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Title: Measurement of Anxiety for Patients with Cardiac Disease: A Critical Review and Analysis

Authors:

- Marla J. De Jong, RN, MS, CCNS, CCRN, CEN, Major
  PhD Student
  University of Kentucky, College of Nursing / United States Air Force
  Lexington, KY

- Lynne A. Hall, RN, DrPH
  Marcia A. Dake Professor of Nursing Science; Assistant Dean for Research and the PhD Program
  University of Kentucky
  Lexington, KY

Contact Author: Marla J. De Jong
527 College of Nursing
University of Kentucky
Lexington, KY 40536
Telephone: (859) 323-6687
FAX: (859) 223-7265
E-mail: mdejong@aol.com

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Although it is well-known that patients with cardiac disease experience psychological impairments, historically, clinicians have used physiologic measures such as ejection fraction, myocardial infarction size, blood pressure, and end-diastolic volume as prognostic indicators. More recently, cardiology experts have expanded their focus to consider how psychological status may contribute to poor outcomes. Specifically, a growing body of research literature contains reports about the relationship between anxiety and risk of rehospitalization, myocardial ischemia, reinfarction, dysrhythmias, quality of life, and mortality for patients with cardiac disease.[1-6]

Despite recent increased interest in anxiety, it remains a somewhat nebulous phenomenon due, in part, to the term's common and imprecise use among the general public, professionals, and researchers.[7] Even clinicians and researchers often fail to conceptually define anxiety and some use anxiety, mental stress, and depression interchangeably. Furthermore, the term anxiety is used to describe not only a normal transient emotion,[8,9] but also psychiatric conditions such as generalized anxiety disorder, panic disorder, posttraumatic stress disorder, and obsessive-compulsive disorder.[10] Although anxiety has been defined in numerous ways (Table 1), common to many definitions is the conceptualization of anxiety as an emotional response to a perceived threat.[8-12]

The purpose of this paper is to present a critical review and analysis regarding measurement of anxiety for patients with cardiac disease. The focus, however, is neither the underlying presence nor diagnosis of anxiety *disorders*, but rather measurement of acute anxiety.

Overview of Anxiety Measurement

The value of anxiety data depend on their careful measurement. Clinicians and researchers who conduct studies regarding the effects of anxiety for patients with cardiac disease

usually assess anxiety using self-report anxiety instruments. Although clinician-rated instruments and or direct observation may also used to assess anxiety, the focus of this paper concerns self-report anxiety instruments.

Using paper-and-pencil or computerized self-report instruments, patients or research participants answer questions about their behaviors, thoughts, and emotions. Self-report data also may be obtained during a structured interview. In either case, self-report measures are dependent on the respondent's awareness of his or her emotions.[13]

The self-report method confers several advantages. The self-report approach has been used to study many facets of emotions and may be the only way to obtain information about subjective aspects of anxiety.[14] "This approach is particularly important when dealing with inner reactions, such as emotions, for which the subject has to be the final authority."[15 p. 277] Persons without formal psychiatric training can administer and score self-report instruments, saving time and money.[16] Self-report results are amenable to analysis and interpretation using common statistical procedures.[17] Finally, use of self-report instruments allows clinicians and researchers to evaluate whether interventions improve emotional health.[18]

Disadvantages of the self-report method are that respondents may misunderstand statements or questions and thus provide inappropriate answers. Others may either refuse to answer or answer in ways that they deem either socially desirable or acceptable to clinicians and researchers. Finally, some individuals may lack the physical or mental capacity to complete self-report instruments.

Description of Three Existing Self-Report Measures of Anxiety

There are over 200 instruments that measure anxiety. Of these, the State-Trait Anxiety Inventory (STAI), the Anxiety Subscale of the Brief Symptom Inventory™ (BSI), and the

Hospital Anxiety and Depression Scale (HADS) are described below and compared in Table 2. The STAI is included because investigators use the STAI the most often to assess cardiac patients for anxiety. Furthermore, its distinction between state and trait anxiety is relevant to acutely ill cardiac patients. The Anxiety Subscale of the BSI is addressed because it is a short, yet valid and reliable instrument that has been used successfully with cardiac patients. Finally, the HADS is included because it was specifically developed for medical and surgical outpatients without a psychiatric disorder.

State-Trait Anxiety Inventory The STAI is a unidimensional, self-report instrument that was designed to provide reliable, relatively brief, and homogeneous measures of both state and trait anxiety.[19] As shown in Table 2, the STAI consists of two distinct 20-item subscales. The state subscale reflects how the individual feels at the present time. In contrast, the trait subscale reflects how the individual generally feels.

The STAI is most often used to assess anxiety[20] and has been translated into 58 languages and dialects. Clinicians and researchers from nursing, medicine, dentistry, psychology, and other social sciences have used the STAI.

