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Changes in anxiety and depression over 2 years in medically stable patients following myocardial infarction and their spouses in the Home Automatic External Defibrillator Trial (HAT): A Longitudinal Observational Study

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Abstract

Objective—To compare the long term effects of CPR training and CPR/AED training on anxiety and depression of patients who were medically stable following myocardial infarction (MI) and their spouses/companions.

Design—Longitudinal

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Contributors: SAT and EF conceptualized, designed and conducted the study. EF and HJL completed the data analysis, HS completed the figures and tables all authors contributed to writing and editing the final manuscript. The HAT investigators designed and conducted the HAT study and provided the infrastructure for this research. The comments of the HAT executive committee were incorporated into the manuscript.

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Participants—Post-MI patients (N=460) and their spouses/companions from the Home Automatic External Defibrillator Trial

Main Outcome Measures—Depression (Beck Depression Inventory-II scores) and anxiety (State –Trait Anxiety Inventory scores)

Results—At study entry, 25% of the patients and 15% of their spouses were depressed and 21% of the patients and 19% of the spouses were anxious. The frequency of depression and anxiety did not change over time in the patients or their spouses. Average depression and anxiety decreased for patients but not for spouses. Intervention group did not contribute significantly to these changes. Psychological distress, indicated by depression or anxiety of the spouse or the patient, occurred in 191 couples. Among psychologically distressed patients (N=128), depression and anxiety decreased over time; intervention group did not contribute to these changes. The reduction in anxiety among male patients was greater than in female patients ($p = .012$, 95% CI .002, .018). Among psychologically distressed spouses (N=118), depression decreased over time independent of the intervention. Changes in spouse anxiety depended on the intervention group ($p = .012$, 95% CI, .001, .012); anxiety decreased significantly in the CPR and remained high in the CPR/AED group.

Conclusion—There was no evidence that home AEDs caused psychological distress among patients. Even among those who were psychologically distressed when they were assigned to receive either CPR training or CPR/AEDs, home AEDs did not influence changes in patients' depression or anxiety or spouses depression when compared with CPR training. Among psychologically distressed spouses, AEDs may keep anxiety higher than it would be otherwise. Interventions to reduce anxiety of spouses who are psychologically distressed may be indicated when their partners receive an AED.

Out-of-hospital sudden cardiac arrest (SCA) is a major contributor to cardiac mortality ¹. Approximately 166,000 patients die of out of hospital SCA each year in the United States and current efforts to reduce this mortality with standard cardiopulmonary resuscitation (CPR) training have had negligible effect ^{2,3}. Earlier reports indicated that 80% of cardiac arrests occur in the home ⁴ and 80% of them are witnessed ^{5,6} although the Home AED Trial ² suggested these rates may be much lower. Resuscitation attempts must begin within minutes of the arrest if they are to prove successful ^{7,8}. The key to survival for most SCA victims is rapid defibrillation when the person is in ventricular fibrillation (VF) ⁹⁻¹¹. Only 2% of those who suffer out-of-hospital SCA survive to hospital discharge ^{4,12,13}. When patients who experience SCA are defibrillated and converted from VF, survival increases to 30% ¹⁰.

Technology is available to permit home defibrillation by lay users. Current automatic external defibrillators (AEDs) are programmed to interpret cardiac rhythms and require only the push of a button from the user to deliver a shock after a voice prompt from the device. The combination of low cost and easy use by a lay person makes home AED therapy feasible and potentially of great value to public health ¹⁴. The two studies that examined patients' and families' psychological responses to CPR training showed increased anxiety and depression in family members. ^{15,16}

Family members trained to use AEDs experienced decreased anxiety and increased confidence ¹⁷ but a more recent study showed that quality of life, anxiety, and depression did not change after AED training ¹⁸. Two qualitative studies of patients and their relatives noted only positive effects of the presence of home AEDs ^{19,20}. Training to use an AED may have different effects on anxiety and depression of patients and family members than CPR training. The potential for increased psychological distress in patients whose family members are taught to respond to SCA is important as expanding evidence documents a link of depression ²¹⁻²⁴ and anxiety ^{21,23,25} to SCA in patients following myocardial infarction

(MI). Strong evidence supports psychological distress as a risk factor for the development of coronary heart disease and prognosis among patients with coronary heart disease²⁶.

As very little is known about the long-term psychological response of patients or spouses to CPR/AED training, the current study's primary objective was to compare depression and anxiety of post MI patients and spouses who received either CPR training only with the responses of those who received CPR/AED training during follow-up of two years. We hypothesized that 1) patients and spouses will experience changes in anxiety and depression from before to after intervention; 2) there will be differences in long term changes in anxiety and depression between patients who received CPR and CPR/AED interventions and between spouses who received CPR and CPR/AED interventions.; and 3) that age, gender and heart failure moderate these changes.

Depressive and anxious symptoms frequently co-exist.^{27;28} The diagnosis of general anxiety disorder is not assigned if it occurs within major depressive disorder in the current Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR). The hierarchical rule was intended to prevent multiple overlapping diagnoses, but may have inadvertently reduced information about the incidence anxiety.²⁹ Depression and anxiety may be components of a broader category of diagnostic distress disorders.^{27;28;30} Our secondary objective was to evaluate changes in depression and anxiety experienced by those who were psychologically distressed at baseline.

METHODS

Recruitment

Patients and their spouses/companions (spouses) who were enrolling in the NHLBI sponsored international Home Automated External Defibrillator Trial (HAT) at 30 sites in Australia (12), Canada (5), New Zealand (2), and the United States (11) were invited to participate in the Psychosocial Responses in HAT (PR-HAT). Human subjects ethics approval was obtained at each participating institution. HAT was designed to test whether an AED in the home of stable post-MI patients improved survival. The HAT study recruited patient-spouse pairs from January 2003 to October 2005. Participants were randomized to CPR training or CPR/AED intervention groups. PRHAT started after HAT, began recruitment in October 2003, and concluded recruitment simultaneously with HAT. Each PR-HAT participant signed a separate informed consent at enrollment.

For inclusion in HAT a spouse or companion living in the household was required to be physically capable of and willing to learn and use CPR and an AED. In addition to the HAT inclusion criteria, the patients and the spouses in PR-HAT were required to demonstrate a lack of significant cognitive impairment by scoring 17 or above on the Adult Lifestyles and Function Interview – Mini Mental State Examination (ALFI-MMSE). Availability of an AED in the home prior to the study or the patient having an implanted cardioverter defibrillator or a “do not attempt resuscitation” order excluded patients from HAT. These conditions would contaminate the randomization or bias the intent to treat analysis of the relative effectiveness of CPR vs CPR/AED for improving survival, the main objective of the HAT trial. Couples were also excluded from PR-HAT if they had been included in another (quality of life) substudy of HAT due to concerns about participant burden^{2;31}. Complete HAT inclusion and exclusion criteria and recruitment methods have been published previously^{2;31}. A prior power analysis indicated that a sample of 400 couples would provide power between .8 and .99 with alpha .05 and a medium effect size (.2 to .3 SD units) to test all PR-HAT hypotheses. Participant recruitment was based on the goal of obtaining 440 couples. Participants were recruited from 30 sites until this target was achieved.

