Emotional Adjustment 5 Years After Heart Transplant: A Multisite Study

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Objective: To assess levels of and factors associated with depression and negative affect 5 years after heart transplant (HT). Participants: 370 adults 5 years post-HT. Outcome Measures: Cardiac Depression Scale and the Positive and Negative Affect Schedule (PANAS). Research Method: Stepwise multiple regression analyses were used to test 32 potential demographic, medical, functional, and psychosocial factors in adjustment. Results: Predictor variables accounted for 53% of the variance of depression scores and 45% of the variance of PANAS negative affect scores. The best predictors (p < .001) for depression were neurological symptoms, younger age, lower recreational functioning, and lower satisfaction with emotional support, and the best predictors for negative affect were neurological symptoms, lower mobility functioning, and perceived uncertainty about health. Depression scores were lower than norms for nontransplanted heart failure patients, and negative affect levels were comparable to those of the general population. Conclusions: The findings indicate normal long-term adjustment among HT recipients. Several factors associated with negative emotions, including younger age, have not been identified in previous research.

Keywords: heart transplant, emotional adjustment, depression, negative affect

Heart transplantation (HT) is a surgical intervention for heart failure patients who have a high risk of mortality within the next year (Hosenpud & Greenberg, 1994). From 1982 through 2003, approximately 56,500 HTs were reported to the International Society for Heart and Lung Transplantation registry by U.S. and international transplant programs (Taylor et al., 2005). In the United States, approximately 2,500 HTs are performed per year, limited primarily by the available donor pool. After HT, 1-year survival is 80%, with a constant annual mortality rate of 3.4% per year well beyond 15 years post-HT (Taylor et al., 2005). The goal of HT is not only to increase life expectancy by 10–15 years but also to improve the patient’s level of functioning. Indeed, functional status among HT recipients has been found to be very high relative to that of disease-matched individuals who have not received a transplant. Data from the International Society for Heart and Lung Transplantation registry indicate that 83% of heart transplant survivors reported no functional limitations at 1 year posttransplant, and recent studies indicate that these high levels of functional status are sustained for 5 years and longer post-HT (Grady et al., 2005; Hetzer et al., 1997).

Although short-term improvements in emotional functioning from the waiting list period to post-HT have been well documented (Jones, Taylor, Downs, & Spratt, 1992; Mai, McKenzie, & Kostuk, 1990), a substantial number of recipients develop new psychological problems in the aftermath of HT. The most systematic study to date found that 3 years after HT, the cumulative risk of major depressive disorder was 26%, the risk of adjustment disorder with anxious mood was 17%, and the risk of posttraumatic stress disorder related to transplant, occurring primarily during the 1st year, was 17% (Dew et al., 2000).
The 1st year post-HT had the highest rates of psychopathology. This appears to be the highest risk period for adjustment difficulties for transplant recipients in general, as recipients learn to cope with the rigorous medication regimen, constant medical surveillance, and negative mood effects of immunosuppressive medications (Olbrisch, Benedict, Ashe, & Levenson, 2002).

There are also mixed findings as to whether the initial emotional functioning gains obtained from HT are sustained over the long term. Two longitudinal studies found that recipients scored in the normal range for the general population on the Beck Depression Inventory following HT and remained in the normal range 4 years post-HT (Jones et al., 1992) and 5 years post-HT (Fisher, Lake, Reutzel, & Emery, 1995). In contrast, a longitudinal study of 33 recipients followed over a period of 5 years post-HT found that emotional complaints increased, whereas physical status gains from HT remained stable (Bunzel & Laederach-Hofmann, 1999). Similarly, in a sample of 77 recipients who lived 9 to 13 years after HT, Hetzer et al. (1997) found significantly elevated levels of depression, but not anxiety, compared with the general population.

Knowledge about the factors that put individuals at risk for poor emotional adjustment may allow for more effective screening and earlier intervention. However, there are only three studies to date that have examined predictors of post-HT psychiatric adjustment, and these studies have tested only a small number of predictors. In the first study (Dew, Roth, Schulberg, & Simmons, 1996), predictors of psychiatric diagnoses during the 1st year post-HT were pre-HT psychiatric history, poor social support, and the use of avoidance coping strategies. Dew et al. (2000) extended these findings by examining the factors that increased the risk of meeting criteria for a Diagnostic and Statistical Manual of Mental Disorders (4th ed.; American Psychiatric Association, 1994) psychiatric disorder during the first 3 years post-HT. Significant predictors of psychiatric diagnosis included limitations in physical functioning, a longer period of hospitalization for the HT, and lower social support. Another study of 50 women who were an average of 5 years post-HT found that a measure of hope and younger age predicted positive emotional adjustment (Evangelista, Doering, Dracup, Vassilakis, & Kobashigawa, 2003).