When constructing the STAI, Spielberger and colleagues (1983) used several methods to validate it. To identify potential items for their instrument, these authors initially administered three widely-used anxiety instruments to psychology students. Based on correlation analysis, 177 items from the three instruments were retained and rewritten, creating one scale that, depending on how it was administered, measured either state or trait anxiety.[21] However, validity analysis revealed problems with this approach, leading the authors to devise separate state and trait anxiety scales. Next, the developers modified the items, making distinctions between state and trait anxiety. To evaluate face validity, psychology majors examined the

modified items for clarity and ability to measure state and trait anxiety. The authors continued to test their instrument with college students and made revisions based on concurrent validity analyses.

Form X of the STAI was published in 1970. For college students, the trait scale was highly correlated with three existing anxiety instruments, a finding that lent support to its convergent validity.[21] Results of known-groups construct validation were also favorable. For example, the STAI discriminated between trait anxiety levels of neuropsychiatric patients and healthy individuals. Likewise, college students reported higher state anxiety during an examination than during a regular class period.

In 1979, Spielberger and colleagues began revising Form X to meet three goals: 1) develop an anxiety measure that would distinguish between anxiety and depression, 2) replace items that possessed weak psychometric properties, and 3) improve the factor structure of the trait scale.[21] Spielberger and colleagues published Form Y in 1983. Correlations between Form X, the original STAI, and Form Y, the revised STAI, ranged from 0.96 to 0.98. The main advantage of form Y is its "purer" measure of anxiety and its better differentiation between anxiety and depression.[21] Factor analysis of the revised STAI supported its two dimensions, namely state and trait anxiety.

The STAI is a reliable measure of anxiety. Thirty-day test-retest reliability coefficients of trait anxiety for male and female high school students were 0.71 and 0.75, respectively.[21] Sixty-day test-retest reliabilities were slightly lower; 0.68 for males and 0.65 for females. Considering the transient nature of state anxiety, test-retest reliability analysis is not appropriate.

Evidence supports the internal consistency reliability for both state and trait anxiety. For working adults, Cronbach's alpha coefficients for the state anxiety and trait anxiety subscales

were 0.93 and 0.91, respectively.[21] Investigators often use the STAI to measure anxiety in patients with cardiac disease and have reported Cronbach's α coefficients ranging from 0.93 to 0.94.[22-26]

Anxiety Subscale of the Brief Symptom Inventory The BSI was developed from its longer parent instrument, the SCL-90-R®, in response to the need for a shorter, less time-consuming instrument.[16] The SCL-90-R® is a 90-item self-report symptom inventory with nine symptom dimensions. For each dimension of the SCL-90-R®, Derogatis[16] selected the items with the highest loadings and used these items to create the BSI. Composed of 53 items that encompass nine primary symptom dimensions, the BSI was designed to assess psychological symptoms for not only psychiatric and medical patients, but also for other persons.[17] When completing the BSI, individuals are to base their answers on how each problem has affected them during the past 7 days.[16]

The BSI has been used with a variety of populations, both in clinical and research situations. The BSI has been translated into at least 26 languages.

The 6-item subscale for the anxiety dimension includes general symptoms that are commonly associated with high anxiety levels. Physiologic indices, such as heart rate and diaphoresis, are not included in this subscale.

Evidence supporting the validity of the BSI has been reported.[16] Strong evidence of convergent validity was found when comparing the results of the BSI with scores from the clinical and content scales of the Minnesota Multiphasic Personality Inventory.[17] Likewise, the correlation between the anxiety subscales on the BSI and SCL-90-R® was 0.95. The results of factor analysis further contributed to the construct validity of the BSI. Lastly, the BSI has been

shown to have predictive validity for persons with cancer, chronic pain, psychopathology, and other illnesses.

Formal analyses have supported the reliability of the BSI anxiety subscale. Derogatis reported an internal consistency α coefficient of 0.81 for psychiatric outpatients.[16] Similarly, the two-week test-retest coefficient was 0.79 for nonpatients.[16] Investigators have reported Cronbach's α ranging from 0.85 to 0.90 when studying patients with cardiac disease.[4,25,27]

Anxiety Subscale of Hospital Anxiety and Depression Scale The HADS was created to detect anxiety and depression for general medical and surgical outpatients because non-psychiatric hospital departments needed a shorter instrument concerning the nature of psychiatric disorders.[28] The HADS consists of a 7-item anxiety subscale and a 7-item depression subscale. The anxiety subscale items were derived from the Present State Examination and the authors' previous research. Its authors purposefully avoided emphasizing somatic symptoms so that general anxiety and depression could be assessed independently of physiologic symptoms.[28] Respondents select answers based on their feelings during the past week.

Although the HADS was developed for general outpatient departments, it has been used in a variety of inpatient, primary care, community, and research settings. The HADS has been translated into over 20 languages.

Limited validity and reliability data were available when the HADS was first introduced. Initially, positive and significant correlations ($r = 0.54$) between self-report data and formal psychiatric interview data supported construct validity of the HADS.[28] There was also a significant positive relationship ($r = 0.74$) between anxiety severity and psychiatric ratings of anxiety. During instrument development, reliability testing with 100 outpatients supported the internal consistency of the HADS.[28] Furthermore, the authors identified cut-off scores that were

designed to distinguish between cases, doubtful cases, and non-cases (see Table 2). These cut-off scores were applied to data from 50 patients and demonstrated sensitivity and specificity for detecting psychiatric cases.

