A Randomized Evaluation of Quality-of-Life Therapy with Patients Awaiting Lung Transplantation

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Research shows that patients wait-listed for lung transplantation have very poor quality of life (QOL). This study evaluated the effectiveness of Quality-of-Life Therapy (QOLT) in improving QOL, mood disturbance and social intimacy in adults awaiting lung transplantation. Thirty-five adults were randomized to QOLT (n = 17) or supportive therapy (ST; n = 18) and received individual, telephone-based treatment sessions. QOL, mood and social intimacy assessments were conducted at baseline and at 1 and 3 months after treatment. Repeated measures analyses of variance showed significant Condition × Time interaction effects for all three primary outcome measures. Subsequent post hoc analyses showed that the two groups did not differ significantly at baseline, but did differ significantly at the 1- and 3-month follow-up assessments. When compared to ST patients, QOLT patients had significantly higher QOL scores at the 1- and 3-month assessments, lower mood disturbance scores at the 3-month assessment, and higher social intimacy scores at the 1-month assessment. Results indicate that a patient's QOL, mood state and relationship with the primary caregiver can be positively impacted by a brief psychological intervention prior to lung transplantation.

Introduction

Numerous studies have documented significant quality of life (QOL) decrements for patients with chronic pulmonary diseases (1–6). Lung transplantation offers the opportunity for extended survival (74% at 1 year, 58% at 3 years, 47% at 5 years) (7) and substantial QOL improvement (4). However, with approximately 2000 new registrants added to the waiting list annually and the median waiting time approaching 3 years (8), it is important to examine how QOL can be enhanced before transplantation.

The development, implementation and evaluation of QOL interventions before transplantation is important for several reasons. First, acquiring skills to cope successfully with declining physical health and the stressful waiting period could benefit patients. Second, elevated anxiety and depression are common before transplantation (3,6,9) and these symptoms, along with lower QOL, are associated with poorer outcomes after transplantation (10,11). Third, psychological interventions have improved the QOL of patients with other types of chronic health conditions (12,13), thereby suggesting their potential utility with transplant patients. The most notable of studies designed to enhance QOL in lung transplant patients (14–16) was that conducted by Napolitano et al. (15), who demonstrated that a brief telephone-based psychological intervention can significantly improve QOL and social support. Although this study was limited by its very short follow-up period, it provides an excellent demonstration of how psychological services can facilitate adaptation during a stressful time period.

The current study expands upon the Napolitano et al. study by further evaluating the potential benefits of a psychological intervention and whether these benefits can be maintained over a longer time period. Quality-of-Life Therapy (QOLT; 17) is a cognitive-behavioral intervention that provides specific intervention strategies to boost happiness and satisfaction in those life domains that compromise overall QOL, including physical health, relationships with family and friends, social functioning, leisure time activities, mental health and community involvement, among others. The World Health Organization (18) has urged QOL researchers to consider the importance of a patient's subjective perception of life in the context of his or her value systems, goals, expectations and standards. QOLT includes a patient's assessment of the degree to which his

or her most important life needs and goals have been ful-filled, including those pertaining to physical health, emotional well-being and social functioning (17,19). The primary aim of the study was to evaluate the effectiveness of telephone-based QOLT in enhancing QOL, reducing mood disturbance, and improving social intimacy among wait-listed lung transplant patients. We predicted that QOLT would be more effective than the more traditional supportive therapy (ST) services across all clinical dimensions.

