteria, with the higher score indicating greater methodological quality.

RESULTS

Identification and selection of studies

Our literature search resulted in 296 studies. Of these studies 186 were excluded as duplicates and 77 studies were excluded when title and abstract were reviewed. Of the 31 studies selected for full text review, 15 were excluded for not meeting the predefined inclusion criteria. A total of sixteen randomized controlled trials were identified.[40-55] All research studies examined the effect of cognitive behavioral therapy on patients' lives suffering from heart failure and coronary heart disease and were published within 2010 and 2020.

In all studies main outcomes were the efficacy of a CBT program on depression, stress, quality of life and sleep; they employed randomized control trials and were written in English. Eight (8) studies were conducted in the US (26-32), three (3) in Sweden (25, 40), two (2) in Australia (33, 41), one (1) in the UK (34), one (1) in China and one (1) in the Philippines.

Participants

A total number of 1664 patients were included, of which 857 received CBT and 807 served as controls. They were over 60 years old, Caucasian, 55.6% male and 44.7% female. In terms of health condition, 705 were patients suffering from Heart Failure (40, 41, 42, 43, 44, 46, 49, 48, 50, and 55) and 959 from Coronary heart disease (45, 47, 51, 52, 53, and 54). Sample sizes in the studies included ranged from 29 to 362 participants.

Intervention

In all studies intervention group recieved single CBT or CBT with multiple component interventions. In 14 of the 16 studies, CBT intervention was provided in face-to-face sessions, while in 2 studies through online meetings (41, 46). Moreover CBT sessions

were conducted either in individual sessions 1:1(40, 41, 45, 46, 47, 48, 49, 50, 51, 54, and 55) or in small groups (42, 43, 44, 52, and 53). The duration of the intervention varied among studies, as some studies provided weekly sessions (41, 46, 47, 48, 49, 50, 51, 52, 54, and 55) and some every two weeks (42-45).

CBT was provided by a psychologist or nurses and other qualified staff who provided techniques such as consulting, psychoeducation, self-monitoring, skills training, cognitive restructuring, structured problem-solving, stress management, homework, behavioral and cognitive tasks.

Comparator

In most of the studies control group received usual care. Although the definition of usual care is not standardized, it includes the routine care received by patients for treatment. The type of routine care for heart patients can vary by disease type and severity and usually includes medication, dietary recommendations, and regular physical exercise. In two of the studies, usual care included educational materials (40, 49), in three studies physical exercise (47, 50, 55), risk factor optimization (48, 53, 54) and in two studies medical care (45, 48). In 3 of the studies the control group was in attention-control condition and included self-management and information (42-44) while in 5 studies the control group involved some other intervention or combination of interventions (41, 46, 47, 50, 52). (Table 3). Characteristics of the studies investigating the effect of CBT on depression, anxiety, sleep and quality of life for patients with heart failure and coronary heart disease.

Outcome measures

Depression was evaluated with Hospital Anxiety and Depression Scale (HADS), Beck Depression Inventory (BDI), Montgomery–Åsberg Depression Rating Scale (MADRS) and Behavioral Activation for Depression Scale Short Form (BADS-SF). Stress and anxiety were evaluated with State-Trait Anxiety Inventory (STAI) and Cardiac Anxiety Questionnaire (CAQ), quality of life was measured with QoL, Health-Related Quality of Life (HRQOL) with Coronary revascularization outcome questionnaire (CROQ PTCA-POST) and sleep evaluated with Pittsburgh Sleep Quality Index (PSQI), Sleep disorders Questionnaire and Epworth Sleepiness Score. (Table2). Overview of outcome measures.

Risk of bias

Sixteen RCTs were included in the review. The total PEDro scores ranged from 5 points (41-46) to 8 points (47, 48, and 51). Quality and findings of the studies were inconsistent. The eligibility criteria were specified for all the included RCTs and in all studies participants were randomly allocated in treatment groups. Allocation concealment was used in ten studies (46, 47, 48, 49, 50, 51, 52, 53, and 54). Due to the nature of the CBT intervention, blinding procedures were difficult to implement, for both participants and therapists; albeit there were blind assessors in ten studies (40, 45, 47, 48, 49, 50, 51, 52, 53, and 55). Measures of at least one key outcome were obtained from more than 85% of the participants initially allocated to groups for all studies. Five of the sixteen RCTs reported an intention-to-treat analysis (47, 49, 50, 51, and 54). Between-group statistical comparisons were implemented in all trials. Point estimates and variability for treatment effects were reported in all studies except one (54). (Table 4). PEDro Scale for Rating Quality of Randomized Controlled Trials.