More recently, investigators have reexamined the validity and reliability of the HADS. In a review paper, Herrmann[29] reported Cronbach's α of 0.80 to 0.93 and retest reliabilities ranging from 0.70 to 0.84 for the anxiety subscale. Others administered the HADS to healthy and ill men and women of wide-ranging ages, reporting Cronbach's α ranging from 0.77 to 0.89 [30-32].

Regarding validity, the HADS usually has acceptable sensitivity and specificity in finding cases of anxiety.[29,33] Convergent validity is supported by medium to strong correlations with existing anxiety instruments such as the STAI.[33]

Newer evidence regarding factorial validity of the HADS is less convincing. Although some investigators[30,34,35] have found evidence supporting the HADS' bifactorial structure of anxiety and depression, results from seven of 19 studies indicated that the HADS has either a three- or four-factor structure.[33] Data from at least three additional studies also have provided evidence for a three-factor HADS structure.[31,36,37] Using confirmatory factor analyses, Johnston and colleagues found that the HADS failed to consistently distinguish between anxiety and depression for patients with AMI and stroke.[32]

Comparison of the Strengths and Weaknesses of Three Existing Self-Report Measures of Anxiety

The STAI, the anxiety subscale of the BSI, and the anxiety subscale of the HADS possess inherent strengths and weaknesses. The STAI measures anxiety from a unidimensional perspective. In contrast, the anxiety subscales of the BSI and the HADS measure additional

emotions such as depression and hostility. Therefore, when clinicians and researchers are interested in exclusively measuring anxiety, they must take care to administer only anxiety items from a multidimensional instrument.

As previously described, there is solid evidence supporting the reliability of the STAI, the anxiety subscale of the BSI, and the anxiety subscale of the HADS. However, factorial validity of the HADS is more questionable as compared to the STAI and anxiety subscale of the BSI.

The STAI, the anxiety subscale of the BSI, and the anxiety subscale of the HADS have been used with numerous populations, including patients with cardiac disease (see Table 3). For international studies, the STAI is valuable because it has been translated into more languages. Nonetheless, the anxiety subscales of the BSI and the HADS are available in numerous languages.

Ideally, clinicians will deliver therapeutic interventions to cardiac patients who are anxious. In these cases, anxiety instruments must be able to measure fluctuations in anxiety intensity over time. The STAI, the anxiety subscale of the BSI, and the anxiety subscale of the HADS have been successfully used to evaluate the effects of an intervention.[16,21,29,36]

Clinicians and researchers rely on normative data to help interpret findings from an anxiety instrument. Normative data are available for the STAI and the anxiety subscale of the BSI but not for the anxiety subscale of the HADS. Although cut-off scores are available for the HADS, its focus is to define cases.

A major weakness of the STAI is its length. Acutely ill and older persons are easily burdened by long instruments and thus may provide incomplete or inaccurate data. Furthermore, clinicians often lack the time needed to administer or score the STAI. From patient and clinician

perspectives, the anxiety subscales of the BSI and the HADS are easy to administer and more time-efficient.

Summary of Measurement of Anxiety

In summary, anxiety is a complex human emotion. There are over 200 instruments that measure the various types and attributes of anxiety. For that reason, it is especially important for clinicians and researchers to understand the empirical evidence regarding these instruments.

An unresolved matter regarding anxiety measurement is the lack of consensus among clinicians and researchers regarding the vague phenomenon termed anxiety. Many researchers omit their conceptual definition of anxiety in research reports (see Table 3). Consequently, it is difficult to assess whether the anxiety instrument that they administered can satisfactorily measure their conceptualization of anxiety. For example, Luskin and colleagues[38] used the STAI to assess whether stress management training reduced anxiety for patients with HF. One would expect interventions to have the greatest impact on state anxiety; however, these investigators reported a single state trait anxiety score.

The measurement of anxiety has been problematic in other ways. First, one surmises that investigators are more interested in state anxiety than trait anxiety for patients with cardiac disease. Yet, various instruments are used to measure anxiety, some of which were not created to measure state anxiety. For example, researchers who use the Profile of Mood States or the anxiety subscale of either the BSI or the HADS sometimes modify the instructions, directing participants to report current feelings rather than feelings during the past week. It is not known whether these altered directions adversely affect the psychometric properties of these instruments. Second, as shown in Table 3, the majority of investigators did not report Cronbach's α coefficients, making it difficult to evaluate the internal consistency of the anxiety

instrument for a specific sample. Finally, as previously alluded to, it is difficult to compare anxiety data for patients with cardiac disease because researchers have not consistently used the same anxiety instruments.

Recommendations for New Directions in Measurement of Anxiety

Although thousands of research studies pertain to anxiety, plenty of unanswered questions remain and thus provide the basis for new directions regarding anxiety measurement. Since the inception of these instruments, much has been learned about anxiety, including its unique attributes, assessment, treatment, and adverse effects. As a result, some have reported that the STAI and the anxiety subscale of the HADS measure concepts such as depression and psychomotor agitation.[31,36,39] Further research is needed to reexamine the factor structure of the STAI and the anxiety subscale of the HADS.