Patients and Methods

Patient characteristics

Between January 2003 and November 2003, we approached all adult patients (n = 58) listed for lung transplantation at the University of Florida to inform them of this study. Forty-two patients (72%) initially agreed to participate in the study. However, 2 patients were admitted to the hospital before consent was obtained, 1 patient took the consent document home to review and did not return it, 1 patient was discharged from the clinic before consent was obtained and he subsequently died, and 3 patients initially contacted by telephone agreed to participate in the study, but did not return a signed consent form to the research team. Consequently, 35 patients provided informed written consent and completed study interventions, and 31 patients (89%) completed all follow-up assessments. Reasons for not completing the study included time constraints (n = 3) and removal from the transplant list (n = 1). Study completers did not differ significantly from study non-completers on age, gender, marital status, diagnosis, time on transplant list, or FEV_1 percent predicted. Four patients underwent lung transplantation after receiving the intervention, but they completed all follow-up assessments and were retained in the overall sample.

Recruitment procedures

Study inclusion criteria included: at least 18 years old, wait-listed for lung transplantation only, residential telephone service and primary caregiver identified. Exclusion criteria were: inability to speak or understand English, current hospitalization and current psychological treatment. Patients were randomized to treatment condition after providing written informed consent. Because of clinic schedules and cancelled appointments, some patients were informed of the study by telephone rather than in clinic. These patients were mailed the informed consent form, we reviewed it with them by telephone, and they were randomized upon receipt of the signed consent document. Seventeen patients were assigned to QOLT and 18 patients to ST.

Study design

The study was a 2 (treatment condition: QOLT vs. ST) × 3 (time of assessment: baseline, 1-month, 3-month) design, with random assignment of patients to treatment conditions. Questionnaire and medical record data were collected. The University of Florida Institutional Review Board approved all study procedures.

Interventions

Both interventions were conducted weekly by telephone, and treatment lasted 8–12 weeks. Telephone counseling was used because most patients lived more than 2 h away from the transplant center and their level of disability precluded weekly face-to-face sessions. Therapists were eight advanced clinical psychology graduate students and interns with prior transplant-related experience. Each therapist provided treatment to at least two patients, but delivered only one of the interventions. They received 3 h of intervention-specific training before initiating treatment and then weekly

(30–60 min) supervision by one of two transplant clinical psychologists. One psychologist supervised therapists in the QOLT exclusively and the other supervised ST therapists exclusively. The therapists were blinded to the primary study hypotheses and the transplant team members were blinded to patient group assignment. A research assistant unfamiliar with the interventions and blinded to the subjects' treatment condition was responsible for all data collection.

QOLT was developed as an integrative and comprehensive approach to improving QOL (17). In this approach, the patient completes the Quality-of-Life Inventory (QOLI), which provides specific information about current QOL levels across multiple life domains. The therapist works with the patient in the first session to select two to five life areas (e.g. self-esteem, goals and values, learning, relationships) that the patient views as highly valued and essential to his/her subjective well-being, but which have high levels of dissatisfaction. Cognitive-behavioral strategies are implemented within each targeted area to facilitate change in the patient's subjective circumstances of the area (e.g. problem solve to improve the situation), attitudes or perceptions of the area, standards of fulfillment for the area, and/or the relative importance placed on the area for overall happiness. Examples of treatment strategies are highlighted in Table 1. Patients also are assigned to complete various homework activities between sessions. The last session focuses on helping the patient develop effective strategies for treatment maintenance and relapse prevention. In this study, patients received weekly telephone counseling sessions that were tailored specifically to meet their assessed QOL needs. Treatment was terminated when the therapist and patient agreed that strategies had been effectively developed and implemented for each of the life domains targeted at the beginning of treatment. In general, QOLT is designed to be delivered in 8 to 15 sessions. The number of sessions in the current study varied based on the number of life areas identified for intervention, patient co-morbidities and the need for some patients with breathing difficulties to have shorter (and therefore more) sessions.