The HAT trial forms included questions about current anti-depressant medication. Only 33 patients reported taking antidepressant medication. Of the 33 patients who were taking antidepressants, 11 were depressed at study intake. Patients taking antidepressant medication tended to be younger [$t(395) = 1.89, p = .06; 57.5 \pm 2.07$ years] than those who were not ($60.9 \pm .5$ years). Initial neurological assessments also included assessment for depression. This assessment identified 48 of the 460 patients as depressed, 23 of those who were depressed were taking anti-depressant medication.

Data Collection

Demographic, medical history, medication and cardiac data in patients enrolled in PR-HAT are shown in Table 1. The characteristics of those enrolled who were assigned to the two HAT treatment groups are included in Table 2. Both patients and spouses completed questionnaires to assess psychosocial status including depression and anxiety at baseline and following 1 month, and 1 and 2 years of follow-up. The one month assessment was designed to capture the immediate effect of the training on depression and anxiety. The 12 and 24 month follow ups were designed to minimize participant burden, obtain a 2 year end point, and coordinated with the follow-up schedule of the HAT trial.

Instruments

The Beck Depression Inventory-2 (BDI-II) was used to assess depressive symptoms. The BDI-II consists of 21 items rated on a Likert (0-3) scale. Total BDI-II scores range from 0 to 63 with higher scores indicating increased depressive symptoms. The reliability and validity of the BDI is well established³². Internal consistency of the scale is high, 0.86 to 0.88 among psychiatric patients and 0.81 in non-psychiatric patients³³. There is ample evidence of construct and concurrent validity.³² Depression severity was categorized according to the BDI-II manual³³ as absent (0-12), mild (13-19), moderate (20-28) or severe (>29). Although the BDI-II measures the severity of depressive symptoms, a clinician-guided interview is required to make a diagnosis of clinical depression. Thus the outcome measure indicates depressive symptom severity but not major depressive disorder³⁴.

Spielberger's State Trait Anxiety Inventory (STAI) was used to assess anxiety³⁵. The state scale contains 20 items. Internal consistency reliability and concurrent validity are well established³⁵. Anxiety scores range from 20 (none) to 80 (extreme). Individuals with scores above 40 are classified as anxious.^{35;36} Thus the anxiety outcome measure indicates the severity of anxiety, although the diagnosis of general anxiety disorder requires clinician interview.

Psychological distress was identified using anxiety and depression scores. Those patients and spouses whose initial assessment scores were in the depressed range on the BDI-II (13 or above)³³ and/or whose state anxiety scores were in the anxious range (40 and above)³⁵ were categorized as psychologically distressed^{27;28}. Recent publications by Frasure-Smith et al. provide clinical evidence of worse outcomes in psychologically distressed post-MI patients and stable coronary artery disease patients when differentiating distressed patients using similar depression and anxiety criteria.^{28;37}

The ALFI-MMSE 26 item version of the mini mental status examination was used to establish eligibility of patients and their spouses by assessing cognitive status during screening.^{38;39} It is the most widely used tool to evaluate cognitive status.⁴⁰ Validity of the ALFI-MMSE had been established with high correlation with the MMSE^{38;39}. The MMSE is well validated for clinical practice and research in adults.⁴⁰⁻⁴². Scores below 17 on the ALFI-MMSE indicate cognitive impairment^{38;39}.

Statistical Analysis

Descriptive statistics including z-tests for skew and kurtosis were utilized to examine the normality of the continuous outcomes prior to multivariate analyses. The skewed distribution of depression necessitated square root transformations and of anxiety necessitated log transformations, to generate normal distributions. The transformed variables were used for parametric statistical analysis.

The randomness of missing data for each dependent variable was examined. Both logistic regression and pattern-mixture models were used.⁴³ Baseline anxiety and depression scale scores did not predict whether anxiety or depression would be missing at subsequent assessments; one month scores did not predict missing data at 12 or 24 months. Baseline values also did not predict patterns of missing data. There was no evidence that depression or anxiety data were missing systematically.

Descriptive statistics were used to evaluate the frequency and severity of depression and anxiety in the entire sample of patients and spouses and separately in those who were psychologically distressed. Chi square tests were used to examine differences in frequency of depression and anxiety between the interventions at each time period and among time periods within each intervention group.

Longitudinal analysis with linear mixed models was conducted on all participants and on psychologically distressed individuals. Linear mixed models have the advantage of allowing cases with variable numbers of assessments to be included in the analysis and thus do not require replacement of missing data.⁴⁴ Separate models were used to examine longitudinal changes in patients' and spouses' anxiety and depression and to explore the potential effects of intervention assignment (CPR or CPR/AED), age, and gender on these changes. Each series of models began with only unconditional means and unconditional growth models. Unconditional means models use only the participant's ID to predict each outcome variable and are used to evaluate the improvement in prediction that occurs when other predictors are added. Unconditional growth models are used to examine the contribution of time to prediction of the outcome variable without other predictors except participant's ID. Both random intercept and random slope/random intercept models with several correlation structures were examined.⁴⁴ Random intercept models were superior based on model fit statistics. Thus random intercept models were used for all analyses.

RESULTS

Subjects

A total of 460 couples participated in the study, 219 who received CPR training only (CPR only) and 241 who received CPR training plus an AED (CPR/AED). Figure 1 includes a consort diagram of the PRHAT study within the context of HAT. Summaries of the demographics, health status, and initial psychosocial status of the patients and their spouses are shown in Tables 1 to 3. Patients' ages ranged from 31 to 84 years and they were largely male (85.2%). All patients had experienced an MI, approximately half had a history of hypertension, few were diabetic, and an overwhelming majority had no clinical features of heart failure. A large proportion of the patients had either percutaneous coronary revascularization and/or coronary bypass grafting. All patients were receiving standard cardiac medications known to improve outcomes following MI and fewer than 10% were taking antidepressant medications. Almost all (90%) of the spouses/companions were spouses, thus the term spouses will be used for this group. Their ages ranged from 18 to 82 years and they were largely female (85.9%).

Demographic and health characteristics of patients who were enrolled in PR-HAT were compared with those of the HAT participants who were not enrolled in PR-HAT (see Table 1). Patients enrolled in PR-HAT were younger, more likely to be white, and healthier than HAT participants not enrolled in PR-HAT. PR-HAT participants were more likely to be employed, less likely to be diabetic, less likely less likely to have NYHA class II (compared with class I) HF, less likely to have had percutaneous transluminal coronary angioplasty, and more likely to take aspirin than those HAT participants who were not enrolled in PR-HAT.

Of those who enrolled in PR-HAT, 453 patients and 453 spouses completed the initial assessment; 414 and 413 completed 1 month, 380 and 379 completed 1 year, and 279 and 271 completed 2 year assessments. Twenty nine couples were dropped from the study because the spouse was no longer available to participate in the study ($n = 12$) or the patient died ($n=17$) during the two year follow-up period.

Measures of Psychosocial Distress

At study entry 25% of all patients enrolled in PR-HAT were depressed and 21% were anxious. After two year follow up, 16% were depressed and 19% were anxious (see Figure 2). Among spouses 15% were depressed and 19% were anxious at baseline and after. At two year follow up, 13% were depressed and 21% were anxious (see Figure 3). Chi square analysis indicated that the frequency of depression and anxiety did not differ significantly between CPR and CPR/AED intervention groups at any assessment for patients or spouses (See Table 4). The frequency of depression and anxiety in patients did not differ according to the time of assessment in either the CPR [depression: χ^2 (3 df) = 4.7, $p = .195$; anxiety: χ^2 (3 df) = .820, $p = .845$] or CPR/AED [depression: χ^2 (3 df) = 2.40, $p = .493$, anxiety: χ^2 (3 df) = .079, $p = .994$] intervention group. Similarly, the frequency of depression and anxiety in spouses did not differ among the assessment times in either group; CPR [depression: χ^2 (3 df) = 1.437, $p = .697$; anxiety: χ^2 (3 df) = 2.81, $p = .421$] or CPR/AED [depression: χ^2 (3df) = .854, $p = .837$, anxiety: χ^2 (3 df) = .854, $p = .837$, .590].