Most anxiety instruments were constructed for use with adults, but not older persons; therefore, limited psychometric data are available for these individuals.[40] Accordingly, it is important that research efforts result in normative data for older adults.

It is well-known that inpatients with cardiac disease are anxious. Yet, results of recent studies reveal that clinicians assess anxiety in an infrequent and inconsistent manner,[23,24] partly because they believe that anxiety instruments are time-consuming,[41,42] clinically irrelevant, and difficult to administer. In addition, rather than using an anxiety instrument, clinicians commonly diagnose anxiety using their clinical judgment.[24] These findings are alarming because investigators have not found a relationship between patient-generated and clinician-generated ratings of patient anxiety.[23,24] Clinicians need data about which anxiety instrument(s) is the most reliable and efficient for cardiac patients.

New research is also needed to ascertain how to best assess anxiety for cardiac patients who cannot complete self-report instruments. In a recent study, nurses reported that they rely on changes in physiologic parameters, such as blood pressure and heart rate, to denote anxiety.[43] Of concern, though, is that physiologic symptoms may not accurately reflect patient anxiety.[44]

Researchers commonly administer a battery of instruments to persons with cardiac disease. For example, respondents may complete instruments that are designed to measure anxiety, depression, quality of life, adherence, and activity status. Future study is needed to determine if the sequence of the questionnaires influences results.[32] Similarly, another issue that deserves more consideration is the frequency with which clinicians should measure anxiety for both inpatients and outpatients. It is possible that some patients may become frustrated with repeated anxiety assessments and thus not report worthy data. In contrast, sporadic assessments may not reveal the true nature of patients' anxiety, placing them at risk for complications. These timing data are critical so that the assessment of anxiety can be integrated into routine and recurring patient assessment processes.

Conclusion

In conclusion, patients with cardiac disease are often anxious. There is no consensus about the conceptual definition of anxiety; yet, many instruments have been designed to measure anxiety. The STAI, the anxiety subscale of the BSI, and the anxiety subscale of the HADS have been used to assess anxiety for patients with cardiac disease. Although these instruments possess several strengths, more study is needed to further advance the measurement of anxiety.

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TABLE 1 Conceptual Definitions of Anxiety

Author	Date	Conceptual Definition of Anxiety
Goldstein[11]	1940	"...the phenomenon of anxiety belongs to the catastrophic condition. That is, anxiety corresponds on the subjective side to a condition in which the organism's existence is in danger. Anxiety is *the subjective experience of that danger to existence.*"[11 p. 91]
Martin and Sroufe[45]	1970	"...a neurophysiological response that has especially strong manifestations in the hypothalamic-sympathetic-adrenal medullary system, and in the hypothalamic-pituitary-adrenal cortical system, and in the reticular systems. Pathological intensity and persistence of anxiety reflects chronic over-reaction in some aspect of these neurophysiological systems."[45 p. 216-217]
Spielberger[19,46]	1966; 1972	a) "State anxiety...refers to an empirical process or reaction which is taking place *now* at a given level of intensity."[46 p. 16] "State anxiety...may be conceptualized as a transitory emotional state or condition of the human organism that varies in intensity and fluctuates over time. This condition is characterized by subjective, consciously perceived feelings of tension and apprehension, and activation of the autonomic nervous system."[19 p. 39] State anxiety is "the subjective feelings of tension, apprehension, nervousness, and worry that are experienced by an individual at a particular moment, and by heightened activity of the autonomic nervous system that accompanies these feelings."[47 p. 5] b) "Trait anxiety...indicates a latent disposition for a reaction of a certain type to occur if it is triggered by appropriate (sufficiently stressful) stimuli."[46 p. 16] "Trait anxiety...refers to relatively stable individual differences in anxiety proneness, that is, to differences in the disposition to perceive a wide range of stimulus situations as dangerous or threatening, and in the tendency to respond to such threats with A-state reactions."[19 p. 39]
McReynolds[48]	1976	a) Primary anxiety: "...anxiety that inevitably occurs under certain limited and prescribed conditions, simply because the organism is made that way..."[48 p. 38] b) Secondary anxiety: "...anxiety which arises through the adventitious association of previously neutral cues with states of primary anxiety."[48 p. 38]
May[12]	1977	"Anxiety is the apprehension cued off by a threat to some value that the individual holds essential to his existence as a personality."[12 p. 205] "Normal anxiety is that reaction which (1) is not disproportionate to the objective threat, (2) does not involve repression or other mechanisms of intrapsychic conflict,...(3) does not require neurotic defense mechanisms for its management. It (4) can be confronted constructively on the level of conscious awareness *or* can be relieved if the objective situation is altered."[12 p. 209] "Neurotic anxiety...is a reaction to threat which is (1) disproportionate