The present study was designed to test the levels and factors associated with depression and negative affect using a database from a multisite study of quality of life in HT recipients 5–10 years post-transplant. The large sample permits exploratory stepwise multiple regression analyses assessing a wide range of potential demographic, medical, functional, and psychosocial predictors of depression and negative affect. Available measures of medical complications, comorbidity, disease burden, and functional impairment are included, under the assumption that such factors play a role in emotional adjustment. On the basis of prior research, two available psychosocial predictors are also included in the analyses: satisfaction with social support and illness uncertainty. Satisfaction with social support has been shown to correlate with emotional adjustment to heart transplant (Dew et al., 1996) and other disabilities (e.g., Rybarczyk, Nynhuis, Nicholas, Cash, & Kaiser, 1995), and illness uncertainty has also been identified as a factor in poorer adjustment to a range of chronic illnesses and disabilities (Hommel et al., 2003; Sanders-Dewey, Mullins, & Chaney, 2001; Wineman, O’Brien, Nealon, & Kuskel, 1993).

A significant advantage of the present study is the multiple sites from which participants were recruited. A recent review (Olbrisch et al., 2002) cited the limited generalizability of almost all previous HT studies as a result of the use of small sample sizes and/or single medical sites. Furthermore, the present study differs from two previous studies by using questionnaire assessment of depression and general negative affect (e.g., fear, irritability, hostility) rather than a structured psychiatric interview. Psychiatric classification studies are essential but do not capture the full spectrum of emotional adjustment, including individuals who have psychological distress at a level that does not meet the threshold for psychiatric diagnosis. To supplement the use of depression as an index of adjustment to illness, we used a more broad-based measure of negative affect, the Positive and Negative Affect Schedule (Watson & Clark, 1991). Most studies of adjustment to illness have focused exclusively on depression, and this approach may fail to detect other forms of maladjustment.

Method

Sample

HT recipients who participated in this research were from a large, multisite, prospective study of quality of life outcomes between 5 and 10 years after HT. The study recruited participants through the Cardiac Transplant Research Database, a voluntary registry coordinated by the University of Alabama, Birmingham. Study inclusion criteria were that participants be at least 4.5 years postorthotopic HT, at least 21 years old, able to read and write English, able to pass the reading subtest of the Wide Range Achievement Test (Wilkinson, 1993), and physically able to participate. An exclusion criterion was transplant of another organ.

On the basis of estimates from the larger sample of 5- to 10-year post-HT participants, 458 of 748 individuals in the registry were eligible for the study. The 290 individuals who were not eligible for study recruitment, on the basis of a review of medical records, included those who died during the 5-year period after transplant (n = 200), transferred care to another institution (n = 87), or had a combined heart–kidney transplant (n = 3). Among the 458 individuals who met criteria on the basis of medical records, 88 were not enrolled for the following reasons: They declined to participate (n = 37), we were unable to contact them (n = 33), they did not speak or read English (n = 11), they did not pass the reading test (n = 6), or they were retransplanted (n = 1). The final cohort for this report consisted of 370 recipients who were transplanted between July 1, 1994, and June 30, 1999, and completed booklets of questionnaires between 5 and 6 years post-HT (i.e., July 1, 2000, to June 30, 2004).

Instruments

Study participants completed 12 self-report instruments in the larger study of quality of life at 5–10 years after HT. Five of the 12 instruments and the chart review were used in the analyses for this report. The 5 self-report instruments were selected on the basis of their relevance to the emotional adjustment of long-term heart transplant recipients and adequacy of psychometric support. The instruments are described below.

Cardiac Depression Scale (CDS; Hare & Davis, 1996). The CDS assesses symptoms of depression relevant to cardiac patients, including sleep disturbances, anhedonia (loss of pleasure), uncer-
tainty, decreased mood, concentration difficulty, hopelessness, and inactivity (Hare & Davis, 1996). The CDS is sensitive to mild and moderate levels of depression, which is appropriate for cardiac patients and HT recipients, for whom depression may be clinically significant even if it does not meet the criteria for a major depressive episode. This tool consists of 26 items that are rated on a 7-point scale of agreement. A higher score indicates a greater level of depression. The CDS has been shown to correlate .73 with the Beck Depression Inventory and .67 with clinical assessment (Hare & Davis, 1996). Internal consistency reliability is high, with an alpha of .90.

Positive and Negative Affect Schedule—Expanded Form (PANAS–X; Watson & Clark, 1991). The PANAS–X is a 52-item scale assessing mood on two hierarchical levels (negative affect and positive affect). Respondents are asked to rate the extent to which they have “felt this way during the past month” using a 1–5 scale:

1 = very slightly or not at all,
2 = a little,
3 = moderately,
4 = quite a bit,
5 = extremely.