Depression

The results of the effect of CBT therapy on depression in patients with heart failure emerge from 7 studies (40, 41, 43, 46, 59, 50, and 55). Five out of these 7 studies conducted face-to-face sessions and showed that CBT is more effective than usual care alone (educational materials, medical care and risk factor optimization) for the depressive symptoms. In other two studies, internet-based CBT intervention was not superior to web-based discussion forums (41, 46)

Four studies indicated the efficacy of CBT in depression of patients suffering from coronary heart disease (45, 51, 52, and 54). In two of them, patients randomized into the intervention group manifested a significantly greater reduction in depressive symptoms than those of the control group. However, in the other two (52, 54) CBT was not found superior to standard care (54) or brief intervention (52).

Stress and anxiety

Stress and Anxiety was assessed in 7 studies. (45, 43, 46, 47, 50, 52, 54). Anxiety was significantly lower in CBT patients than in controls in four studies. (45, 43, 47, 50). Three studies presented no difference in stress and anxiety after CBT treatment (46, 52, and 54), except one that in the secondary within-group analysis, the ICBT group showed a decrease in the total Cardiac Anxiety Questionnaire score as well as d in the subscale of fear (46).

Quality of life

Quality of life was assessed in 6 RCTs (45, 46, 49, 53, 54, 55) Three of the RCTs indicated improvements in quality of life scores for the CBT intervention groups but for two studies no significant changes in QoL scale were found (46, 54).

Sleep

Three studies demonstrated the effectiveness of CBT on sleep of heart failure patients (42-44). CBT therapy was effective against insomnia (44), dysfunctional sleep-related cognitions (43), fatigue (44, 43), negative sleep conditions and disturbance (42).

Clinical events and survival

Two of the studies indicated the effectiveness of CBT for patients with CHD. In the first study one participant in cardiac rehabilitation, supported by stress management techniques and CBT, exhibited lower rates of clinical events, compared to those in the CR-alone group (18% versus 33%). In the second study, the intervention group had a lower rate of fatal and nonfatal first recurrent CVD events by 41%, fewer recurrent acute myocardial infarctions by 45% and a nonsignificant percentage (28%) of all-cause mortality. Although CBT therapy tended to have beneficial effects for CHD patients, there were limited data for HF patients, during the period covered by the review (last decade).

DISCUSSION

The aim of this systematic review was to evaluate the effects of cognitive behavioral therapy on depression, anxiety, sleep and quality of life on people suffering from heart failure and coronary heart disease. Most of the studies suggested that there is a significant positive association of CBT therapy with the mental health of cardiac patients. In the present study CBT seems to be an effective treatment for reducing depression and anxiety in

patients with HF and CHD. Reduction in depression symptoms has been associated with improving the quality of life of cardiac patients. Moreover, although there is currently insufficient evidence that improving mental health reduces mortality and heart disease, on the other hand reducing depression seems to play an important role in treating adherence, adopting positive changes in lifestyle, nutrition, and selfcare (57). Furthermore, face to face CBT intervention seems to have a positive effect in reducing patients' depression. Two of the studies which provided web-based CBT to heart failure patients for 9 weeks concluded that this kind of intervention was no superior to web-based discussion forum; these findings question the effectiveness of online discussion forums in this specific population. It is also important to mention that the majority of patients with heart failure and coronary heart disease are in older age and therefore less familiar with new technology. Ease of access, familiarity with technology and emotional proximity are factors that require more study in their relation to patient's dropouts. The traditional type of psychotherapy is carried out with lifelong treatments, no feasible in all cases. Recently, evolution of internet platforms and easy access to online sessions has increased significantly. Limitations suchs as luck of individual space and capable network may not inhance home sessions. Requirements of conducting online sessions as well as the conditions that will increase the effectiveness of internet-based CBT in patients with heart failure and coronary heart disease need to be studied further in the future.