Author	Date	Conceptual Definition of Anxiety
		to the objective danger, (2) involves repression (dissociation) and other forms of intrapsychic conflict, and...(3) is managed by means of various forms of retrenchment of activity and awareness, such as inhibitions, the development of symptoms, and the varied neurotic defense mechanisms."[12 p. 214]
Sims and Snaith[9]	1988	"Anxiety is the emotion of fearful apprehension. Cognitively, it is the emotion associated with the anticipation of an unpleasant event involving either severe discomfort, or loss, or both."[9 p. 4]
Diagnostic Manual of Mental Disorders (DSM-IV)[10]	2000	"The apprehensive anticipation of future danger or misfortune accompanied by a feeling of dysphoria or somatic symptoms of tension."[10 p. 820]
Emilien, Durlach, Lepola, and Dinan[8]	2002	"...a psychophysiological phenomenon experienced as a foreboding dread or threat to a human organism whether the threat is generated by internal, real or imagined dangers."[8 p. 1]

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TABLE 2 Comparison of Three Self-Report Measures of Anxiety

Instrument; Year	Number of Items	Response Options for Each Item	Scoring and Range	Time Required to Complete	Grade Level	Normative Values
State-Trait Anxiety Inventory; 1970 (Form X) with revision in 1983 (Form Y)	State anxiety subscale = 20 Trait anxiety subscale = 20	1 (not at all) to 4 (very much so)	Responses for the items are summed; scores for each subscale range from 20-80	10-20 minutes	6	State anxiety Working adults aged 50-69 Males: 34.51 ± 10.34 Females: 32.20 ± 8.67 Neuropsychiatric patients: 47.74 ± 13.24* Medical-surgical patients: 42.38 ± 13.79* Trait anxiety Working adults aged 50-69 Males: 33.86 ± 8.86 Females: 31.79 ± 7.78 Neuropsychiatric patients: 46.62 ± 12.41* Medical-surgical patients: 41.91 ± 12.70*
Anxiety Subscale of the Brief Symptom Inventory; 1975	Anxiety subscale = 6	0 (not at all) to 4 (extremely)	Responses for the items are summed and averaged; scores range from 0 to 4	2-5 minutes	6	Healthy adults: 0.35 ± 0.45 Psychiatric outpatients: 1.70 ± 1.00 Psychiatric inpatients: 1.70 ± 1.15
Anxiety Subscale of the Hospital Anxiety and Depression Scale; 1983	Anxiety subscale = 7	0 to 3 (response options vary)	Responses for the items are summed; scores range from 0-21	3-4 min	NR	Normative values are not available. Cutoff scores: 0-7 = non-cases, 8-10 = doubtful cases, 11-21 = definite cases

* Based on State-Trait Anxiety Inventory, Form X
NR = Not reported

TABLE 3 Summary of Anxiety Research for Patients with Cardiac Disease

Author/Date	Major Purpose of Study Regarding Anxiety	Sample	Authors' Conceptual Definition of Anxiety	Anxiety Instrument with Cronbach's α (if reported)	Major Findings Related to Anxiety
Thompson et al., 1987[49]	Describe the pattern of anxiety during the first year after AMI; identify sources of anxiety	76 male inpatients with AMI	Not defined	State-Trait Anxiety Inventory; seven-point anxiety rating scale that the authors created to assess seven AMI-specific sources of anxiety, Cronbach's α = 0.76	Trait anxiety was lower 1 year after AMI than 24 hours, 5 days, or 6 weeks post-AMI; state anxiety and anxiety rating scale scores were highest one day after admission and lowest 1 year post AMI but were higher 6 weeks post-discharge than 5 days post-admission; sources of anxiety included the AMI itself, return to work, the future, potential complications, and leisure activities
Sykes et al., 1989[50]	Assess how the timing of discharge from the CCU affects anxiety for patients with AMI	569 inpatients with AMI; based on illness severity, patients were assigned to either a good or poor prognosis group; next, patients were randomly assigned to either an early or late discharge from the CCU	"...an emotional reaction to the trauma which in its extreme form may have a disorganizing effect on behaviour, inhibiting recovery and the adaptive process" (p. 477). Also summarized Spielberger's definitions of state and trait anxiety (see Table 1).	State-Trait Anxiety Inventory	Women had higher levels of trait and state anxiety than men; when patients with a poor prognosis were discharged early, their anxiety levels increased post-discharge; patients with a poor prognosis who did not survive 3 months reported lower initial state anxiety levels than survivors; for patients with a good prognosis, day 6 and 3 month state anxiety scores were higher for those who had not returned to a normal way of life 3 months post-AMI
Buchanan et al.,	Describe HRV	21 inpatient men	Briefly differentiated	State-Trait	State anxiety was elevated the first