These two mood dimensions are based on factor analyses of mood descriptors used in diverse time frames, response formats, languages, and cultures (Watson, 1988a, 1988b; Watson & Clark, 1991). The PANAS–X also assesses 11 lower order dimensions of mood, yielding subscales that reflect the specific content of different emotional states. Negative Affect, which was used in the present study, is composed of 10 items (afraid, scared, nervous, jittery, irritable, hostile, guilty, ashamed, upset, and distressed). The Negative Affect scale has some support as a trait-type construct when the general instructions are given. Respondents are asked to rate the extent to which they have “felt this way during the past month” using a 1–5 scale: 1 = very slightly or not at all, 2 = a little, 3 = moderately, 4 = quite a bit, and 5 = extremely. These two mood dimensions are based on factor analyses of mood descriptors used in diverse time frames, response formats, languages, and cultures (Watson, 1988a, 1988b; Watson & Clark, 1991). The PANAS–X also assesses 11 lower order dimensions of mood, yielding subscales that reflect the specific content of different emotional states. Negative Affect, which was used in the present study, is composed of 10 items (afraid, scared, nervous, jittery, irritable, hostile, guilty, ashamed, upset, and distressed). The Negative Affect scale has some support as a trait-type construct when the general instructions are used (Watson & Clark, 1991), but the present study used “during the past month” instructions to capture mood states that are likely to be related to adjustment issues. With similar instructions, the authors reported (Watson & Clark, 1991) that the Negative Affect scale has shown moderate to high correlations with other clinical measures of psychological distress, including the Beck Depression Inventory (r = .58; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), the State–Trait Anxiety Inventory state anxiety measure (r = .51; Spielberger, Gorsuch, & Lushene, 1970), and the total score of the Hopkins Symptom Checklist (r = .74; Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974).

Sickness Impact Profile (SIP; Bergner, Bobbitt, Carter, & Gilson, 1981). The 136-item SIP is a widely used instrument that measures functional ability (Bergner et al., 1981). It is designed to reflect a participant’s perception of his or her performance of activities involved in carrying on his or her life. The SIP assesses the extent of disability in 12 areas of physical and psychosocial functioning, with higher scores indicating greater disability. For the present study, the three physical functioning scales (Self-Care, Mobility, and Ambulation) plus two others (Home Management and Recreation) that did not overlap with other measures were included as potential predictors. Items were weighted by Bergner et al. on the basis of the severity of disability for each item, and higher scores equal greater levels of disability. The SIP has extensive psychometric support in the literature (Bergner, Bobbitt, Pollard, Martin, & Gilson, 1976; Kaplan, 1985; Pollard, Bobbitt, Bergner, Martin, & Gilson, 1976).

Social Support Index (SSI; Grady et al., 1995). The SSI subscales used in the present study were Satisfaction With Tangible and Emotional Support. These subscales are based on satisfaction with the support received for 15 illness-related tasks (Grady et al., 1995). Satisfaction with support was rated on a 4-point scale, with higher scores indicating less satisfaction with social support. We derived satisfaction with support by summing scores for each subscale item and dividing by the number of tasks for which a person received help. The SSI has adequate psychometric support. Cronbach’s alphas were .78 (tangible support) and .69 (emotional support; Grady et al., 1995).

Heart Transplant Symptom Checklist (HTSC; Jalowiec et al., 1997). This tool measures the presence and severity of 89 adverse symptoms related to heart failure, HT, medications, and complications. These items were compiled through a literature review and the clinical expertise of clinicians experienced in the care of these individuals. Participants indicate whether they have had the symptom in the past 6 months and, if so, rate how bothered they were by each symptom on a scale of 0–3: 0 = not bothered at all, 1 = slightly bothered, 2 = moderately bothered, and 3 = very bothered. The tool has six subscales of symptoms: Cardiopulmonary, Gastrointestinal, Genital–Urinary (sexual and urinary functioning), Neurological (cognitive deficits, lethargy and fatigue, sensory deficits, weakness, pain), Dermatological (physical appearance and discomfort symptoms), and Psychological. The latter scale was omitted from the present study because of its overlap with the outcome measures. The HTSC was found to be a reliable and valid tool in heart failure and HT recipients. In HT recipients, Cronbach’s alpha for the entire tool was .95 and ranged from .68 to .91 for all subscales except for Genital–Urinary, which had an alpha of .46 (Jalowiec et al., 1997).