ST was designed to mirror the supportive treatments that are most commonly offered to lung transplant patients. The overall goal of this treatment was to provide emotional and educational support to patients as they cope with the demands of waiting for lung transplantation. Sessions focused on providing patients with information about the transplant experience, listening actively to their concerns and worries, displaying a genuine interest in their life activities and well-being as well as a non-judgmental acceptance of

Table 1: Examples of QOLT treatment strategies

Written emotional expression regarding important personal relationships that have grown distant due to illness

Three-step plan for increasing social contact and support

Relaxation rituals (e.g. progressive muscle relaxation, meditation, therapeutic massage)

Completion of daily stress diaries

Challenging unhealthy core beliefs about oneself and replacing them with healthier beliefs

Problem-solving ways to increase creativity and community connection despite physical limitations (e.g. identifying appropriate volunteer activities, technology-assisted social activities)

Problem-solving attitudinal and physical barriers to recreation

Build commitment and motivation to engage in health promoting behaviors

Re-evaluation of life goals and values by using a "life before" and "life after" transplantation technique

their current state, providing encouragement and reinforcement, and promoting the use of other support systems (20).

Assessment protocol

Questionnaires were completed at home by patients and returned to the research team in postage-paid envelopes. Cronbach's alpha, averaged across the three assessments, is reported for each measure for the current study sample.

Quality of life: The Quality-of-Life Inventory (QOLI; $\alpha = 0.86$) (21) was used to assess QOL. Patients read 32 statements reflecting 16 domains of life and then provide ratings about their relative importance and satisfaction with each area currently. The 16 domains of life include: health, self-esteem, goals and values, money, work, play, learning, creativity, helping, love relationship, friendships, relationships with children, relationships with relatives, home, neighborhood and community. Using 3-point scales (0 = *not important*, 1 = *important*, 2 = *extremely important*), patients rate how important each of the 16 domains are to their overall happiness and then use 6-point scales (−3 = *very dissatisfied* to +3 = *very satisfied*) to rate how satisfied they are in each area. A weighted satisfaction rating is calculated for each domain, a total raw score is determined from these ratings and the total raw score is then converted to a standardized *T* score. Higher scores indicate a higher QOL. The QOLI has good temporal stability (test-retest reliability of 0.73 2-week), satisfactory internal consistency ($\alpha = 0.79$), good convergent validity (i.e. significantly correlated with other measures of life satisfaction and QOL), and sensitivity to clinical treatment (21).

Mood disturbance: Mood disturbance was measured using the Profile of Mood States Short Form (POMS; $\alpha = 0.81–0.95$) (22,23). The items are self-descriptive adjectives to which patients indicate on a 5-point scale (0 = *not at all* to 4 = *extremely*) the extent to which they have felt that way in the past week. The Total Mood Disturbance score was the unit of analysis in this study, with higher scores indicating more mood disturbance. The POMS has good temporal stability (test-retest reliability of 0.65–0.74 3-week), excellent internal consistency ($\alpha = 0.87–0.95$), good convergent validity with other measures of psychological distress, and sensitivity to change associated with psychotherapy (22–25).

Social intimacy: The 17-item Miller Social Intimacy Scale (MSIS; $\alpha = 0.86$) (26) was used to assess closeness between the patient and his/her spouse or partner. In all but two cases, the spouse/partner was the identified primary caregiver for transplantation. In addition to a Total Intimacy score, the questionnaire yields scores on two intimacy subscales: Frequency (e.g. When you have leisure time, how often do you choose to spend it with him/her?) and Intensity (e.g. How affectionate do you feel toward him/her?). Higher scores indicate greater intimacy. Excellent test–retest reliability coefficients have been reported for 2-month (0.96) and 1-month (0.84) intervals (26), there is good evidence that the measure discriminates close from casual friends and happily married from distressed couples (26), and the MSIS can detect clinically meaningful change following psychological treatment (27).

Treatment process and satisfaction

Patient and therapist ratings regarding treatment process and satisfaction were obtained using a 12-item questionnaire that asked about the degree to which using the telephone impacted comfort level, attentiveness, rapport with the therapist, treatment helpfulness and convenience.