Author/Date	Major Purpose of Study Regarding Anxiety	Sample	Authors' Conceptual Definition of Anxiety	Anxiety Instrument with Cronbach's α (if reported)	Major Findings Related to Anxiety
1993[51]	and psychological emotions after AMI	with AMI	between state and trait anxiety when describing the State-Trait Anxiety Inventory	Anxiety Inventory	4 days post-AMI but did not correlate significantly with HRV; state anxiety scores were lower 6 months after AMI; trait anxiety levels did not vary by time
Rose et al., 1994[52]	Study the relationship between trait and state anxiety for patients with AMI	62 inpatients with AMI	"Anxiety is a common response found among hospitalized MI survivors[a]…and may affect both hospital and post-discharge experiences among these persons…"[b]	State-Trait Anxiety Inventory	Older patients had lower state anxiety than younger patients; state and trait anxiety scores did not differ by gender; patients with higher state anxiety were more likely to smoke 3 months post-AMI
Crowe et al., 1996[13]	Investigate numerous aspects of anxiety and depression for patients with AMI	785 inpatients with AMI	"…feeling of fear, tension, or panic or an expectancy that something unpleasant is going to happen and is almost invariably accompanied by physical signs and symptoms."[c]	State-Trait Anxiety Inventory	69% of patients were anxious; compared with psychiatric patients, 10% had higher state anxiety scores and 14% had higher trait anxiety scores; state and trait anxiety levels remained elevated during the year after AMI
Thomas et al., 1997[1]	Assess the effects of psychosocial variables on survival for patients with AMI who developed	348 patients with AMI and ventricular dysrhythmias; of these, 308 received a nonactive medication	Briefly differentiated between state and trait anxiety when describing the State-Trait Anxiety Inventory	State-Trait Anxiety Inventory	In a logistic regression model, high state anxiety independently predicted survival even after controlling for the effects of physiological variables

Author/Date	Major Purpose of Study Regarding Anxiety	Sample	Authors' Conceptual Definition of Anxiety	Anxiety Instrument with Cronbach's α (if reported)	Major Findings Related to Anxiety
	ventricular dysrhythmias				
Lane et al., 2001[2]	Evaluate the effect of anxiety on mortality and QOL for patients with AMI	288 inpatients with AMI	Not defined	State-Trait Anxiety Inventory	State and trait anxiety neither predicted cardiac nor all-cause 12-month mortality after AMI; in a multiple regression model, state anxiety predicted 12-month QOL
Luskin et al., 2002[38]	Investigate the effect of stress management training on QOL, physical function, and HRV for patients with HF	Treatment group = 16 outpatients with HF; control group = 17 outpatients with HF	Briefly differentiated between state and trait anxiety when describing the State-Trait Anxiety Inventory	State-Trait Anxiety Inventory	Patients in the treatment group had lower anxiety 1-2 weeks post-training; however, the decrease was not statistically significant
An et al., 2004[26]	Explore the evolution of anxiety early after AMI; assess for gender differences in anxiety early after AMI	486 inpatients with AMI	"…a feeling of fear, tension, panic or the expectancy that something unpleasant is going to happen."[d]	State-Trait Anxiety Inventory, Cronbach's α = 0.94	Patients were most anxious during the first 12 hours after AMI; in general, women reported higher anxiety than men
Frasure-Smith et al., 1995[3]	Examine whether psychological variables predict future cardiac	222 inpatients with AMI	Not defined	State portion of the State-Trait Anxiety Inventory	In a multivariate model containing physiologic and psychologic factors, high anxiety and the prescription of ACE inhibitors at discharge were the only significant

Author/Date	Major Purpose of Study Regarding Anxiety	Sample	Authors' Conceptual Definition of Anxiety	Anxiety Instrument with Cronbach's α (if reported)	Major Findings Related to Anxiety
	events for patients with AMI				independent predictors of recurrent cardiac events during the first year after AMI; although the model contained depression, it was not an independent predictor
O'Brien et al., 2001[24]	Measure how frequently clinicians assess patients for anxiety; compare patient-generated ratings with clinician-generated ratings of state anxiety for patients with AMI	101 inpatients with AMI	"...a natural response to the threats associated with AMI..." (p. 97).	State portion of the State-Trait Anxiety Inventory, Cronbach's α = 0.94	45% of patient medical records contained an anxiety assessment; there was no relationship between patient-generated and clinician-generated ratings of patient anxiety
Frazier et al., 2002[23]	Describe how anxiety is managed and examine the relationship among patient reported anxiety, clinician anxiety assessment, and subsequent treatment of anxiety for patients with	101 inpatients with AMI	"Anxiety, the psychological and physiological responses of an individual to a perceived threat, usually generates feelings of apprehension, dread, or uneasiness."[d]	State portion of the State-Trait Anxiety Inventory, Cronbach's α = 0.94	47% of patients reported moderate to severe anxiety; clinicians assessed anxiety for 45% of patients; there was no relationship between clinician-generated and patient-generated anxiety ratings; patients with higher anxiety received significantly more anxiolytic medications; there was no relationship between clinician-generated anxiety ratings and treatment of anxiety