Medical variables. These data were recorded either on chart reviews or on survey forms designed for this study or on CTRD forms. The eight variables included in this study were as follows: number of medical comorbidities, hospitalizations during the previous 6 months, the presence of coronary artery disease (referred to as cardiac allograft vasculopathy) as determined by angiography, cumulative nonimmunological complications of HT, a composite of the four immunological complications of HT (cumulative acute rejections, infections, cardiac allograft vasculopathy, and malignancies), and New York Heart Association (NYHA) functional classification (1 = fewest physical limitations, 4 = most physical limitations).

Procedures

The four medical centers that participated in the study received institutional review board approval to conduct the study and participate in the Cardiac Transplant Research Database registry. All qualified individuals in the registry were contacted, the study was explained, and those who volunteered to join the study were sent an informed consent form or consented face to face during a clinic visit. Participants subsequently completed the self-report instruments (collated into a booklet of instruments) every 6 months, on the basis of their transplant anniversary date, beginning at 5 years post-HT. Booklet data from 5, 5.5, or 6 years post-HT were included in this report. Given that participants completed more than one booklet between 5 and 6 years post-HT for future longitudinal data analyses, only data from the first booklet were included in these analyses.

Participants were asked to complete each booklet of self-report instruments within 2–3 days and return the booklet to the study coordinator in a stamped, self-addressed envelope. Measures to reduce the incidence of missing data included reminder telephone calls to participants who did not return booklets.
Statistical Analyses

Data analyses were performed with SAS Version 8.2. Prior to analyses, mean item, subscale, and total scale scores were calculated for each participant and converted to proportional scores, when indicated. We calculated proportional scores by dividing the participant’s item, subscale, or total scale score by the maximum possible score to convert the ranges to a standard scale with a range of .00 to 1.00. Proportional scores were not calculated for PANAS–X and CDS because normative data reported by the authors of the tools used the original scale scores. Subsequent data analyses included correlations (Pearson correlation coefficients), forward-entry stepwise multiple regression, and t tests for the age variable. Level of significance was set at .05 for all analyses.

The outcome variables for the two forward-entry stepwise regression analyses were PANAS–X negative affect and CDS depression scores. Thirty predictor variables were tested for both regression analyses: 5 demographic variables, 8 medical variables, 10 HT symptom variables, 5 SIP scales, and 2 social support satisfaction variables. The negative affect regression also included two additional measures from the CDS: the Sleep subscale (“My sleep is restless and disturbed” and “I wake up in the early morning hours and cannot get back to sleep”) and an illness uncertainty item (“I am concerned about the uncertainty of my health”). The Sleep subscale was determined to be a more specific measure of sleep per se than the SIP Sleep and Rest subscale given the broad focus on sleep, daytime functioning, and fatigue found in the latter. The model fits were tested and found to be acceptable. No influential outliers were identified, and all participants were retained in the analyses.

Results

Demographic and Clinical Characteristics

Participants who took part in our study (N = 370) were a mean of 54.3 years of age (range = 22–75 years) at the time of HT and 59 years of age at the time of participation in the study; 78% were men, 90% were Caucasian, 78% were married, and 30% were employed; and they had a mean of 14.1 (SD = 2.9) years of education. For most of these participants, the etiology of heart failure that resulted in HT was either ischemic cardiomyopathy (58%) or dilated cardiomyopathy (30%). Table 1 presents demographic characteristics of eligible patients who were enrolled in the study compared with those who were not enrolled. Statistical comparison showed that the nonenrollees were significantly more likely (p < .03) to be African American (15% vs. 8%). Otherwise, the two groups were not significantly different on any demographic characteristics.

The mean score for the CDS was 79.0 (SD = 25.0). Given the CDS authors’ suggested cutoff score of 100 (Hare, 1997), 19% of study participants had clinically significant depression scores. The mean score for PANAS–X negative affect was 14.9 (SD = 6.2), which was lower than the mean of 18.2 (SD = 6.2) for a large, normative sample of adults (Watson & Clark, 1991). Ten percent of study participants scored greater than one standard deviation from the mean (greater than 24) in a normative sample (Watson & Clark, 1991). The CDS score was moderately correlated with the PANAS–X negative affect score (r = .67, p < .0001).