Statistical analysis

In preliminary analyses, the two treatment groups were compared on sociodemographic and medical characteristics, treatment characteristics and baseline assessments using *t* tests for continuous data and non-parametric

measures of association for nominal data. The primary analytic strategy was to evaluate whether there were differences between the two treatment groups (i.e. QOLT vs. ST) in QOL, mood disturbance and social intimacy and to determine whether any treatment gains were maintained over time. An intent-to-treat approach was used for all multivariate analyses such that patients (n = 4) with missing follow-up assessment data were included in the analysis by carrying forward their most recent outcome measure scores. The last observation carry-forward method has been found to be asymptotically valid when only two treatments with approximately equal sample sizes are compared (28). Repeated measures analyses of variance were used to explore treatment effects, time trends and interactions between treatment and time on the total scales for each outcome measure. Covariates were forced expiratory volume in 1-sec (FEV_1) percent predicted, time on the waiting list, and number of treatment sessions. Significant effects were followed by *t* tests at the two post-treatment follow-up assessments, with Bonferroni correction for multiple comparisons (i.e. $\propto 0.05/2 = 0.025$). Effect size estimates are reported as η_p^2 (partial eta squared) for multivariate effects and *d* (Cohen's *d*) (29,30) for *t* tests of the differences between the two groups. Cochran's *Q* statistic was used to examine proportional change over time on the QOLI. The Statistical Package for the Social Sciences (SPSS), Version 11, was used for all statistical analyses.

Results

Sample characteristics

The sample was predominantly Caucasian, female, married and medically disabled (Table 2). The mean age was 48.7 years (range: 22–61), and the mean time on the waiting list was 513 days (range: 28–1830). The majority of patients had either chronic obstructive pulmonary disease (COPD) or emphysema, and were significantly impaired as indicated by their FEV_1 and 6-min walk test findings. Overall, there were no statistically significant group differences on any of these characteristics.

Retention, compliance rates and treatment characteristics

Among the 17 QOLT patients, 88% of them completed the intervention and all assessments. Two patients completed the baseline and 1-month follow-up assessments, but not the 3-month follow-up assessment. In both cases, the patients cited time constraints as the reason for not completing the last assessment. Two additional patients underwent lung transplantation—one before the 1-month assessment and one before the 3-month assessment. However, both patients completed the subsequent follow-up assessments.

Among the 18 ST patients, 89% of them completed the intervention and all assessments. One patient completed the baseline assessment, but dropped out of treatment prematurely and did not complete any of the follow-up assessments. Another patient completed the baseline and 1-month follow-up assessment, but not the 3-month follow-up assessment. Two patients in this treatment condition also underwent lung transplantation during the study (between the 1- and 3-month follow-up assessments), but completed all study assessments.