CBT therapy was found to be effective on anxiety, distress and perceived stress. Pharmacological treatment is by far the most common treatment for the management of anxiety. Albeit, as cardiovascular patients often receive several medications, non-pharmaceutical methods in order to improve mental health and quality of life seem to be necessary. There is growing evidence that exercise and psychotherapy may have beneficial effects in patients with cardiovascular diseases.[58]

CBT therapy for the quality of life in CHD and HF patients was noted as superior to usual care. In two studies, CBT did not appear to be more effective than web-based discussion forum and

standar care. It is worth mentioning that in one of the studies the researcher considers that no improvement in the quality of life scores may be due to the duration and frequency of face to face sessions.[54] Literature argues that CBT sessions have to be time efficient.[59] The study of Zetta et al. is an example of short intervention showing that a short intervention based on theoretical principles of CBT led to increased knowledge and fewer misconceptions of cardiac risk factors but it did not make any difference in depression and independence. Regular weekly sessions appeared to be more effective in reducing patients' depression, anxiety and insomnia compared to shorter interventions. Improving the quality of life of patients requires a multi-disciplinary approach and time. Similarly, treatment for depression, anxiety and insomnia may require systematic weekly sessions over a variable period of time, because duration of the sessions depends on patient's personal health, lifestyle, behaviour and treatment compliance.

Regarding sleep, 3 studies investigated the efficacy of CBT on insomnia in heart failure patients. CBT was effective in reducing insomnia, dysfunctional sleep-related cognitions, fatigue, negative sleep conditions and sleep disturbance. Sleep quality and duration can have a major effect on many health risk factors. Research findings suggest that good quality sleep can protect the heart function and contribute to the reduction of atherosclerosis[60] CBT could help heart failure patients by enhancing sleep quality.

CBT is a broad term incorporating a number of tools and a wide range of strategies. When determining which selection technique is most appropriate, it is necessary to consider patient needs, the capabilities of the institution, and cost effectiveness evaluation. Future research should work to distinguish the effectiveness of techniques used in CBT on a range of outcome measures and clinical events in cardiac patients.

It is worth mentioning that some studies[42-47, 52, 53] have chosen to study the effectiveness of group CBT therapies while others have studied the effectiveness of individual therapies. All but one[52] of the studies have shown that conducting CBT in group meetings has a positive effect on patients' sleep, depression and anxiety. Group CBT therapy offers several facilities but also has difficulties for some patients. On the one hand group meetings are less time-consuming than individual sessions for specialists, moreover patients feel they can finally be understood and a supportive network develops between patients. On the other hand, practical issues arise often (e.g. arranging a common session time), the procedure is not personalized and the time allocated for each patient is shorter than in individual sessions; some people feel discomfort and not every person is a good candidate for group therapy. It would be interesting in the future to study the effectiveness of group sessions versus individual sessions; more particularly, research could examine which kind of CBT intervention, individual vs group, is more effective for different categories of patients. The studies reviewed also illustrate a difficulty of doing research with heart failure and coronary heart disease patients who suffer from depressive symptoms, even when sufficient numbers of participants are secure at the early stages of a study, along the way they may leave the procedure.

In summarizing, our review of 16 studies published during the the past decade, suggests that CBT outweighs usual care in positive effects on depression, sleep anxiety and the quality of life of patients with heart failure and coronary heart disease. More studies are necessary to ensure the conclusion. Moreover, some limitations apply. The studies of patient depression, anxiety and quality of life were all based on self-report scales. In addition, due to the nature of CBT intervention it was difficult to implement blinding processes appropriately. The majority of the studies had a sufficient number of participants, however, greater patient participation would have been desirable for both statistical and methodological purposes. It would have been useful if we had longitudinal studies with a follow-up of six-months or greater so that the long-term effectiveness of CBT could be evaluated.

Concluding, we propose that patients with heart failure and coronary heart disease should be treated in a more holistic way by a collaborating interdisciplinary team of experts. Future research may help in developing new forms of psychological interventions to improve the quality of life of heart disease patients.

Mental health is affected by living conditions and the social milieu of the patient. Research should take into account the impact of social support, interpersonal relationships, history of punishment, social skills and daily social activities. Informed integration of social factors into cardiac rehabilitation programs could subsequently benefit participating patients.