Linear mixed models were used to examine changes in patients' and spouses' average depression and anxiety scores over time and whether availability of an AED impacted on these changes. Several models were used to examine the contributions of months after initial assessment (time), intervention group, gender, age and NYHA class to patients' depression and/or anxiety and to changes in their depression and anxiety. The unconditional growth models for depression [χ^2 (1 df) = 5.93, $p < .01$] and anxiety were associated with significant improvements [χ^2 (1 df) = 12.04, $p < .01$] over the unconditional means models. In the unconditional growth models, time made a significant contribution to patients' depression ($t = -2.393$, $p = .017$), explaining 5.3% of the variability in depression and to patients' anxiety ($t = -2.223$, $p = .027$) explaining 5.5% of the variability in STAI. Average depression and anxiety scores of the patients decreased over the 2 year follow up period. For example, a patient with an initial BDI-II score of 10 had a BDI-II score of 9.3 at 2 years; a patient with an initial state anxiety score of 40 had a state anxiety score of 28.6 at 2 years. The addition of intervention type and the interaction of intervention group with time did not improve prediction.

The contributions of gender, age, and NYHA class to the changes in depression and anxiety experienced by the patients were examined using linear mixed models. No model that included the interaction of these variables with time or the interaction of time and intervention group improved the prediction. Depression did differ according to age ($t = -1.97$, $p = .05$). The younger the patients, the higher their depression scores. There was no evidence that gender, age, or NYHA class influenced the improvement in depression or anxiety the patients experienced over the two years of follow-up.

Similar models were used to examine the contributions of months after initial assessment (time), intervention group, gender, and age to spouses' depression and/or anxiety and to changes in their depression and anxiety. Time did not make a significant contribution to spouses' depression ($t = -.298, p = .766$) or anxiety ($t = -.273, p = .785$). The unconditional growth models did not add significantly to the explanation of variance in the unconditional means models for depression [$\chi^2 (1 \text{ df}) = 3.28, p > .10$] or anxiety [$\chi^2 (1 \text{ df}) = 1.60, p > .10$]. Spouses' depression and anxiety did not change significantly over the 2 years of the study. There was no evidence that intervention group, gender, or age influenced changes in spouses' depression or anxiety during follow-up.

Psychologically Distressed Patients and Spouses

Individuals who are psychologically distressed are at increased risk for cardiovascular morbidity and mortality²⁶. To examine only the psychologically vulnerable patients and spouses, those who experienced depression and/or anxiety at initial assessment were identified and changes in their depression and anxiety were examined.

Psychological distress was present at baseline in 128 patients (62 in the CPR and 66 in the CPR/AED group) and 118 spouses (59 in each intervention group). Comparisons of the CPR and CPR/AED groups with chi squares at each assessment time among the 128 psychologically distressed patients revealed no differences in frequency of depression between the intervention groups at any assessment time (see Table 4). Frequency of depression and anxiety differed across time periods in each intervention group [depression CPR: $\chi^2 (3 \text{ df}) = 11.01, p = .012$; CPR/AED: $\chi^2 (3 \text{ df}) = 14.87, p = .002$; anxiety CPR: $\chi^2 (3 \text{ df}) = 14.79, p = .002$; CPR/AED: $\chi^2 (3 \text{ df}) = 12.89, p = .005$]. In both intervention groups, depression and anxiety were significantly more common among patients at the initial assessment than at subsequent assessments (see Figure 4).

Chi square analyses indicated that among psychologically distressed spouses, neither frequency of depression nor frequency of anxiety differed significantly between the CPR and the CPR/AED intervention groups at any assessment time (see Table 4). Depression tended to be more frequent at one month in the spouses who received AED training than in those who received CPR training only. Anxiety tended to be more frequent in spouses who received AED training at the one and two year assessments. The frequency of depression and anxiety differed significantly according to assessment time for spouses in the CPR group [depression: $\chi^2 (3 \text{ df}) = 12.46, p = .006$; anxiety: $\chi^2 (3 \text{ df}) = 9.05, p = .029$] but not for those in the CPR/AED group [depression: $\chi^2 (3 \text{ df}) = 4.72, p = .194$; anxiety: $\chi^2 (3 \text{ df}) = 6.7, p = .082$]. Depression and anxiety were more frequent at the initial assessment than at subsequent assessments for spouses in the CPR group (See Figure 5).

Variables with Possible Influence on Measures in Psychosocially Distressed Patients Several models were used to examine the contributions of months after initial assessment (time), intervention group, gender, age, and NYHA class to psychologically distressed patients' depression and anxiety and to changes in them over time. Parallel analyses without NYHA class were conducted to examine spouses' depression and anxiety.

Patient Depression

Time was a significant predictor of depression in psychologically distressed patients' ($p < .001$) in the unconditional growth model (see Table 5 Model A). This model was significantly better at predicting distressed patients' depression than the unconditional means model [$\chi^2 (1 \text{ df}) = 13.5, p < .01$]. The average BDI-II scores of distressed patients decreased from 13.18 at initial assessment to 10.35 at 2 years. There was no evidence that intervention group predicted depression or changes in depression over time. The addition of

age, gender and NYHA class and interactions of these variables with time and intervention group did not improve model fit. Thus there was no evidence that age, gender or NYHA class influenced the changes in patients' depression over the 2 years of the study.

Patient Anxiety

Anxiety in psychologically distressed patients' decreased as time after initial assessment increased ($p < 0.001$). This model was significantly better at predicting distressed patients' anxiety than the unconditional means model [χ^2 (1 df) = 19.9, $p < .001$], explaining 14% of the variance in STAI. The best model included time, age, gender, intervention group, and the interactions of gender with time, and intervention group with time and explained 21.6% of the variance in anxiety (see Table 5 Model B). Only time ($p < .001$) and the interaction of gender with time ($p < .01$) were significant independent predictors of anxiety among psychologically distressed patients. This model was a significant improvement over the unconditional growth model [χ^2 (5 df) = 30.59, $p < .01$]. The average state anxiety scores of psychologically distressed men decreased from 40.38 at initial assessment to 27.01 at 2 years and of psychologically distressed women decreased from 37.9 at initial assessment to 32.18 at 2 years. State anxiety scores of women decreased more slowly than those of men. There was no evidence that intervention group or NYHA class predicted anxiety or changes in anxiety over time for psychologically distressed patients after controlling for age and gender and the interaction of gender with time.

Spouse Depression

Time was a significant predictor of depression in psychologically distressed spouses' ($p < .001$) in the unconditional growth model, explaining 11.4 % of the variation in depression (see Table 5 Model C). This model was significantly better at predicting distressed spouses' depression than the unconditional means model [χ^2 (1 df) = 14.7, $p < .01$]. The average BDI scores of distressed spouses at initial assessment, 1 month, 12 months, and 24 months were 11.50, 11.36, 9.87, and 8.37, respectively. There was no evidence that intervention group predicted spouses' depression or changes in depression over time. The addition of age and gender and interactions of these variables with time and intervention group did not improve model fit.