Table 2: Sample characteristics overall and by treatment condition

	Total sample (N = 35) M ± SD or No. (%)	Treatment condition		Test statistic
		QOLT (n = 17) M ± SD or No. (%)	ST (n = 18) M ± SD or No. (%)	
Age, year	48.7 ± 10.6	48.4 ± 10.0	49.0 ± 11.3	$t(33) = 0.23$, p = 0.82
Gender, female	23 (65.7)	11 (64.7)	12 (66.7)	Fisher's exact test$^{\pm}$, p = 0.40
Race, white	26 (74.3)	13 (76.5)	15 (83.3)	$\chi^2(2) = 1.31$, p = 0.52
Marital status, married	25 (71.4)	11 (64.7)	14 (77.8)	$\chi^2(3) = 1.78$, p = 0.62
Education, ≥12 years	30 (85.7)	14 (82.4)	16 (88.9)	$\chi^2(3) = 4.15$, p = 0.25
Employed	9 (25.7)	4 (23.5)	5 (27.8)	$\chi^2(4) = 4.56$, p = 0.34
Time on waiting list, days	513.0 ± 511.1	481.8 ± 457.4	541.7 ± 583.7	$t(33) = 0.41$, p = 0.69
Time on waiting list, days, transformed§	19.9 ± 10.1	19.8 ± 9.0	19.9 ± 11.6	$t(33) = 0.02$, p = 0.99
Underlying disease				$\chi^2(4) = 2.71$, p = 0.38
COPD/Emphysema	15 (42.8)	9 (52.9)	6 (33.3)	
Pulmonary fibrosis	10 (28.6)	5 (29.4)	5 (27.8)	
Primary pulmonary hypertension	5 (14.3)	1 (5.9)	4 (22.2)	
Cystic fibrosis	2 (5.7)	1 (5.9)	1 (5.6)	
Other	3 (8.6)	1 (5.9)	2 (11.1)	
FEV_1,% predicted	32.6 ± 20.1	31.9 ± 20.0	33.4 ± 20.5	$t(33) = 0.21$, p = 0.83
FEV_1,% predicted, transformed§	5.5 ± 1.6	5.4 ± 1.7	5.6 ± 1.6	$t(33) = 0.28$, p = 0.79
6-min walk test, ft	729.9 ± 466.2	713.8 ± 398.2	741.7 ± 489.6	$t(33) = 0.33$, p = 0.81
Body mass index	23.2 ± 3.6	22.8 ± 3.1	23.5 ± 3.4	$t(33) = 0.64$, p = 0.53

$^{\pm}$Only p-value is reported because Fisher's exact test does not yield formal test statistic or critical value.
§Data presented are based on square root transformations.

For the entire sample, treatment included an average of 8.8 telephone sessions per patient. The mean session length was 44.6 min (range: 30–56). QOLT patients had a mean of 9.3 (±2.1) sessions, lasting 46.8 (±5.7) min on average. ST patients had 8.4 (±3.3) sessions with a mean duration of 42.5 (±7.2) min. There was no statistically significant group difference in number and length of sessions.

Treatment outcomes
Prior to examining treatment effects, Kolmogorov–Smirnov tests were conducted to evaluate the distributional characteristics of the primary outcome measures. The primary outcome measures were found to be normally distributed and no transformations were necessary. Two covariates (waiting list time and FEV_1) were found to be positively skewed and square root transformations were performed. There were no significant group differences on any of the outcome measures at baseline assessment.

A significant Condition × Time interaction effect [$F(2, 29) = 6.8$, p = 0.004, $\eta_p^2 = 0.32$] was found for overall QOL (Figure 1). Compared to ST patients, QOLT patients had significantly higher QOLI scores at the 1-month follow-up [$t(33) = 2.4$, p = 0.022, $d = 0.83$] and at the 3-month follow-up [$t(33) = 3.7$, p = 0.001, $d = 1.29$]. We also examined the QOLI categorically, to assess the prevalence of clinically meaningful levels of QOL. The recommended cutoff for designating a low QOL is a T score below 43 (21). At baseline assessment, approximately two-thirds of the sample had QOLI scores that fell in this range (Table 3), with no proportional difference between the two treatment con-

ditions. In the QOLT condition, the proportion of patients meeting this criterion fell significantly overall [$Q(2) = 9.33$, p = 0.009]. Separate comparisons showed that the proportion of patients with low QOL scores was significantly lower at both follow-up assessments than at baseline [$Q(1) = 4.00$, p = 0.04 and $Q(1) = 6.00$, p = 0.014, respectively]. In the ST condition, the proportion of patients meeting the low QOL criterion did not change significantly over time [$Q(2) = 1.20$, p = 0.55].

A significant Condition × Time interaction effect [$F(2, 29) = 5.1$, p = 0.01, $\eta_p^2 = 0.27$] was observed for total mood disturbance (Figure 2). Compared to ST patients, QOLT patients had significantly lower POMS scores at the 3-month follow-up [$t(33) = 4.4$, p = 0.0001, $d = 1.53$]. Both groups reported lower POMS scores at 1-month follow-up, although the two groups did not differ significantly at that assessment point [$t(33) = 1.47$, p = 0.15].