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ANNEX

Table 1. Study Selection Criteria

	Inclusion criteria	Exclusion criteria
Population	patients with HF or CHD	infant population
Intervention	single or multiple component interventions that CBT is the main psychological intervention	patients who received other stress management technique as main therapy
Control group	usual care, other psychological interventions, waiting list or no intervention	
Outcomes	depression, anxiety, sleep & quality of life	changes only on biomarkers without psychological indicators
Study design	RCTs	

Figure 1. Flow Chart picturing the steps conducted for the review

Date of publication: 2010-2020

Article: Randomized controlled trial

Language: English
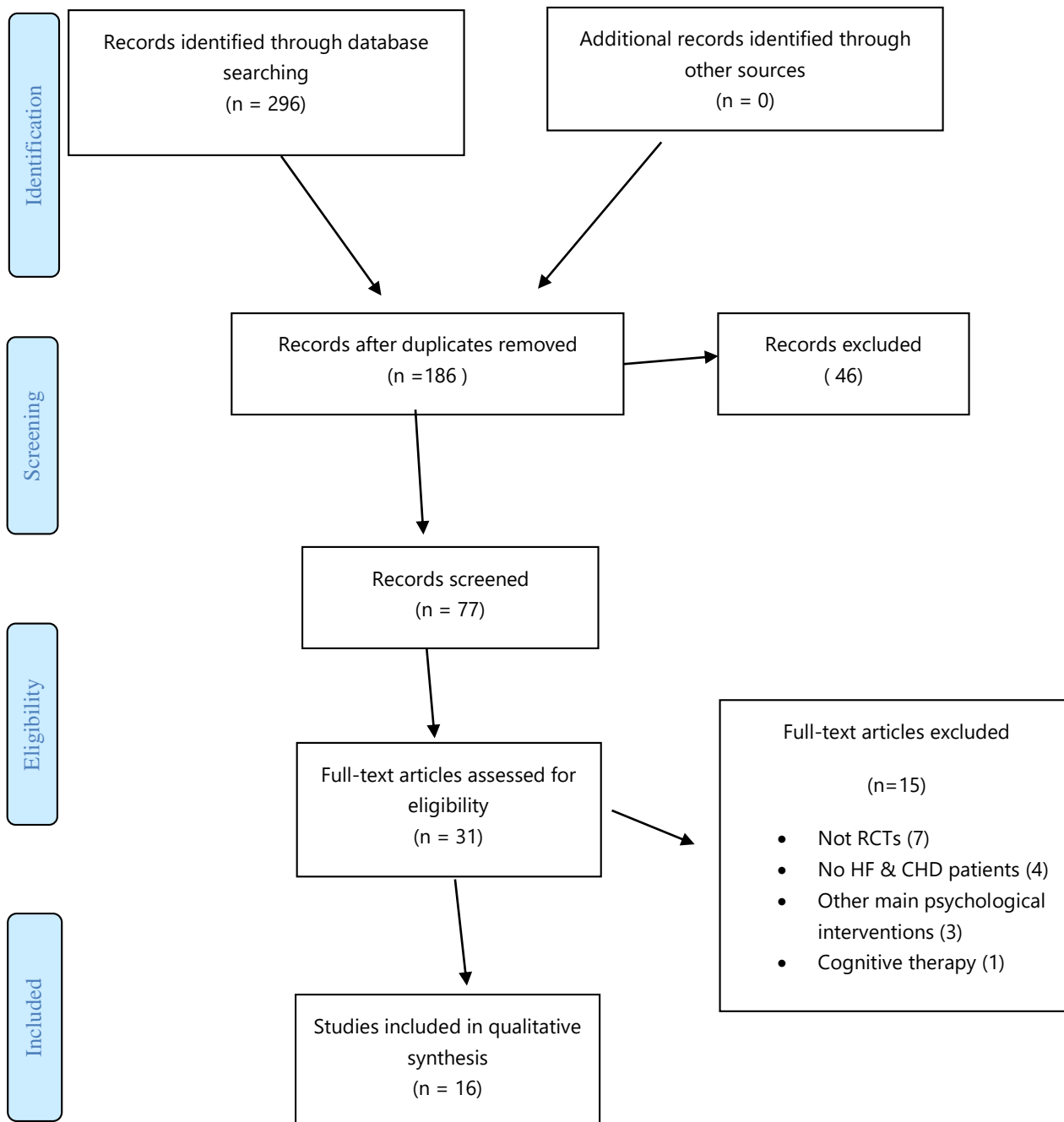
Table 2. Overview of outcome measures