Spouse Anxiety

In the unconditional growth model, time was a significant predictor of anxiety ($p < .001$), with anxiety decreasing as time after initial assessment increased. This model was significantly better at predicting distressed patients' anxiety than the unconditional means model [χ^2 (1 df) = 9.64, $p < .01$]. The best model included time, intervention group, and the interactions of intervention group with time and explained 21.3% of the variance in distressed spouses' anxiety. Only time ($p < .001$) and the interaction of intervention group with time ($p < .05$) were significant independent predictors of anxiety (see Table 4 Model D). This model was a significant improvement over the unconditional growth model [χ^2 (2 df) = 11.01, $p < .01$]. Estimates of spouses' anxiety in both intervention groups at the initial assessment and 24 months, indicate reductions in average anxiety for the spouses in the CPR group from 41.5 to 35.2, and increases in average anxiety for spouses in the CPR/AED group from 41.2 to 43.9 over the same time period.

Intervention group predicted changes in anxiety over time for psychologically distressed spouses. The addition of age and gender and interactions of these variables with time and intervention group did not improve model fit.

Psychological Distress in Couples

The relationships of patient's depression to depression in their spouse's and patient's anxiety to their spouse's anxiety were examined. Among all couples, there was a significant relationship between the couples' depression (initial: $r = .277$, $p < .001$; 1 month: $r = .252$, $p < .001$; 1 year: $r = .240$, $p < .001$; 2 years: $r = .247$, $p < .001$) and similarly, between the couples' anxiety (initial: $r = .315$, $p < .001$; 1 month: $r = .352$, $p < .001$; 1 year: $r = .337$, $p < .001$; 2 years: $r = .276$, $p < .001$) at each assessment time.

A total of 191 couples had psychological distress at baseline. The psychologically distressed couples included 128 psychologically distressed patients and 118 psychologically distressed spouses. In 58 couples, both members of the couple were distressed; in 60 couples the patient was distressed and in 73 the spouse was distressed.

Among those couples who experienced psychological distress, depression score in spouses was not significantly related to patient depression score at any assessment time (initial: $r = -.122$, $p = .091$; 1 month: $r = .136$, $p = .076$; 1 year: $r = -.005$, $p = .949$; 2 years: $r = .129$, $p = .182$). However spouse anxiety scores were significantly related to patient anxiety scores at one month, but not at other assessment times (initial: $r = -.126$, $p = .081$; 1 month: $r = .203$, $p = .008$; 1 year: $r = .064$, $p = .454$; 2 years: $r = .07$, $p = .562$).

Discussion

This is the first study to compare the effects of CPR training and CPR/AED training on anxiety and/or depression of patients and their spouses, and was conducted within the HAT clinical trial. This trial tested whether the home use of an AED would improve survival of post-MI patients when compared to conventional resuscitation methods. In HAT, among 7,000 couples, only 58 tachyarrhythmic SCAs occurred at home with witnesses present. An AED was used in 32 patients; 14 received appropriate shocks; and 4 survived to hospital discharge. A home AED did not significantly improve overall survival compared with CPR training. The trial reported overall SCA survival of 28.6% when an AED was present². This survival rate was significantly higher than the 6% survival rate reported with community-based emergency medical services⁴⁵

We found no evidence that home AEDs caused psychological distress among patients. In the current study, 25% of the patients were depressed and 21% were anxious at initial assessment which is similar to rates in hospitalized patients following MI; depression rates of 17% to 31%⁴⁶⁻⁴⁹ and anxiety in 26%⁴⁷. Previous studies of patients whose spouses were trained to respond to SCA did not report prevalence of depression or anxiety^{15-20;50;51}.

The high initial prevalence of depression and anxiety in the current study demonstrates the persistence of depression and anxiety among post-MI patients long after the cardiac event. In the current study only 10% of the patients had suffered an MI within a month and almost half of the patients (45%) had experienced their most recent MI more than one year prior to enrollment in PRHAT/HAT.

In previous studies of hospitalized post-MI patients, depression and anxiety increased at 4 and 12 months post MI⁴⁷. This contrasts with the longer term experience in the current study where average depression and anxiety decreased during two years of follow-up. Our longer follow-up, longer time post-MI, and inclusion of only patients enrolled in a clinical trial who are living with a supportive significant other likely contribute to the differences in these findings. Previous studies reported that emotional distress in post-MI patients whose spouses received CPR training was worse than in a control group of similar patients^{15;16}. Two studies of small groups of patients whose spouses were trained to use AEDs reported

no significant changes in psychological distress at 3 months¹⁷ and 3, 6, 9, and 12 months.¹⁸ Those studies compared no training to CPR in contrast to the current study that compared two groups with different types of training. The patients in these studies generally were pleased with their experiences. Recent qualitative studies report that patients are very accepting of AEDs. They value their AEDs highly and believe they enhance their perceived control over their disease.^{19;20} If the patients in the current study held similar beliefs toward CPR and CPR/AED, this may have contributed to the improvement in depression and anxiety of the patients over time. It is also possible that general support provided within the context of a clinical trial (HAT) contributed to these observations.

Our findings of no changes in average depression and anxiety scores of spouses trained to prevent SCA were consistent with findings of no changes in depression or anxiety of family members who received AED training.¹⁸ These findings complement the six month follow up study of spouses in four groups of CPR training where CPR training without other support led to worsening of spouses depression and anxiety.¹⁶ In the course of the HAT clinical trial spouses received continuing education and support from site staff. This could have positively impacted and enhanced their experience.

No previous study compared psychological responses to CPR with responses to CPR/AED in either patients or spouses. Previous studies of patients' and spouses' psychological responses to training to prevent SCA included couples who received AEDs only with no comparison groups^{17;18} or compared those who received CPR training with control interventions^{15;16;51}.

In the current study, in the subgroup of psychologically distressed patients average depression and anxiety scores decreased after the initial assessment in both CPR and CPR/AED intervention groups. Among the patients who initially experienced psychological distress, 16% had significant symptoms of depression and 9% had significant symptoms of anxiety two years later. While the magnitude of the changes in depression and anxiety scores experienced may appear small, differences of one half standard deviation are clinically significant for a broad range of quality of life measures across a wide variety of conditions.^{52;53} Thus differences of 2.1 points in depression and 4.9 points in anxiety represent clinically significant changes. The reductions in depression and anxiety experienced by psychologically distressed patients are clinically as well as statistically significant. These findings suggest that training spouses to respond to SCA decreases patients' anxiety and depression, even among those who began with high psychological distress.

Among those patients with psychological distress, assignment to receive an AED had no impact on depression or anxiety. In both intervention groups among psychologically distressed patients, anxiety and depression were higher at initial assessment and decreased thereafter over 2 years of follow-up. This did not depend on intervention group, age, gender, or NYHA class.

Improvement in depression and anxiety is particularly important for psychosocially distressed patients as depression and anxiety increase the risk of cardiovascular morbidity and mortality 21;21-23;23-25.