Finally, a significant Condition × Time interaction effect [$F(2, 29) = 3.5$, p = 0.04, $\eta_p^2 = 0.21$] was found for total social intimacy (Figure 3). Compared to ST patients, QOLT patients had significantly higher MSIS scores at the 1-month follow-up [$t(33) = 3.6$, p = 0.001, $d = 1.26$]. The two groups did not differ significantly at the 3-month follow-up assessment.

To assess whether changes in physical health status could account for the observed treatment effects, we examined whether there were any significant differences between the two treatment conditions on FEV_1 percent predicted
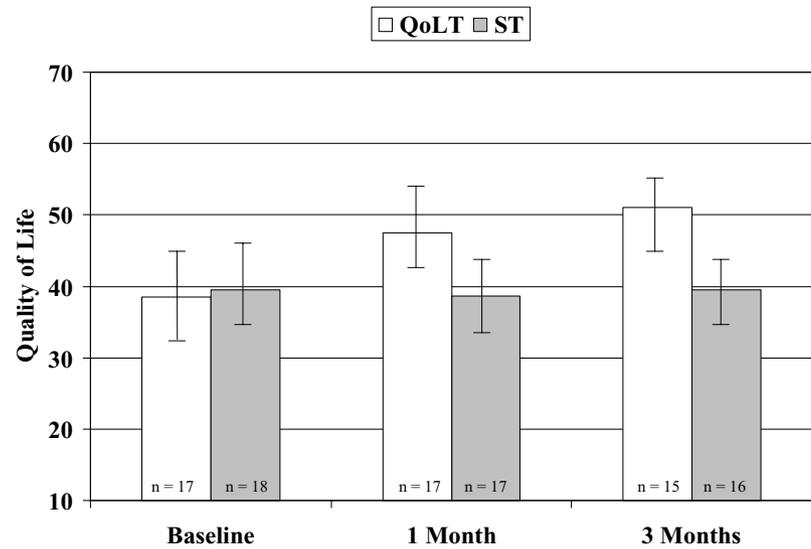
Figure 1: Comparison of QOLI *T* scores (unadjusted), by treatment condition over time (error bars depict 95% confidence intervals).

Table 3: Number of patients meeting criterion for low QOL, by treatment condition over time

Treatment condition	Baseline	1-Month	3-Months
QOLT (n = 17)	11	6	4
ST (n = 18)	12	13	11

and 6-min walk test performance at the conclusion of the study. Because patients were not required to return to the transplant center for an assessment of these two variables as part of this study, we used the FEV_1 and 6-min walk test results that were closest in time to the 3-month follow-up assessment point. The two groups did not differ significantly on either of these two variables [$t(33) = 1.6$, p = 0.12 and $t(33) = 1.2$, p = 0.22].

Treatment process and satisfaction

There were no significant group differences on either patient or therapist treatment process ratings. Patients and therapists in both treatment groups reported high levels of comfort, rapport, helpfulness and convenience, and low levels of distraction. Moreover, 87% (27/31) of participants stated that they would consider participating in telephone counseling again in the future, and 32% (10/31) stated a preference for telephone counseling over face-to-face counseling.