Stepwise Multiple Regression Analyses

Depression score. Demographic, medical, physical functioning, and psychosocial variables were entered into a stepwise multiple regression equation with the CDS score as the outcome variable. Ten of the 30 candidate variables were significant and explained 53% of the variance in the depression score, F(1, 358) = 40.07, p < .0001. Thus, significant predictors of depression were younger age, female gender, being unemployed, a greater number of and more distress from neurological symptoms, a greater number of genitourinary symptoms, more malignancies, a higher level of NYHA cardiac functioning, lower recreational functioning, and less satisfaction with emotional support. The means and standard deviations for these

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Table 1

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Enrolled in study</th>
<th>Not enrolled in study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at transplant (years)</td>
<td>54.3 10.1</td>
<td>52.2 10.4</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>78</td>
<td>80</td>
</tr>
<tr>
<td>Female</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>90</td>
<td>81</td>
</tr>
<tr>
<td>African American</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
| Most severe disease category prior to transplant | 66 | 65 

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1 Space does not permit presentation of bivariate correlations for all 34 variables in the study. These results are available on request from Bruce Rybarczyk.
significant predictors are presented in Table 2, and the beta weights, incremental changes in squared multiple correlation, and corresponding $F$ values for the significant variables, in order of their entry into the equation, are reported in Table 3.

**Negative affect.** Demographic, medical, physical function, and psychosocial variables were entered into a stepwise multiple regression equation with the PANAS–X negative affect score as the outcome variable. Thirteen of the 32 candidate variables were significant and explained 45% of the variance in depression scores, $F(1, 354) = 21.98, p < .0001$. Significant predictors of negative affect were younger age; female gender; lack of employment; Caucasian race; a greater number of and more distress from neurological symptoms; a greater number of dermatological symptoms; more comorbid medical conditions; more malignancies; a higher level of NYHA cardiac functioning; lower recreational mobility, and ambulation functioning; poorer sleep quality; and more concern about illness uncertainty. The means and standard deviations for these significant predictors are presented in Table 2, and the beta weights, incremental changes in squared multiple correlation, and corresponding $F$ values for the significant variables, in order of their entry into the equation, are reported in Table 4.

**Correlational Analyses of Items From Neurological Symptoms Scale**

A post hoc correlational analysis of individual items (presence or absence of a symptom) from the Neurological Symptoms scale of the HTSC was undertaken because it was the strongest predictor for both regression analyses and has a high number and variety of individual items (28 items). All but 3 items (fainting spells, seizures, and being unusually energetic) were significantly correlated ($p < .05$) with the outcome measures. The symptoms that were correlated higher than .30 with depression score and the number of participants who endorsed those symptoms as being present were as follows: “trouble concentrating” ($r = .47; n = 122$), “weakness in the whole body” ($r = .43; n = 123$), “feeling restless” ($r = .42; n = 120$), “difficulty sleeping” ($r = .41; n = 161$), “tiredness” ($r = .40; n = 228$), “weakness in arms” ($r = .34; n = 85$), “cramps in hands, feet or legs” ($r = .32; n = 143$), “headache” ($r = .30; n = 109$), and “tremors or shaking of hands or body” ($r = .30; n = 136$). The symptoms that were correlated higher than .30 with negative affect score were “feeling restless” ($r = .40$), “trouble concentrating” ($r = .37$), “tiredness” ($r = .31$), “tremors or shaking of hands or body” ($r = .31$), “difficulty sleeping” ($r = .30$), and “weakness in legs” ($r = .30; n = 143$).

Three HTSC items measuring pain were all correlated less than .30 with both depression and negative affect score. The individual correlations with depression score were as follows: pain at the incision site ($r = .20; n = 138$), back pain ($r = .15; n = 72$), and pain in extremities or joints ($r = .28; n = 38$). The individual correlations with negative affect score were as follows: pain at the incision site ($r = .13; n = 138$), back pain ($r = .21; n = 72$), and pain in extremities or joints ($r = .17; n = 38$).

**Univariate Analysis for Age and Gender**

Because age emerged as a significant predictor for both depression and negative affect and gender emerged as a significant predictor for depression, secondary $t$ test analyses were conducted. For age, participants were divided into younger (age < 60 years; $n = 162$) and older (age $\geq$ 60; $n = 204$) groups; $t$ tests indicated that younger adults had significantly higher scores for depression, $t(365) = 5.44, p < .0001$, and negative affect, $t(364) = 3.91, p < .0001$. The mean depression scores for study participants and a nontransplanted heart failure normative sample (Hare, 1997) by age are presented in Figure 1.

In contrast to the regression analysis, $t$ tests for gender indicated that there were no significant differences between men and women for depression scores. For the negative affect variable, $t$ tests showed a modest, significant difference between men and women, $t(364) = 1.32, p < .05$. Men scored lower than women on negative affect, with a mean of 13.8 ($SD = 14.2$), compared with a mean score of 18.6 ($SD = 17.2$) for women.