Spouses who were in the AED/CPR group, especially those who were psychologically distressed, did not experience decreases in anxiety similar to those experienced by those in the CPR group. It could be possible that these spouses may have focused more on the intervention than those in the CPR only group. This attention to the intervention could result in the observed differences between the intervention groups in diminution of anxiety among the distressed spouses. While there is no way to test that directly, the HAT trial included an

assessment of compliance with training recommendations through a random skills retention assessment. Spouses demonstrated that they knew how to implement their assigned intervention; in the CPR group 80% passed CPR testing and in the AED/CPR group 92% applied the AED pads correctly and 66% passed CPR testing.⁵⁴

These data do not support large differences in adherence to training recommendations as a basis for differences in psychological responses between the intervention groups.

Linear mixed models revealed that men and women patients who are psychologically distressed experienced different changes in anxiety over the two years. Women experienced a slower decline in anxiety; this was independent of intervention group. To our knowledge, no other study examined differences in longitudinal psychological responses of male and female patients whose family members were trained to respond to SCA. Differences in beliefs about health between men and women could be responsible for the differences in the trajectories of anxiety^{55;56}.

Among psychologically distressed spouses in the current study, assignment to an AED did not affect depression but had a significant effect on anxiety. Psychologically distressed spouses' depression decreased over time and these changes did not depend on intervention group, age, or gender. The linear mixed model revealed that changes in psychologically distressed spouses' anxiety depended on intervention group. In the CPR group, psychologically distressed anxiety decreased significantly over two years of follow-up. In contrast in the CPR/AED group, spouses' anxiety increased slightly over time. This could reflect the spouses' possible need to use the AED if a SCA occurred. Previous smaller studies of AED and CPR recipients provide inconsistent evidence for psychosocial influences of the interventions on spouses and other family members. In two studies of family members who received AED training, neither depression nor anxiety changed significantly over 3 months and 1 year^{17;18}. In a six month longitudinal study of family members of post MI patients, depression and anxiety increased in those who received CPR training but not in a control group¹⁶.

Among psychologically distressed spouses, AEDs maintained anxiety at higher levels than would otherwise occur with CPR training only. A longitudinal study has reported that spouses with high perceived control related to their partner's heart disease were less anxious and depressed at baseline. The perceived control increased significantly in spouses after CPR training but did not change in a control group.⁵⁷ It is possible that in the current study decreases in perceived control were experienced by spouses who received AEDs in addition to CPR training. These decreases in perceived control could contribute to distressed spouses' continued anxiety.

Other literature has reported that patients' and spouses' depression and anxiety are related to each other⁵⁸. Although these relationships were statistically significant they were of somewhat lower magnitude in the current study. Moser and Dracup⁵⁸ reported correlations of patient with spouse of $r = .39$ for depression and $r = .40$ for anxiety while in the current study the couples' correlations ranged from $r = .24$ to $.28$ for depression and $r = .28$ to $.35$ for anxiety. Among couples who were experiencing psychological distress, spouses' depression was not significantly related to patients' depression at any assessment time. Spouses' anxiety was related to patient's anxiety at one month, but not at other time points.

The findings of the current study indicate the need to address anxiety in psychologically distressed spouses who are trained to use AEDs. The presence of the AED is a tangible reminder to the patient and the spouse of the patient's vulnerability to SCA. Social support interventions decreased anxiety in family members who learned CPR¹⁶. They may also be effective for those who receive AEDs.

High anxiety among spouses trained to use AEDs could decrease effective implementation of this life-saving technology. Conversely, high anxiety among patients could lead to improved adherence with medical regimens. Additional research will be needed to evaluate these possibilities.

Limitations

The findings are based on use of self-report symptom questionnaires to assess depression and anxiety. Although both the BDI and the STAI are widely used in studies of post-MI patients and are preferable to single item reports of mood, they do not allow clinical diagnoses of anxiety or depression.^{34;49;59} The current study was limited to symptoms of depression and anxiety expressed by the patients and spouses at specific times and did not include evaluation of the effect of treatment for these or other psychiatric disorders. The HAT participants in PR-HAT were younger and healthier than the other participants in HAT. The responses of the sicker, older patients may have been worse. The generalizability of the current study is also limited by the lack of diversity in race, gender and marital status among the cohort studied. The amount of missing data is of concern.

By the end of the study, many couples did not provide follow-up psychosocial or HAT data. Much missing data is due to patients moving, changing medical care, and changes in site personnel. The amount of missing data is similar to that observed in other longitudinal assessments of psychosocial status within clinical trials for example the AFCHF trial.³⁷ Unfortunately no data about refusal to participate in PR-HAT were obtained. It is possible that more depressed or anxious participants refused to participate in the study, withdrew from the study, or died. However our analyses indicated that data were missing at random, depression and anxiety scores at baseline and each assessment did not predict whose data were missing at any subsequent times.

Conclusions

This longitudinal prospective analysis of depression and anxiety among couples who received training to respond to SCAs revealed that home AEDs did not increase depression or anxiety in post-MI patients and their spouses. Among the subgroup of patients with psychological distress, women's anxiety decreased more slowly than men's over two years independent of whether or not they received an AED. In comparison of psychologically distressed spouses, anxiety decreased in the CPR group but remained high in the CPR/AED group. Assessment of anxiety and consideration of strategies to reduce anxiety in spouses of patients who receive AEDs is warranted.

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Reference List

1. Rosamond W, Flegal K, Furie K, et al. Heart disease and stroke statistics--2008 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation*. 2008; 117(4):e25–146. [PubMed: 18086926]