Discussion

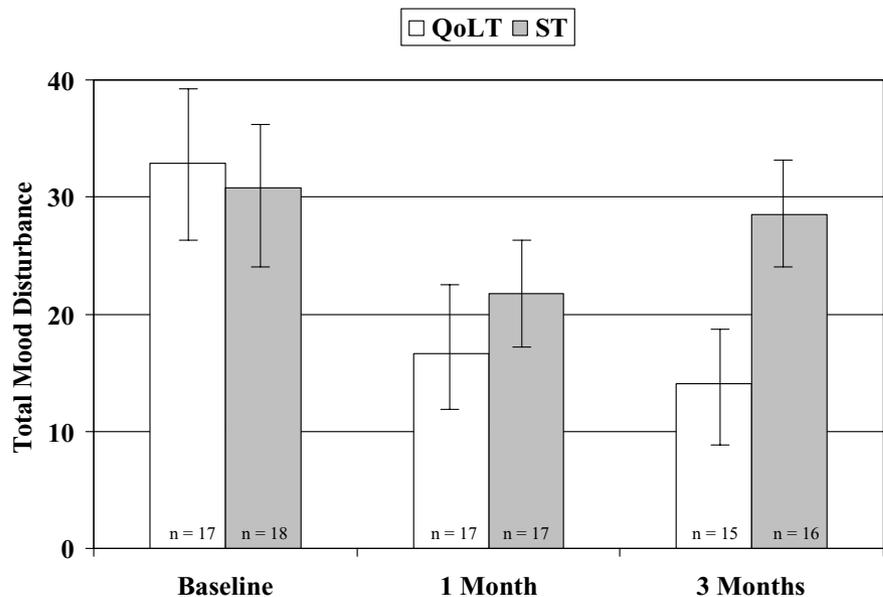A growing body of research has shown that patients awaiting lung transplantation have very low levels of

Figure 2: Comparison of POMS Total Mood Disturbance scores (unadjusted), by treatment condition over time (error bars depict 95% confidence intervals).
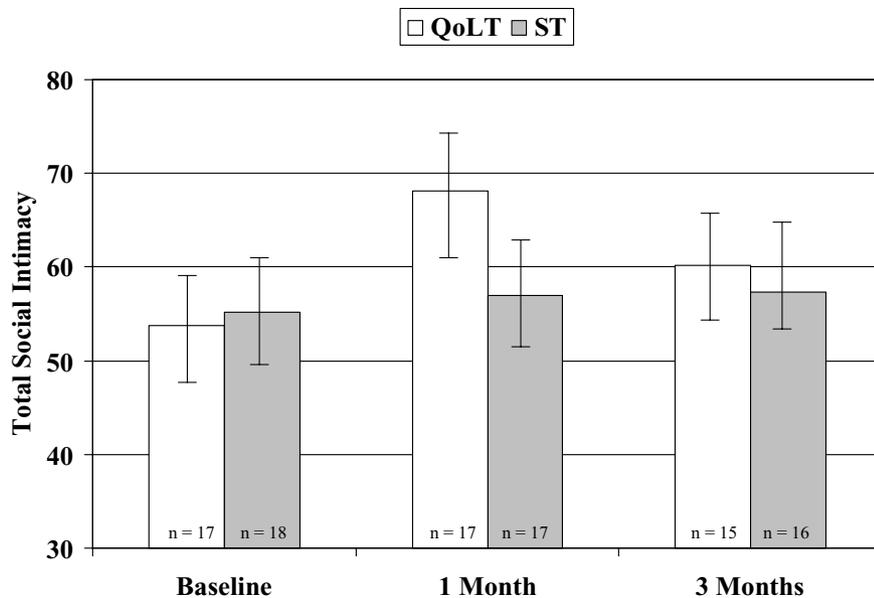
□ **QoLT** ▪ **ST**

Figure 3: Comparison of the MSIS Total Social Intimacy scores (unadjusted), by treatment condition over time (error bars depict 95% confidence intervals).

health-related QOL. This study advances QOL research in lung transplantation by implementing and evaluating an intervention designed specifically to enhance QOL. Four primary findings emerged from this study. First, a brief, targeted psychological intervention (i.e. QOLT) with wait-listed lung transplant patients leads to significant improvement in QOL, mood disturbance and social intimacy. Second, improvements in QOL and mood appear to be maintained for as long as 3 months after treatment. Third, while ST appears to yield some short-term benefits in mood, QOLT is a more effective treatment overall. Fourth, use of the telephone is a viable and effective option for delivering intervention services to this medically disabled patient population.