**Discussion**

The exploratory analyses indicate that a range of biopsychosocial variables (see Tables 3–4) were able to account for a substantial portion of the variance of both depression (53%) and negative affect (45%). Although there were 10 significant predictor variables for CDS score, only 7 were significant at the more conservative $p < .01$ level with an incremental squared multiple correlation equal to or greater than .01: more neurological symptoms, younger age, decreased recreational functioning, less emotional support satisfaction, more genetic–urinary symptoms, greater number of malignancies, and more neurological symptom discomfort. For PANAS–X negative affect, 7 of the 13 significant predictors met the same criteria: more neurological symptoms, lower mobility functioning, more health uncertainty, more sleep problems, lower number of malignancies, poorer recreational functioning, and lower NYHA classification. As hypothesized, the psychosocial variables of emotional support satisfaction and perceived health uncertainty were able to explain a significant amount of variance.

The neurological symptoms scale emerged as the strongest predictor for both variables, explaining 37% and 26% of the

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**Table 2**

<table>
<thead>
<tr>
<th>Variable</th>
<th>$M$</th>
<th>$SD$</th>
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</thead>
<tbody>
<tr>
<td>Neurological symptoms (28 items)</td>
<td>7.3</td>
<td>4.8</td>
</tr>
<tr>
<td>Neurological symptoms discomfort</td>
<td>42.8</td>
<td>16.8</td>
</tr>
<tr>
<td>Genital–urinary symptoms (7 items)</td>
<td>1.4</td>
<td>1.1</td>
</tr>
<tr>
<td>Dermatologic symptoms (16 items)</td>
<td>3.4</td>
<td>2.4</td>
</tr>
<tr>
<td>CDS sleep (2 items)</td>
<td>6.0</td>
<td>4.1</td>
</tr>
<tr>
<td>CDS health uncertainty item</td>
<td>3.8</td>
<td>2.1</td>
</tr>
<tr>
<td>Satisfaction with emotional support</td>
<td>1.4</td>
<td>2.8</td>
</tr>
<tr>
<td>(mean per item endorsed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobility functioning scale</td>
<td>4.3</td>
<td>8.6</td>
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<tr>
<td>Ambulation functioning scale</td>
<td>7.6</td>
<td>10.9</td>
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<tr>
<td>Recreation functioning scale</td>
<td>5.9</td>
<td>8.4</td>
</tr>
<tr>
<td>New York Heart Association classification</td>
<td>1.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Coexisting illnesses</td>
<td>5.1</td>
<td>2.8</td>
</tr>
<tr>
<td>Malignancies</td>
<td>0.3</td>
<td>0.7</td>
</tr>
</tbody>
</table>

*Note.* CDS = Cardiac Depression Scale.
variance of depression and negative affect, respectively. The correlational item analysis for this subscale indicated a wide range of the 28 symptoms accounted for the high levels of variance for each of the two outcome variables (all but 3 were significantly correlated at least at the \( p < .05 \) level). Some of the high item correlations may be explained partially by the overlap between these potential neurological symptoms and vegetative depressive symptoms (e.g., low energy and sleep problems). However, neurological symptoms are also among the most common adverse side effects of immunosuppressive medications, as evidenced by the frequency with which these symptoms were reported and the fact that correlations with depression were only in the low moderate range (i.e., \( r < .40 \)).

The relationship between adverse neurological symptoms and emotional adjustment has not been tested or reported in previous studies of HT recipients and makes a strong case for paying closer attention to these subjective and difficult to assess symptoms. The varied and sometimes unpredictable incidence of complications after HT and adverse effects from immunosuppression, coupled with uncertainty about how many additional years of life will be afforded by the transplant, makes HT recipients particularly vulnerable to the apparent negative course (Mishel & Braden, 1988), such as epilepsy, cancer, diabetes, and multiple sclerosis. The varied and sometimes unpredictable incidence of complications after HT and adverse effects from immunosuppression, coupled with uncertainty about how many additional years of life will be afforded by the transplant, makes HT recipients particularly vulnerable to the apparent negative effects of this perception. To substantiate these findings with a notable finding is that pain symptoms were not present for the majority of the participants and, when present, were not among the more highly correlated items of the neurological symptoms subscale (i.e., \( r > .30 \)). This indicates that, in contrast to many chronic medical conditions and disabilities (e.g., arthritis, amputation), pain is not a significant factor in adjustment to HT.