2. Bardy GH, Lee KL, Mark DB, et al. Home use of automated external defibrillators for sudden cardiac arrest. *N.Engl.J.Med.* 2008; 358(17):1793–804. [PubMed: 18381485]
3. Callans DJ. Can home AEDs improve survival? *N.Engl.J.Med.* 2008; 358(17):1853–55. [PubMed: 18381486]
4. Becker L, Eisenberg M, Fahrenbruch C, Cobb L. Public locations of cardiac arrest. Implications for public access defibrillation. *Circulation.* 1998; 97(21):2106–9. [PubMed: 9626169]
5. Eisenberg MS, Horwood BT, Cummins RO, Reynolds-Haertle R, Hearne TR. Cardiac arrest and resuscitation: a tale of 29 cities. *Ann.Emerg.Med.* 1990; 19(2):179–86. [PubMed: 2301797]
6. Pell JP, Sirel JM, Marsden AK, Ford I, Walker NL, Cobbe SM. Potential impact of public access defibrillators on survival after out of hospital cardiopulmonary arrest: retrospective cohort study. *BMJ.* 2002; 325(7363):515. [PubMed: 12217989]
7. Valenzuela TD, Roe DJ, Nichol G, Clark LL, Spaite DW, Hardman RG. Outcomes of rapid defibrillation by security officers after cardiac arrest in casinos. *N Engl J Med.* 2000; 343:1206–1209. [PubMed: 11071670]
8. Weaver WD, Cobb LA, Hallstrom AP, Fahrenbach C, Copass MK, Ray R. Factors influencing survival after out of hospital cardiac arrest. *J Am Coll Cardiol.* 1986; 7:654–57.
9. Solomon NA. What are representative survival rates for out of hospital cardiac arrest? Insights from New Haven (Conn) experience. *Arch Intern Med.* 1993; 153:1218–21. [PubMed: 8494474]
10. Eisenberg MS, Mengert TJ. Cardiac resuscitation. *N.Engl.J.Med.* 2001; 344(17):1304–13. [PubMed: 11320390]
11. Eisenberg MS, Moore J, Andresen E, Litwin PE, Hallstrom AP, Hearne TR. Use of the automatic external defibrillator in homes of survivors of out-of-hospital Ventricular Fibrillation. *American Journal of Cardiology.* 1989; 63:443–46. [PubMed: 2916429]
12. Becker LB, Han BH, Meyer PM. Racial differences in the incidence of cardiac arrest and subsequent survival. *N Engl J Med.* 1993; 329:600–606. [PubMed: 8341333]
13. Norris RM. Circumstances of out of hospital cardiac arrest in patients with ischaemic heart disease. *Heart.* 2005; 91(12):1537–40. [PubMed: 15883135]
14. Riegel B. Training nontraditional responders to use automated external defibrillators. *Am.J.Crit.Care.* 1998; 7(6):402–10. [PubMed: 9805112]
15. Dracup K, Guzy PM, Taylor SE, Barry J. Cardiopulmonary resuscitation (CPR) training. *Arch Intern Med.* 1986; 146:1757–61. [PubMed: 3753116]
16. Dracup K, Moser DK, Taylor SE, Guzy PM, Peter M. The Psychological Consequences of Cardiopulmonary Resuscitation Training for Family Members of Patients at Risk for Sudden Death. *American Journal of Public Health.* 1997; 87(9):1434–39. [PubMed: 9314793]
17. McDaniel CM, Berry VA, Haines DE, DiMarco JP. Automatic external defibrillation of patients after myocardial infarction by family members: Practical aspects and psychological impact of training. *PACE.* 1988; 11:2029–34. [PubMed: 2463583]
18. Sanna T, Fedele F, Genuini I, et al. Home defibrillation: a feasibility study in myocardial infarction survivors at intermediate risk of sudden death. *Am.Heart J.* 2006; 152(4):685–87. [PubMed: 16996835]
19. Chen MA, Eisenberg MS, Meischke H. Impact of in-home defibrillators on postmyocardial infarction patients and their significant others: an interview study. *Heart Lung.* 2002; 31(3):173–85. [PubMed: 12011808]
20. Haugk M, Robak O, Sterz F, et al. High acceptance of a home AED programme by survivors of sudden cardiac arrest and their families. *Resuscitation.* 2006; 70(2):263–74. [PubMed: 16828958]
21. Thomas SA, Friedmann E, Wimbush F, Schron EB. Psychological factors and survival in the cardiac arrhythmia suppression trial (CAST): a reexamination. *Am J CritCare.* 1997; 6(2):16–26.
22. Alonzo AA. The impact of the family and lay others on care seeking during life-threatening episodes of suspected coronary artery disease. *Social Science in Medicine.* 1986; 22:1297–311.
23. Kawachi I, Sparrow D, Volonas PS, Weiss S. Symptoms of anxiety and risk of coronary heart disease: The normative aging study. *Circulation.* 1994; 90(5):2225–29. [PubMed: 7955177]

24. Carney RM, Freedland KE, Steinmeyer B, et al. Depression and five year survival following acute myocardial infarction: a prospective study. *J.Affect.Disord.* 2008; 109(1-2):133–38. [PubMed: 18191208]
25. Kubansky LP, Kawachi I, Weiss ST, Sparrow D. Anxiety and coronary heart disease: A synthesis of epidemiological psychological and experimental evidence. *Ann Behav Med.* 1998; 20(2):47–58. [PubMed: 9989308]
26. Hemingway H, Marmot M. Evidence based cardiology: psychosocial factors in the aetiology and prognosis of coronary heart disease. Systematic review of prospective cohort studies. *BMJ.* 1999; 318(7196):1460–1467. [PubMed: 10346775]
27. Pelle AJ, Gidron YY, Szabo BM, Denollet J. Psychological predictors of prognosis in chronic heart failure. *J.Card Fail.* 2008; 14(4):341–50. [PubMed: 18474348]
28. Frasure-Smith N, Lesperance F. Depression and anxiety as predictors of 2-year cardiac events in patients with stable coronary artery disease. *Arch.Gen.Psychiatry.* 2008; 65(1):62–71. [PubMed: 18180430]
29. Lawrence AE, Liverant GI, Rosellini AJ, Brown TA. Generalized anxiety disorder within the course of major depressive disorder: examining the utility of the DSM-IV hierarchy rule. *Depress.Anxiety.* 2009; 26(10):909–16. [PubMed: 19798759]
30. Watson D. Rethinking the mood and anxiety disorders: a quantitative hierarchical model for DSM-V. *J.Abnorm.Psychol.* 2005; 114(4):522–36. [PubMed: 16351375]
31. Bardy GH, Lee KL, Mark DB, et al. Rationale and design of the Home Automatic External Defibrillator Trial (HAT). *Am.Heart J.* 2008; 155(3):445–54. [PubMed: 18294476]
32. Beck AT, Steer RA, Garbin MG. Psychometric properties of the Beck Depression Inventory - 25 years of evaluation. *Clinical Psychology Review.* 1988; 8(1):77–100.
33. Beck, AT.; Stear, RA.; Brown, GK. *The Beck Depression Inventory. Second Edition.* Houghton Mifflin; Boston MA: 1996.
34. Strik JJ, Honig A, Lousberg R, Denollet J. Sensitivity and specificity of observer and self-report questionnaires in major and minor depression following myocardial infarction. *Psychosomatics.* 2001; 42(5):423–28. [PubMed: 11739910]
35. Spielberger, CD.; Lushene, RE.; Gorsuch, RL. *STAI Manual.* Consulting Psychology Press; Palo Alto, CA: 1972.
36. Frasure-Smith N, Lesperance F, Talajic M. Depression and 18-month prognosis after myocardial infarction. *Circulation.* 1995; 91(4):999–1005. [PubMed: 7531624]
37. Frasure-Smith N, Lesperance F, Habra M, et al. Elevated depression symptoms predict long-term cardiovascular mortality in patients with atrial fibrillation and heart failure. *Circulation.* 2009; 120(2):134–40. 3p. [PubMed: 19564557]
38. Newkirk LA, Kim JM, Thompson JM, Tinklenberg JR, Yesavage JA, Taylor JL. Validation of a 26-point telephone version of the Mini-Mental State Examination. *J.Geriater.Psychiatry Neurol.* 2004; 17(2):81–87. [PubMed: 15157348]
39. Roccaforte WH, Burke WJ, Bayer BL, Wengel SP. Validation of a telephone version of the mini-mental state examination. *J.Am.Geriater.Soc.* 1992; 40(7):697–702. [PubMed: 1607586]
40. Folstein MF, Folstein SE, McHugh PR. “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. *J.Psychiatr.Res.* 1975; 12(3):189–98. [PubMed: 1202204]
41. Teng EL, Chui HC, Schneider LS, Metzger LE. Alzheimer's dementia: Performance on the mini-mental state examination. *Journal of Consulting and Clinical Psychology.* 1987; 55:96–100. [PubMed: 3571664]
42. Crum RM, Anthony JC, Bassett SS, Folstein MF. Population-based norms for the mini-mental state examination by age and educational level. *JAMA.* 1993; 269:2386–91. [PubMed: 8479064]
43. Hedeker D, Gibbons R. Application of random effects pattern mixture models for missing data in longitudinal studies. *J Psych Methods.* 1997; 2:64–78.
44. Singer, J.; Willett, J. *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence.* Oxford University Press; New York: 2003.