Author/Date	Major Purpose of Study Regarding Anxiety	Sample	Authors' Conceptual Definition of Anxiety	Anxiety Instrument with Cronbach's α (if reported)	Major Findings Related to Anxiety
	AMI				
Watkins et al., 2002[53]	Assess the relationship between anxiety and baroreflex sensitivity for patients with AMI	204 inpatients with AMI	Not defined	State portion of the State-Trait Anxiety Inventory	The addition of state anxiety scores to physiologic variables significantly improved ability of a multiple regression model to predict lower baroreflex sensitivity; more patients with high anxiety had a history of cardiac dysrhythmias
Frasure-Smith & Lesperance, 2003[22]	Assess the importance of psychological variables as long-term prognostic indicators for patients with AMI	896 inpatients with AMI	Not defined	State portion of the State-Trait Anxiety Inventory, Cronbach's α = 0.93; Modified Somatic Perception Questionnaire, Cronbach's α = 0.81	High state anxiety predicted 5-year cardiac mortality but did not remain significant when adjusting for cardiac disease severity
Welin et al., 2000[54]	Assess the relationship between psychosocial variables and 10-year prognosis for patients with AMI	275 outpatients with recent AMI	Not defined	Trait portion of the State-Trait Anxiety Inventory	Neither all-cause mortality nor prognosis were associated with anxiety
Moser & Dracup, 1996[4]	Examine the relationship	86 inpatients with AMI	"Anxiety is one of the earliest and most	Anxiety subscale of the	Patients with high anxiety were 4.9 times more likely to

Author/Date	Major Purpose of Study Regarding Anxiety	Sample	Authors' Conceptual Definition of Anxiety	Anxiety Instrument with Cronbach's α (if reported)	Major Findings Related to Anxiety
	between anxiety and in-hospital complications for patients with AMI		intense psychological responses to AMI."[e]	Brief Symptom Inventory, Cronbach's α = 0.85	experience ischemia, reinfarction, and ventricular fibrillation than patients with low anxiety; in a multiple regression model, anxiety independently predicted complications
Kim et al., 2000[25]	Assess gender differences in anxiety for patients with AMI	424 inpatients with AMI	"State anxiety is characterized by current feelings of tension, apprehension, nervousness, and worry and by activation of the autonomic nervous system."[d]	Anxiety subscale of the Brief Symptom Inventory, Cronbach's α = 0.87; state portion of the State-Trait Anxiety Inventory, Cronbach's α = 0.94	Women were more anxious than men; single men were more anxious than married or widowed men; married women were more anxious than single or widowed women; women with lower income were more anxious than women with higher income
Moser et al., 2003[27]	Assess gender differences in anxiety for patients with AMI from five countries	912 inpatients with AMI from five countries	"Anxiety is defined as the emotional response to 'anticipation of threats to safety or integrity of body or self.'"[f]	Anxiety subscale of the Brief Symptom Inventory, Cronbach's α = 0.85-0.90 among the five countries	Women in each country had higher anxiety than men; anxiety did not differ by country; patients less than 60 years old were more anxious than patients greater than 60 years old
De Jong et al., in press[55]	Explore whether anxiety post-AMI differs across five	912 inpatients with AMI from 5 countries	"...psychophysiological phenomenon experienced as a foreboding dread or	Anxiety subscale of the Brief Symptom Inventory,	Patients from all countries reported higher anxiety than the normal reference mean; after controlling for sociodemographic

Author/Date	Major Purpose of Study Regarding Anxiety	Sample	Authors' Conceptual Definition of Anxiety	Anxiety Instrument with Cronbach's α (if reported)	Major Findings Related to Anxiety
	countries		threat to a human organism whether the threat is generated by internal, real or imagined dangers."[g]	Cronbach's α = 0.85-0.90 among the five countries	variables, anxiety levels did not differ significantly by country
Chiou et al., 1997[56]	Describe anxiety, depression, and coping styles of Taiwanese patients with AMI	40 inpatients with AMI	Not defined	Hospital Anxiety and Depression Scale, Cronbach's α = 0.91 for anxiety subscale	25% of patients had high levels of anxiety; positive and significant correlations were found between anxiety and social class and between anxiety and perceived severity of AMI
Mayou et al., 2000[5]	Evaluate the impact of emotional distress as a predictor of outcomes for patients with AMI	344 inpatients with rule-in or possible AMI	Not defined	Hospital Anxiety and Depression Scale	18.5% of patients were identified as probable cases of anxiety; anxiety levels decreased by 3 months post-AMI but remained steady 12 months post-AMI; anxiety predicted worse QOL and higher use of primary care and surgical health resources at 3 and 12 months post-AMI
Herrmann-Lingen, et al., 2003[57]	Evaluate the relationship between pro-ANP and anxiety for patients with HF	46 patients with HF; 73 individuals with cardiovascular risk factors (controls)	Not defined	Hospital Anxiety and Depression Scale	Anxiety and pro-ANP were significantly and negatively correlated for patients with HF, but not for controls; for all patients, vital exhaustion, age, depression, and pro-ANP levels were multivariate predictors of anxiety
Dellipiani et al.,	Describe anxiety	Group A = 203	Not defined	Cattell 8-	For group A, anxiety was first