The two psychosocial variables, perceived illness uncertainty and satisfaction with emotional support, were also significant predictors of adjustment. The significance of perceived illness uncertainty for predicting negative affect underscores similar findings with other medical conditions (Hommel et al., 2003; Sanders-Dewey et al., 2001; Wineman et al., 1993). Perceived uncertainty has been hypothesized to be most common and detrimental in medical conditions that have a less stable and more unpredictable course (Mishel & Braden, 1988), such as epilepsy, cancer, diabetes, and multiple sclerosis. The varied and sometimes unpredictable incidence of complications after HT and adverse effects from immunosuppression, coupled with uncertainty about how many additional years of life will be afforded by the transplant, makes HT recipients particularly vulnerable to the apparent negative effects of this perception. To substantiate these findings with a

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### Table 3
Stepwise Multiple Regression Predictors of Cardiac Depression Scale Score 5 Years After Heart Transplantation

<table>
<thead>
<tr>
<th>Variable</th>
<th>( \beta )</th>
<th>( SE )</th>
<th>Model ( R^2 )</th>
<th>Incremental ( R^2 )</th>
<th>Incremental ( F )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurological symptoms</td>
<td>0.35</td>
<td>0.04</td>
<td>0.258</td>
<td>0.258</td>
<td>127.61****</td>
</tr>
<tr>
<td>Age</td>
<td>0.19</td>
<td>0.00</td>
<td>0.308</td>
<td>0.500</td>
<td>26.51****</td>
</tr>
<tr>
<td>Recreational functioning</td>
<td>0.01</td>
<td>0.02</td>
<td>0.369</td>
<td>0.028</td>
<td>15.16****</td>
</tr>
<tr>
<td>Emotional support satisfaction</td>
<td>0.03</td>
<td>0.01</td>
<td>0.391</td>
<td>0.012</td>
<td>6.96**</td>
</tr>
<tr>
<td>New York Heart Association classification</td>
<td>0.12</td>
<td>0.04</td>
<td>0.397</td>
<td>0.011</td>
<td>6.45*</td>
</tr>
<tr>
<td>Malignancies</td>
<td>0.04</td>
<td>0.02</td>
<td>0.400</td>
<td>0.008</td>
<td>4.75**</td>
</tr>
<tr>
<td>New York Heart Association classification</td>
<td>0.12</td>
<td>0.04</td>
<td>0.418</td>
<td>0.011</td>
<td>7.00**</td>
</tr>
<tr>
<td>Neurological symptom discomfort</td>
<td>0.19</td>
<td>0.06</td>
<td>0.406</td>
<td>0.009</td>
<td>5.44**</td>
</tr>
<tr>
<td>Caucasian</td>
<td>0.04</td>
<td>0.02</td>
<td>0.440</td>
<td>0.008</td>
<td>4.75**</td>
</tr>
<tr>
<td>Ambulation functioning</td>
<td>0.12</td>
<td>0.04</td>
<td>0.418</td>
<td>0.011</td>
<td>7.00**</td>
</tr>
<tr>
<td>Age</td>
<td>0.01</td>
<td>0.00</td>
<td>0.432</td>
<td>0.008</td>
<td>4.82*</td>
</tr>
<tr>
<td>Coexisting illnesses</td>
<td>0.01</td>
<td>0.00</td>
<td>0.424</td>
<td>0.007</td>
<td>4.23*</td>
</tr>
<tr>
<td>Dermatologic symptoms</td>
<td>0.06</td>
<td>0.03</td>
<td>0.446</td>
<td>0.006</td>
<td>4.14*</td>
</tr>
</tbody>
</table>

* \( p < .05 \). ** \( p < .01 \). *** \( p < .001 \). **** \( p < .0001 \).
more refined instrument, future studies with HT recipients should use the Mishel Uncertainty in Illness Scale (Mishel, 1981). The finding that older HT participants were less depressed than younger HT participants is particularly notable given Evangelista et al.’s (2003) finding that younger individuals were better adjusted. Their sample was limited by the fact that it included only 50 female participants who encompassed a very wide range of years since HT (i.e., 5 months to 22 years). There is similar evidence regarding a greater coping capacity of older children in relation to younger adults for adjusting to cancer (Williamson & Schulz, 1994) and amputation (Dunn, 1997; Livneh, Antonak, & Gerhardt, 1999; Williamson, Shulz, Bridges, & Behan, 1994). Theories that have been advanced to explain aging benefits include increased coping skills as a result of life experiences and the notion of increased acceptance given that older adults expect to have some disability later in life (Neugarten, 1969; Williamson et al., 1994).

The levels of depression and negative affect in the present sample as a whole indicate that long-term emotional adjustment among HT recipients was comparable with the normal range for the non-HT general population. This general finding supports those obtained in two previous studies (Fisher et al., 1995; Jones et al., 1992) but contradicts the findings from two other studies (Bunzel & Laederach-Hofmann, 1999; Hetzer et al., 1997). However, the present study used a larger, more representative sample relative to any of the previous studies and therefore is likely to have greater generalizability.