45. Nichol G, Stiell IG, Laupacis A, Pham B, De M, V, Wells GA. A cumulative meta-analysis of the effectiveness of defibrillator-capable emergency medical services for victims of out-of-hospital cardiac arrest. *Ann. Emerg. Med.* 1999; 34(4 Pt 1):517–25. [PubMed: 10499952]
46. Cherrington CC, Moser DK, Lennie TA, Kennedy CW. Illness representation after acute myocardial infarction: impact on in-hospital recovery. *Am. J. Crit Care.* 2004; 13(2):136–45. [PubMed: 15043241]
47. Lane D, Carroll D, Ring C, Beevers DG, Lip GY. The prevalence and persistence of depression and anxiety following myocardial infarction. *Br. J. Health Psychol.* 2002; 7(Pt 1):11–21. [PubMed: 14596714]
48. Ziegelstein RC, Fauerbach JA, Stevens SS, Romanelli J, Richter DP, Bush DE. Patients with depression are less likely to follow recommendations to reduce cardiac risk during recovery from a myocardial infarction. *Arch. Intern. Med.* 2000; 160(12):1818–23. [PubMed: 10871976]
49. Green LA, Dickinson WP, Nease DE, Schellbase KG, Campos-Outcalt D, Jeffcott-Pera M. AAFP guideline for the detection and management of post-myocardial infarction depression. *Ann. Fam. Med.* 2009; 7(1):71–79. [PubMed: 19139452]
50. Cagle AJ, Diehr P, Meischke H, et al. Psychological and social impacts of automated external defibrillators (AEDs) in the home. *Resuscitation.* 2007; 74(3):432–38. [PubMed: 17395358]
51. Dracup K, Heaney DM, Taylor SE, Guzy PM, Breu C. Can family members of high-risk cardiac patients learn cardiopulmonary resuscitation. *CPR Training.* 1989; 149:61–64.
52. Norman GR, Sloan JA, Wyrwich KW. The truly remarkable universality of half a standard deviation: confirmation through another look. *Expert. Rev. Pharmacoecon. Outcomes. Res.* 2004; 4(5):581–85. [PubMed: 19807551]
53. Norman GR, Sloan JA, Wyrwich KW. Interpretation of changes in health-related quality of life: the remarkable universality of half a standard deviation. *Med. Care.* 2003; 41(5):582–92. [PubMed: 12719681]
54. Anderson, J.; Munkers, CD.; Bischoff, E., et al. AED and CPR Video Training in the Home Automatic External Defibrillator Trial (HAT).. Presented at the XIII World Congress of Pacing and Electrophysiology; Rome; 7 A.D.. December 6; 2007;
55. Ho SY, Mak KK, Thomas GN, et al. The relation of chronic cardiovascular diseases and diabetes mellitus to perceived health, and the moderating effects of sex and age. *Soc. Sci. Med.* 2007; 65(7):1386–96. [PubMed: 17597275]
56. Ladwig KH, Muhlberger N, Walter H, et al. Gender differences in emotional disability and negative health perception in cardiac patients 6 months after stent implantation. *J. Psychosom. Res.* 2000; 48(4-5):501–8. [PubMed: 10880672]
57. Moser DK, Dracup K. Impact of Cardiopulmonary Resuscitation Training on Perceived Control in Spouses of Recovering Cardiac Patients. *Research in Nursing & Health.* 2000; 23:270–278. [PubMed: 10940952]
58. Moser DK, Dracup K. Role of spousal anxiety and depression in patients' psychosocial recovery after a cardiac event. *Psychosom. Med.* 2004; 66(4):527–32. [PubMed: 15272098]
59. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. IV ed.. American Psychiatric Association; Washington, DC: 1994.

Figure 1.
Consort diagram showing the relationship of enrollment in PR-HAT to enrollment in HAT.
QOL = quality of life

s

Figure 2.

Frequency of depression (BDI-II) and anxiety (state anxiety score on the STAI) among all patients enrolled in PR-HAT in the CPR training (CPR) and CPR/AED (AED) intervention groups at initial assessment, and 1 month, 1 year, and 2 years later. Degree of depression is indicated by the color of the fill. Significance of Chi square differences are indicated by ** $p < .05$; * $p < .10$.

Figure 3.

Frequency of depression (BDI-II) and anxiety (state anxiety score on the STAI) among all spouses enrolled in PR-HAT in the CPR training (CPR) and CPR/AED (AED) intervention groups at initial assessment, and 1 month, 1 year, and 2 years later. Degree of depression is indicated by the color of the fill. Significance of Chi square differences are indicated by ** $p < .05$; * $p < .10$.

Figure 4.

Frequency of depression (BDI-II) and anxiety (state anxiety score on the STAI) among patients experiencing psychological distress in the CPR training (CPR) and CPR/AED (AED) intervention groups at initial assessment, and 1 month, 1 year, and 2 years later. Degree of depression is indicated by the color of the fill. Significance of Chi square differences are indicated by ** $p < .05$; * $p < .10$.

Figure 5.

Frequency of depression (BDI-II) and anxiety (state anxiety score on the STAI) among spouses experiencing psychological distress in the CPR training (CPR) and CPR/AED (AED) intervention groups at initial assessment, and 1 month, 1 year, and 2 years later. Degree of depression is indicated by the color of the fill. Significance of Chi square differences are indicated by ** $p < .05$; * $p < .10$.

Table 1

Demographic and health characteristics of patients enrolled in PRHAT (N=460) compared with patients enrolled in the HAT trial but not in PRHAT (N=6541)

Characteristic	PR- HAT	HAT	p
	Mean (SD)	Mean (SD)	
Age	61.13 (9.65)	62.39 (10.78)	0.014
	N (%)	N (%)	
Female - N (%)	68 (14.8)	1152 (17.6)	0.11
White	427 (92.8)	5779 (88.4)	0.0019
Married	421 (91.5)	5939 (90.8)	0.60
Unemployed	206 (44.8)	3814 (58.3)	<0.0001
Completed secondary school	344 (74.8)	5061 (77.4)	0.21
Medical history			
Hypertension	228 (49.6)	3541 (54.1)	0.058
Diabetes	79 (17.2)	1425 (21.8)	0.017
Hypercholesterolemia	358 (77.8)	5199 (79.5)	0.40
Stroke	21 (4.6)	416 (6.4)	0.11
Cigarette smoking	47 (10.2)	665 (10.2)	0.97
PTCA ^a	300 (65.2)	3442 (52.6)	<0.0001
CABG ^b	118 (25.7)	1749 (26.7)	0.61
NYHA ^c			<0.0001
I	352 (76.5)	4218 (64.5)	
II	95 (20.7)	1958 (29.9)	
Medication			
β blocker ^d	364 (79.1)	5167 (80.0)	0.94
ACE ^e inhibitor	314 (68.3)	4689 (71.7)	0.12
ARB ^f	52 (11.3)	902 (13.8)	0.12
Digoxin	25 (5.4)	464 (7.1)	0.16
Statins	412 (89.6)	5829 (89.1)	0.76
Aspirin	419 (91.1)	5644 (86.3)	0.0021
Other antiplatelet agents	123 (30.9)	1611 (31.5)	0.79
Antidepressant	33 (8.3)	444 (8.7)	0.80