Author/Date	Major Purpose of Study Regarding Anxiety	Sample	Authors' Conceptual Definition of Anxiety	Anxiety Instrument with Cronbach's α (if reported)	Major Findings Related to Anxiety
1976[58]	after AMI and relate it to treatment regimens	inpatients with AMI or myocardial ischemia; Group B = 83 patients with definite, possible, or ruled out AMI who were treated either at home or in the hospital		Parallel-Form Anxiety Battery	measured after transfer from CCU and was highest immediately after transfer; anxiety levels decreased over the following week but rose when hospital discharge was imminent; anxiety levels 4 months post-discharge were lower than normal; patients in group B reported a similar pattern in anxiety, but were more anxious
Moser & Dracup, 1995[59]	Assess the relationship between perceived control and psychosocial recovery for patients with AMI, CABG, or both	176 outpatients with recent AMI, CABG, or both	Not defined	Multiple Affect Adjective Checklist	Patients with low levels of perceived control were more anxious than patients with high levels of perceived control
Dracup et al., 2003[60]	Evaluate whether perceived control reduces emotional distress, such as anxiety, in patients with HF	222 outpatients with HF	Not defined	Multiple Affect Adjective Checklist	Patients with high levels of perceived control were less anxious than those with low levels of perceived control.

Author/Date	Major Purpose of Study Regarding Anxiety	Sample	Authors' Conceptual Definition of Anxiety	Anxiety Instrument with Cronbach's α (if reported)	Major Findings Related to Anxiety
Kohn et al., 1983[6]	Examine the relationship between stress and norepinephrine for patients with AMI and healthy participants	21 patients with history of AMI; 27 healthy individuals (controls)	Not defined	Affect Adjective Checklist for anxiety	Anxiety was moderately and positively correlated with norepinephrine levels for patients with AMI; for both groups, anxiety was significantly and positively correlated with depression, stress at home, duration of stress, and duration of stress accompanying major life changes occurring within the previous 3 years
Havik & Maeland, 1990[61]	Describe the pattern of emotions in the 5 years after AMI	283 inpatients with AMI	Not defined	Semantic differential type of questionnaire, Cronbach's α = 0.80-0.90 among the testing times	Anxiety levels were stable during hospitalization; 1-2 weeks post-discharge, anxiety levels were significantly higher and remained so for the subsequent 3-5 years; six patterns of long-term emotional reactions were identified
Conn et al., 1991[62]	Examine whether there are gender and age differences in psychosocial condition, health state, and adherence for patients with AMI	197 outpatients with a history of AMI	"…heightened musculoskeletal tension, including somatic tension, which may not be overtly observable, as well as observable psychomotor manifestations" (p. 1028).	Profile of Mood States	No association between age and anxiety was found; women were more anxious men*
Riegel &	Compare	64 outpatients	Not defined	Profile of Mood	Men and women were more

Author/Date	Major Purpose of Study Regarding Anxiety	Sample	Authors' Conceptual Definition of Anxiety	Anxiety Instrument with Cronbach's α (if reported)	Major Findings Related to Anxiety
Gocka, 1995[63]	psychosocial adjustment for men and women with AMI	with recent AMI		States, Cronbach's α = 0.97	anxious 1 month post-AMI than 4 months after AMI
Oldridge et al., 1995[64]	Assess the efficacy of an 8 week cardiac rehabilitation program for patients with AMI who were anxious and/or depressed before discharge	Rehabilitation group = 93 patients; usual care group = 94 patients	Not defined	Profile of Mood States	Upon completing cardiac rehabilitation, patients in the rehabilitation group whose initial anxiety scores were higher than the mean had lower anxiety scores than the usual care patients; 12 months after AMI, both groups of patients reported similar and significant improvements in anxiety
Riedinger et al., 2002[65]	Compare aspects of QOL, including emotional distress, in women with HF with that of a normative group and with groups of women with other chronic diseases	691 women with HF	Not defined	Anxiety subscale of Profile of Mood States, Cronbach's α > 0.70	Women with HF had higher anxiety than a normative group of women, geriatric women and women with either HTN or cancer; women with recent AMI and patients with COPD had higher anxiety than women with HF
Uuskula, 1996[66]	Assess psychological differences between young	64 inpatients with AMI	Not defined	Present Affect Reactions Questionnaire	Women had higher state anxiety than men during the first week after AMI

Author/Date	Major Purpose of Study Regarding Anxiety	Sample	Authors' Conceptual Definition of Anxiety	Anxiety Instrument with Cronbach's α (if reported)	Major Findings Related to Anxiety
	men and women after AMI				
Winefield & Martin, 1981[67]	Identify variables that predict recovery after AMI	28 inpatient men with AMI	Not defined	The S-R Inventory of General Trait Anxiousness	High in-hospital trait anxiety and manual occupation predicted poor recovery; anxiety predicted rehospitalization for cardiac indications

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*Data from table but conflicts with the text

AMI = acute myocardial infarction; CABG = coronary artery bypass grafting; CCU = coronary care unit; COPD = chronic obstructive pulmonary disease; HF = heart failure; HRV = heart rate variability; HTN = hypertension; pro-ANP = atrial natriuretic pro-peptide; QOL = quality of life