Outcomes	N° of Studies	Measures
Depression	9	HADs, BDI, MADRS, BADS-SF
Stress or cardiac anxiety	6	STAI, CAQ
Quality of life	4	QoL, HQol, CROQ PTCA-POST
Sleep	3	PSQI, Sleep Disorders Questionnaire, Epworth Sleepiness Scores

Table 3. Characteristics of the studies investigating the effect of CBT on depression, anxiety, sleep and quality of life for patients with heart failure and coronary heart disease

Study	Population	Intervention	Control	Results
Smagula S 2019	94 HF patients Class I–III HF diagnosed >3months before screening, current major depressive episode	CBT & enhanced UC (6 months) UC: educational materials, 3 30-minute telephone calls with an experienced cardiac nurse conducted for 3 to 4 weeks after randomization)	Enhanced UC alone	Lower LVEF (%) : greater effect of CBT versus UC on depression symptom change Patients in NYHA class III: more severe HF symptoms (versus NYHA classes I/II), also benefited more from CBT.
Johansson 2019	50 HF patients with depressive symptoms	ICBT (9weeks) & Self care CBT included: 7 modules of education (1) Introduction (2) Living with heart failure (3) Depressive symptoms and heart failure; (4) Behaviour activation – enabling change (5) Behaviour activation – implementing change (6) Problem-solving (7) Consummation Self care: psychoeducation & homework	Online discussion forum & Self care (9week) Self care: discussions in writing.	Improvement in symptoms of depression was significantly associated with improvement in autonomy-based self-care (exercise and daily weighing) ICBT not superior to an on-line discussion group
Redeker 2018	51 Patients with stable Class II-IV HF and indicating at least mild chronic insomnia	CBT (group meetings) for Insomnia on Sleep, Symptoms, Stress, and Autonomic Function (4weeks of biweekly with a telephone call on the alternate weeks provided by a clinical psychologist sleep specialist. (4 biweekly 1-h sessions over an 8-week period with telephone calls on intervening weeks)	Attention control (HF self-management education)	Significant effects of CBT-I on insomnia, sleep disturbance, and fatigue and dysfunctional beliefs and cognitions about sleep Increases in the ratio between day and night cortisolwere associated with statistically significant improvements in fatigue, depression, sleep duration, and sleep-related cognitions.

Redeker 2017	51 HF patients	CBT (group meetings) for Insomnia on Sleep Related Cognitions conducted by a clinical psychologist certified in sleep medicine. (4 biweekly sessions over an eight-week period with telephone calls on intervening weeks).	Attention Control (HF self-management education, sleep hygiene & information)	CBT improved insomnia severity & fatigue. Improvements in dysfunctional cognitions were associated with improved sleep quality, insomnia severity, sleep latency and decreased fatigue, depression, and anxiety, with sustained effects at six months.
Redeker 2015	48 HF patients with Insomnia Severity Index > 7	CBT (group meetings) in 4 biweekly 1-h sessions over an 8-week period with telephone calls on intervening weeks.	Attention Control (HF self-management education & sleep hygiene education)	CBT-I group: improved more levels of insomnia severity and no one deteriorated Moderate CBT-I effects on actigraph-recorded sleep latency and duration Improvement in fatigue & a small improvement in physical function, but no meaningful differences in sleepiness,depression, or anxiety at follow-up CBT-I had a statistically significant effect on insomnia and fatigue, while controlling for the effects of comorbidity and age.
Jianfeng Lv, 2015	75 CHD young and middle-aged patients after PCI	CBT (8 weeks every 1-2 weeks, each lasting 1 hour, for a total of 6 meetings conducted by clinical psychologists) & medication (CBT:constructive cooperation, treatment goals, psychoeducation, cognitive reconstruction, Develop plans, regular stage summary and ending summary)	Routine postoperative treatment medication	CBT improved depression, anxiety & QOL After 8 weeks of treatment, HAM-D17 and HAM-A scores were significantly decreased in the CBT group compared with the control group CBT group showed better scores in symptoms, physical function psychological function & satisfaction. no difference in cognitive function
Lundgren 2016	50 HF patients with depressive symptoms	Guided Web-Based CBT (9 week)	Web-based moderated discussion forum (DF)	No difference in the CAQ total score. Decrease in the subscale of fear in the ICBT group ICBT not superior to participation in a Web-based DF