When we compare the depression scores of younger and older participants with the normative samples reported by Hare (1997), a more nuanced picture emerges. As can be seen in Figure 1, depression scores for younger participants were significantly higher than those for older participants and almost identical to the mean for a same-aged group of nontransplanted heart failure patients (Hare, 1997). In contrast, the older participants in this study had substantially lower depression scores compared with younger participants and older, nontransplanted heart failure patients (Hare, 1997). These data suggest that older adults sustain their emotional adjustment benefits from HT over 5 years, whereas younger recipients return to the pretransplant levels of depression found in heart failure patients of a similar age. Therefore, the ambiguity in the literature as to whether recipients sustain HT emotional adjustment benefits over the long term relative to the consistently reported functional benefits appears to be an age-dependent issue.

It is surprising that although the traditional measures of disability (ambulation, mobility, household functioning) did predict negative affect, they were not predictive of depression symptom level. Only recreational functioning was predictive of depression scores. This latter finding is consistent with research in rehabilitation psychology suggesting that being able to sustain activities in critical areas (i.e., friendships, recreation) is more crucial to emotional adjustment than level of mobility or functioning per se (see Williamson, 1998, for a review).

The significance of the NYHA functional classification variable in the opposite direction from what was anticipated (i.e., fewer functional symptoms predicted poorer emotional adjustment) is likely an artifact of an interaction with other variables and its limited range in this sample. All but 3 participants scored were classified at Level 1 or 2 out of four levels. Additionally, this variable was not significantly correlated ($p > .05$) with either depression score or negative affect score in the simple bivariate correlations.

However, the fact that fewer malignancies were predictive of poorer emotional adjustment is more difficult to explain. There were 70 participants who had malignancies, ranging between one and four, and the bivariate correlations were significant for depression score ($r = -.16, p < .01$) and negative affect score ($r = -.15, p < .01$). One possible explanation is that individuals who had a cancer diagnosis received additional psychosocial support from health care providers and family. Also, the cancer diagnoses that are most common in HT recipients, primarily skin cancer, are not as life threatening or difficult to endure as some other cancers.

There are several limitations to the present study. First, in light of the exploratory statistical method used (i.e., stepwise multiple regression), these findings need to be replicated in future studies. Although stepwise regression allows for a strictly empirical approach to choosing the best predictors of adjustment, it runs a higher risk of chance findings and Type I error. Similarly, the measures included in the larger database that this study used were selected to address a wide range of biopsychosocial aspects of post-HT functioning rather than to test an a priori theory of adjustment to chronic illness. As such, psychological constructs shown to be important in recent studies of adjustment to disability, such as hope, optimism, and problem-solving orientation, were not able to be addressed in the present study. Second, the study did not use a longitudinal methodology, so the direction of causality between negative emotional states and various measures cannot be determined. Functional limitations or low satisfaction with social support, for example, may either be caused by depression or vice versa.

Third, although the study sample matched the International Society for Heart and Lung Transplantation International Registry for Thoracic Organ Transplantation for age and gender (Bennett, Keck, Daily, Novick, & Hosenpud, 2000), it fell short on minority representation (national average = 81% Caucasian). This was partially due to disproportionate nonenrollment of African Amer-
icans (see Table 1). Finally, the assessment of adjustment via negative affect is a medical model perspective only and does not address the other half of the equation (i.e., positive adjustment and well-being). The absence of negative affect is not the equivalent of optimal adjustment, and separate measures are needed to assess positive adjustment. When such studies are conducted, measures that address positive coping resources, such as hope and optimism, should be included.

Detection and treatment of psychological adjustment problems in transplant recipients not only are important for quality of life reasons but also are likely to confer benefits in terms of reductions in physical morbidity and mortality. In one longitudinal study, initial post-HT mental health predicted morbidity and mortality up to 3 years after HT (Dew et al., 1998). A second study found that the presence of psychiatric problems after HT was associated with increased infection rates, readmissions, and total medical care costs up to 2 years after HT (Paris, Muchmore, Pribil, Zuhdi, & Cooper, 1994). Level of motivation to be compliant with the rigorous medication and health management protocols required posttransplant appears to be the mediating factor in the relationship between mental and physical health status.

Using a larger and more representative sample and testing a wide range of variables, the present study has identified several important factors associated with emotional adjustment not found in previous studies. If these factors are substantiated in further studies, they may serve as markers for identifying individuals who should be screened more frequently and thoroughly for mental health concerns. Neurological symptoms, in particular, may serve as a red flag for additional screening. This study has also confirmed that HT recipients are generally no more likely to experience negative emotions than the general population and are better off relative to nontransplanted heart failure patients. This general finding is less true among younger recipients, who appear to have rates of depressive symptoms that are significantly higher than those of older recipients and on a par with rates of age-matched nontransplanted heart failure patients.

References


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