^a percutaneous transluminal coronary angioplasty

^b coronary artery bypass grafting

^c New York Heart Association heart failure class

^d other than sotalol or amiodarone

^e angiotensin converting enzyme

^f angiotensin II receptor blockers

Table 2

Demographic and health characteristics of patients enrolled in PRHAT (N=460), comparison of those assigned to CPR only and CPR+AED HAT interventions

Characteristics	ALL PR-HAT N = 460	CPR only n = 219	CPR + AED n = 241	p
Age, mean (SD)	61.09 (9.69)	61.38 (9.77)	60.81 (9.60)	.53
Female, n (%)	68 (14.8)	29 (13.2)	39 (16.2)	.43
White, n (%)	428 (93.0)	202 (92.2)	226 (93.8)	.58
Married, n (%)	421 (91.5)	199 (90.9)	222 (92.1)	.74
Unemployed, n (%)	206 (44.8)	97 (44.3)	109 (45.2)	.91
Completed secondary school, n (%)	344 (74.8)	160 (73.1)	184 (76.3)	.45
Medical history				
Hypertension, n (%)	228 (49.6)	113 (51.6)	115 (47.7)	.45
Diabetes, n (%)	79 (17.2)	42 (19.2)	37 (15.4)	.32
Hypercholesterolemia, n (%)	358 (77.8)	164 (74.9)	194 (80.5)	.17
Stroke, n (%)	21 (4.6)	5 (2.3)	16 (6.6)	.03
Cigarette smoking, n (%)	47 (10.2)	24 (11.0)	23 (9.5)	.77
PTCA ^a , n (%)	300 (65.2)	143 (65.3)	157 (65.1)	.97
CABG ^b , n (%)	118 (25.7)	56 (25.6)	62 (25.7)	.97
NYHA ^c				
I, n (%)	352 (76.5)	172 (78.5)	180 (74.7)	.52
II, n (%)	95 (20.7)	41 (18.7)	54 (22.4)	
Medication				
β blocker ^d , n (%)	364 (79.1)	166 (75.8)	198 (82.2)	.11
ACE ^e inhibitor, n (%)	314 (68.3)	153 (69.9)	161 (66.8)	.48
ARB ^f , n (%)	52 (11.3)	23 (10.5)	29 (12.0)	.66
Digoxin, n (%)	25 (5.4)	13 (5.9)	12 (5.0)	.68
Statins, n (%)	412 (89.6)	197 (90.0)	215 (89.2)	.88
Aspirin, n (%)	419 (91.1)	199 (90.9)	215 (89.2)	.87
Other antiplatelet agents, n (%)	123 (30.8)	62 (32.6)	61 (29.2)	.49
Antidepressant, n (%)	33 (8.3)	16 (8.4)	17 (8.1)	.99
Baseline Psychosocial Scale Scores				
BDI ^g , mean (SD)	8.28 (6.96)	7.87 (6.59)	8.64 (7.27)	.24
Depressed (BDI $\geq$ 13), n (%)	92 (20.31)	39 (18.2)	53 (22.2)	.35
STAI ^h , mean (SD)	31.68 (9.79)	31.69 (9.49)	60.81 (9.60)	.99
Anxious (STAI $\geq$ 40), n (%)	97 (21.41)	47 (21.9)	50 (21.0)	.91

^a percutaneous transluminal coronary angioplasty

^b coronary artery bypass grafting

^c New York Heart Association heart failure class

^d other than sotalol or amiodarone

^e angiotensin converting enzyme

^f angiotensin II receptor blockers

^g Beck Depression Inventory

^h State Trait Anxiety Inventory

Table 3

Demographic and health characteristics of spouses enrolled in PRHAT (N=460)

Characteristics	N (%)	Range	Mean (SD)
Relationship to patient			
Spouse	414 (90.0)		
Domestic partner	29 (6.3)		
Age		18-82	57.19 (10.84)
Female	395 (85.9)		
Unemployed	202 (43.9)		
Completed secondary school	381 (82.8)		
Received CPR training prior to patient's enrollment in HAT	198 (43.0)		
Received AED training prior to patient's enrollment in HAT	8 (1.7)		
The presence of another person living in patient home who might help during a cardiac arrest	130 (28.3)		
Baseline Psychosocial Scale Scores			
Beck Depression Inventory	453	0-40	6.91 (6.21)
Depressed (BDI $\geq$ 13)	69 (15.23)		
State anxiety score (range)	453	20-64	31.77 (9.78)
Anxious (STAI $\geq$ 40)	87 (19.21)		

Table 4

Comparison of frequency of depression and anxiety in the CPR and CPR/AED intervention groups at each assessment time among all patients (N = 460) and spouses (N = 460) and among the psychologically distressed patients (N = 128) and spouses (N = 118)

	Initial	1 month	12 months	24 months
	χ^2 (1 df), p	χ^2 (1 df), p	χ^2 (1 df), p	χ^2 (1 df), p
All Participants				
Patient depression	.272, .602	.047, .882	2.40, .121	2.30, .129
Patient anxiety	.049, .825	.000, .982	.007, .931	.353, .552
Spouse depression	.435, .509	.353, .553	.421, .351	.118, .731
Spouse anxiety	.095, .758	.212, .645	.903, .342	.308, .579
Psychologically Distressed Participants				
Patient depression	1.00, .32	0.10, .74	1.32, .25	0.11, .25
Patient anxiety	0.29, .59	0.02, .88	0.05, .82	0.02, .88
Spouse depression	0.07, .79	3.25, .07	0.00, .95	0.83, .36
Spouse anxiety	1.68, .20	1.14, .29	2.99, .08	3.39, .06

Table 5

Summaries of estimates of fixed effects for best models used to predict psychologically distressed patients' and spouses'/companions' depression and anxiety scores at initial assessment, 1 month, 1 year and 2 years.

Parameter	Estimate	Std. Error	df	t	p	95% Confidence Interval
						lower upper
Model A: Patient Depression (square root of BDI-II score)						
Intercept	3.630182	.092299	162.931	39.331	.000	3.447925 3.812439
Time	-.017172	.004465	309.686	-3.846	.000	-.025958 -.008386
Model B: Patient Anxiety (ln of STAI state anxiety score)						
Intercept	3.807551	.146772	115.713	25.942	.000	3.516842 4.098260
Time	-.017825	.004542	265.133	-3.924	.000	-.026768 -.008882
Gender	-.062416	.064955	151.245	-.961	.338	-.190753 .065920
Time * Gender	.009995	.003952	267.408	2.529	.012	.002213 .017777
Age	-.001189	.001957	105.074	-.608	.545	-.005068 .002691
AED	.052876	.043356	149.841	1.220	.225	-.032792 .138544
Time * AED	.002310	.002556	263.466	.904	.367	-.002724 .007343
Model C: Spouse Depression (square root of BDI-II score).						
Intercept	3.391825	.094795	161.061	35.781	.000	3.204624 3.579025
Time	-.020856	.005664	274.831	-3.682	.000	-.032007 -.009705
Model D: Spouse (ln of STAI state anxiety score)						
Intercept	3.696777	.027235	184.712	135.736	.000	3.643045 3.750509
Time	-.007445	.001849	291.915	-4.026	.000	-.011084 -.003806
AED	.032368	.038026	180.179	.851	.396	-.042665 .107401
Time * AED	.006548	.002576	286.652	2.542	.012	.001478 .011619

AED: 0 = CPR only, 1 = CPR/AED; Gender: 1 = male, 2 = female; Time = time in months from initial assessment