Blumenthal J 2016	151 CHD outpatients	CR, CBT, education & group support (12 weekly 1.5-hour sessions in groups of 4 to 8 participants	Standard CR (eg: aerobic exercise, nutritional counseling based on AHA guidelines, and 2 classes devoted to the role of stress in CHD).	CR+SMT group: greater improvements in anxiety, distress and perceived stress (compared with the CR-alone group) Improvements on biomarkers for both groups, no treatment group differences
Cajanding 2016	100 HF patients	CBT & Traditional Care (Once-weekly for 12 consecutive weeks lasting between 1-2 hours conducted by a nurse nurse following hospital discharge.) CBT included: 5key elements Traditional Care: medical/pharmacologic optimization therapy, HF-specific preventable risk factor modification strategies as prescribed	Traditional Care (medical/pharmacologic optimization therapy,risk factor modification	CBT group: improvements in their quality of life, self-esteem and mood scores
Freedland 2015	158 NYHA Class I, II, and III HF outpatients with comorbid major depression	CBT (6 months of weekly 1-hour sessions. Sessions tapered to biweekly and then monthly.Up to four 20- to 30-minute relapse prevention telephone contacts between 6 and 12 months post randomization)conducted by 2masters-level and 2doctoral-level therapists CBT: standard CBT manuals	CBT & UC OR UC alone UC: medical care & educational materials on HF self-care three 30-minute telephone calls over 3 to 4 weeks post randomization from a nurse.	Six-month depression scores were lower in the CBT than the usual care arm on the BDI-II. Six-month outcomes were superior in the CBT relative to he UC arm on secondary measures of depression, anxiety, quality of life, HF-related QoL, mental health-related Qol, fatigue and social functioning.
Tully 2014	29 HF patients under psychiatric management	CBT (1-h sessions once per week for 12 weeks).	CBT including psychoeducation, exercise, and anxiolytic Depression CBT treatment targeted depressogenic cognitions,negative beliefs, automatic thoughts and related schema OR	GAD treatment led to significant change in depression symptoms, reduction in average number of hospital readmissions at 6-month follow-up No significant between-treatment group differences in PHQ-9 change scores for depression versus GAD CBT

			CBT for generalized anxiety disorder (GAD), exercise, and anxiolytic (treatment targeted worry frequency, positive and negative worry meta-beliefs, and challenging worry cognitions).	Significant time and treatment interaction effect that favored the primary GAD CBT group for reduction in PHQ symptoms reduction in average number of hospital readmissions No significant between-treatment group differences in PHQ-cognitive change scores PHQ -somatic symptoms also showed a significant main effect for participation in the exercise program and a significant time & anxiolytic interaction
Doering 2013	81 Patients recovering from cardiac surgery (coronary artery bypass grafting or valve replacement/ repair) and met the criteria for clinical depression	Homebased CBT (8weeks, weekly face to face 50 to 60 minutes sessions, 1:1 conducted by 4 advanced practice nurses)	Usual care (referrals to their primary care providers, along with biweekly follow-up telephone calls from study staff for 8 weeks. 26 participants of the UC group who remained depressed after the 8-week UC condition were offered CBT and comprised the later CBT (UC + CBT) group.	CBT group: decline in BDI scores & greater remission of clinical depression Later UC + CBT group also experienced a reduction in BDI scores, but the group _ time effect was smaller & remission rates between the 2 groups did not differ. The early CBT group had a significantly greater reduction in depressive symptoms
Turner 2012	57 Cardiac patients (ACS, PCI or CABG) scoring >13 on the Beck Depression Inventory-II (BDI-II)	CBT (closed group programme 6 weekly sessions, 1.5 hours duration, with an extra hour at weeks 1 and 6 conducted by 2 trained clinical psychologists)	Brief intervention (verbal feedback regarding assessment results, recommendations for treatment, information regarding relevant mental health and support services, letters & call	No differences were found between the CBT and BI conditions on change in BDI-II score, rates of major depressive episode or HADS-A score.
Gulliksson 2011	362 CHD patients discharged from the hospital within the past 12 months.	CBT (group meetings) focused of stress management & Traditional Care (20 two-hour sessions during 1 year conducted by experienced clinical psychologists, nurses & experts) CBT: 5 key components Traditional treatment: risk factor optimization efforts	Tradittional treatment (traditional risk factor optimization)	CBT group: 41% lower rate of fatal and nonfatal 45% fewer recurrent acute myocardial infarctions & a nonsignificant 28% lower all-cause mortality first recurrent CVD events. Dose-response effect between intervention group attendance and outcome.