Findings from this study suggest that QOLT offers a clinical opportunity to enhance the lives of patients while they confront a life-threatening illness and are awaiting lung transplantation. Specifically, by targeting unsatisfactory levels of self-esteem, goals and values, use of leisure time, learning and creative processes and relationships with others, among other life areas, significant QOL, emotional and interpersonal benefits can be realized. The social intimacy finding has potential clinical implications since transplant caregivers are known to have lower QOL and high levels of caregiving stress (31–35). High levels of stress in the patient-caregiver relationship can contribute to increased tension, conflict and interpersonal distancing, as well as poorer psychological outcomes in patients and couples following transplantation (36,37). Psychological interventions that strengthen and enrich the relationship between the transplant candidate and his/her primary caregiver may help ensure the stability of the support system over time. Since the social intimacy benefits observed among patients receiving QOLT decreased

by the 3-month assessment, it may be necessary to either involve the spouse/partner in the treatment process or provide booster sessions specifically targeting social intimacy throughout the transplant waiting period, or both.

ST, whether done individually or in groups, is arguably the most common psychosocial service provided to transplant patients and their families. Findings from the current study indicate that patients receiving individual ST appear to experience some decrease in mood disturbance, but this effect may last for as little as 1 month after treatment ends. It is not known whether ST delivered in a group format would have yielded more favorable clinical findings. Often, patients have the opportunity to participate indefinitely in transplant support groups, and this may provide longer-term mood benefit than what was observed in the current study.

This study highlights that psychological services can be delivered effectively by telephone. Telephone- and Internet-based counseling, especially with medically disabled patients, has yielded favorable clinical outcomes (15,38–41). Many patients awaiting lung transplantation are oxygen-dependent and medically fragile, and traveling long distances to the transplant center for weekly psychological services may not be feasible. Moreover, some patients may reside in communities without access to specialized behavioral health services. Telephone-based services may provide an efficient and cost-effective way for transplant programs to deliver psychological services to this patient population. The design of this study did not permit us to evaluate the benefits of telephone-based services in comparison to more traditional face-to-face services, so this issue warrants further empirical evaluation.

The findings from this study compare favorably to those reported by Napolitano et al. (15). Both clinical trials evaluated the effectiveness of a telephone-delivered psychological intervention with patients awaiting lung transplantation, and both found significant benefit. The Napolitano et al. study offers some advantages over the present study, including larger sample size and broader conceptualization of QOL. The present study has the advantage of a longer follow-up period (i.e. 3 months) and the inclusion of a comparison group that received supportive therapy services. Combined, both studies provide empirical support for the beneficial effects of psychological intervention during the stressful transplant waiting period. They further highlight the need for lung transplant programs to routinely assess QOL and mood disturbance in wait-listed patients, as well as perceived stress in the patient-caregiver relationship. Programs should consider implementing interventions specifically designed to impact QOL before transplantation. Interventions that rely solely on providing transplant education and emotional support run the risk of failing to impact QOL and social intimacy between the patient and caregiver.

The findings reported herein should be evaluated within the context of certain methodological limitations. Specifically, the sample size was relatively small, the recruitment and participation rates were modest, all participants were recruited at one transplant center, the sample was highly educated, and ethnic minorities were not well represented. All of these factors limit the generalizability of the findings. Another limitation was that patients with varying lengths of time on the waiting list were enrolled in this study. Finally, the number of treatment sessions varied, with QOLT patients receiving, on average, one intervention session more than ST patients. This additional intervention time could account for some of the observed treatment effects. A logical next step would be to replicate this study on a larger scale (i.e. multisite study), with a more diverse patient population, and involving an evaluation of when to provide intervention services to achieve optimal effectiveness. Additional research also is needed to examine how long the QOLT benefits can be maintained, and whether they are associated with post-transplant outcomes (e.g. morbidity, mortality, compliance, QOL).

Acknowledgment

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