			no significant group differences in traditional risk factors after 2 years
Zetta 2011	233 CHD patients with an acute exacerbation of angina	Angina Plan: Cognitive behavioral nurse-facilitated self-help intervention. (One, 45-minute, face-to-face session and three, 5-minute, telephone sessions delivered by nurses 12 weeks a method of "goal setting and pacing").	Standard Care (a minimal intervention provided advice on their condition and risk factor reduction)	Patients reported improved knowledge, fewer misconceptions, improvements in some cardiac risk factors self-reported exercise) Improvements in physical limitation, general health perceptions and social and leisure activities. No reliable differences were found in any the total QoL.
Gary 2010	HF patients	CBT conducted by a psychologist (12 week home-based) CBT: based on Beck's CBT model of depression.	CBT only OR EX alone OR Usual Care OR EX/CB	6MWT distances were significantly greater at 12 & 24 weeks. CBT/EX had sustained lower HAM-D scores at 12 and 24 weeks CBT/EX had improvements in HRQOL.

Abbreviations:

HF: Heart failure, **HFSA**: Heart Failure Society of America and the American Heart Association, **AHA**: American Heart Association. **CBT**: Cognitive behavioral therapy, **UC**: Usual Care, **LVEF**: Left Verticular Ejection Fraction, **NYHA**: New York Heart Association **HADs**: Hospital Anxiety and Depression Scale, **MADRSs**: Montgomery-Asberg Depression Rating Scale-Self Rated, **HAM-D**: Hamilton Depression Rating Scale, **HAS**: Hamilton Anxiety scale, **CHD**: coronary heart disease, **DF**: discussion forum, **CC**: Collaborative care, **CR**: Cardiac rehabilitation, **SMT**: Stress management techniques, **MI**: myocardial infarction **BDI**: Beck Depression Inventory, **EQ5D**: Patient-Reported Outcome Measure **PHQ-9**:Patient Health Questionnaire-9, **DASI**: Duke Activity Status Index, **HRQoL**: Health-Related Quality of Life, **GAD**: generalized anxiety disorder **PD**: panic disorder, **ACS**: Acute coronary syndrome, **AP**: Angina Plan, **6MWT**: Six minutes walking technique

Table 4. PEDro Scale for Rating Quality of Randomized Controlled Trials

PEDro SCALE	Smagula S 2019	Johansson P	Redeker N 2018	Redeker 2 2017	Redeker 2015	Jianfeng Lv, 2015	Lundgren J 2016	Blumenthal 2016	Cajanding 2016	Freedland K 2015	Tully P 2014	Doering L, 2013	Turner A 2012	Gulliksson M 2011	Zetta S 2011	Gary R 2010
Eligibility criteriawere specified *	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Random allocation	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Concealed Allocation	√						√	√	√	√	√	√	√	√	√	
Comparable at baseline	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√
Blind subjects		√														
Blind therapists																
Blind assessors	√					√		√	√	√	√	√	√	√		√
>15% dropouts	√		√	√	√			√	√	√		√		√		√
Intention to treat analysis		√						√		√	√	√			√	
Between group comparisons	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√
Point estimates &variability	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Total (0-10)	7	5	5	5	5	5	6	8	7	8	7	8	6	7	6	6