Factors Affecting Adherence to Rehabilitation Interventions for Individuals With Fibromyalgia

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ABSTRACT. Fibromyalgia Syndrome (FS), a chronic nonarticular rheumatic syndrome, is characterized by diffuse pain and functional impairment. Identifying factors that contribute to treatment adherence is an important research objective. This study examined treatment adherence of 87 people with FS enrolled in a rehabilitation clinical trial study, and randomly assigned to one of three treatment groups: (1) biofeedback, (2) exercise, (3) combination (biofeedback and exercise). Between-group differences on an adherence measure were examined, and multiple regression analyses were used to determine the best model for predicting adherence. The results suggest that adherence among people with FS is multidetermined. Those in the biofeedback intervention were more adherent, suggesting that treatment factors impact adherence. Furthermore, the best model for predicting adherence suggests that subject characteristics like age and education also influence adherence.

Fibromyalgia Syndrome (FS) affects approximately 6 million Americans (Goldenberg, 1987) and is characterized by diffuse pain, disturbed sleep, the presence of tender-points (Yunus, Masi, Calabro, Miller, & Feigenbaum, 1981; Yunus, 1984), and functional impairment (Cathey, Wolfe, Kleinheksel, & Hawley, 1986; Hawley & Wolfe, 1991). Increasing evidence suggests that amitriptyline or cyclobenzaprine (Carette et al., 1994; Santandrea, Montrone, Sarzi-Puttini, Boccassini, & Caruso, 1993), exercise programs (McCain, 1986; McCain, Bell, Mai, & Halliday, 1988; Mengshoel, Komnaes, & Forre, 1992), and biofeedback/relaxation training (Buckelew et al., 1992) may help people with FS better manage pain and reduce disability.

The term adherence refers to the extent to which patients follow the instructions of their health care providers (Meichenbaum & Turk, 1987). The effectiveness of treatment for a chronic illness may depend, in large measure,
upon the extent of patient adherence (Leventhal, Zimmerman, & Gutmann, 1984). However, adherence rates can be quite low. For example, nonadherence rates for all medications written each year are estimated to be 50% (Buckalew & Sallis, 1986). Nonadherence rates for other types of interventions can be even higher. For example, among rheumatoid arthritis patients (RA), estimates of nonadherence rates for behavioral interventions range from 35%-75% (Turk & Rudy, 1991).

Identifying factors that contribute to treatment adherence is an important research objective. To date, no studies have examined factors that predict adherence in a FS sample. The purpose of the present study is to identify factors associated with adherence to rehabilitation treatments among patients enrolled in a FS clinical trial study.

**FACTORS RELATED TO ADHERENCE**

A number of factors have been associated with adherence. One is self-efficacy, which refers to beliefs about one’s ability to successfully manage a challenging situation (Bandura, 1986). Self-efficacy has been positively associated with adherence to a smoking cessation program (Walker & Franzini, 1985), to diabetes regimens (Kavanaugh, Gooley, & Wilson, 1993; Littlefield et al., 1992), and to exercise programs (Desharnais, Bouillon, & Godin, 1986; McAuley, Courneya, Rudolph, & Lox, 1994).

Outcome expectancies, which refer to individuals’ beliefs about the effectiveness of an intervention (Bandura, 1986), should be differentiated from self-efficacy because adherence to a regimen could be low if individuals have low outcome expectations, despite high self-efficacy beliefs. In general, research supports an association between adherence and outcome expectancy. Studies among rheumatoid arthritis patients have found that outcome expectancies predict adherence to both drug regimens (Ferguson & Bole, 1979; Geertsen, Gray, & Ward, 1973) and to a home exercise regimen (Ferguson & Bole, 1979). However, a relationship between outcome expectancy and adherence was not found with a mixed arthritis sample (Carpenter & Davis, 1976).

Rates of depression are generally elevated among people with chronic diseases (Cassileth et al., 1984). In relation to other rheumatic disease groups, depression rates are especially high among those with FS (Hawley & Wolfe, 1992, 1993). In theory, depression and a concomitant sense of helplessness could negatively impact adherence (Seligman, 1975). In fact, there is some empirical support for an association between depression and adherence. For example, higher depression has been associated with lower adherence to a multimodal rehabilitation treatment for kidney transplant patients (Kiley, Lam, & Pollak, 1993), and with lower adherence to a diet/exercise/medication intervention for adults with diabetes (Kavanaugh, Gooley, & Wilson, 1993). Further, with an adolescent diabetic sample, lower rates of adherence were
associated with both higher depression and anxiety (Littlefield et al., 1991). Somewhat surprisingly, one study which analyzed rehabilitation programs for a chronic pain sample found that more adherent participants reported more depression at intake than did lower adherers (Painter, Seres, & Newman, 1980). However, these high adherers also showed consistent improvement in mood over the course of the intervention.

Demographic variables also have been associated with adherence. Among an RA sample, a significant association was found between patient education level and adherence to a medication regimen (Beck et al., 1988). Further, lower educational attainment and lower socioeconomic status have been linked with lower rates of adherence in a rheumatic heart disease sample (Elling, Whittemore, & Green, 1960).

Disease characteristics such as high pain levels and long symptom duration have been negatively associated with treatment adherence (Fuller & Gross, 1990). Furthermore, treatment regimen characteristics may also influence adherence. In general, the more a patient is required to do, and the more complex a treatment regimen, the more likely the occurrence of partial or complete nonadherence (O'Brien, Petrie, & Raeburn, 1992).

Based on the review above, adherence appears to be multi-determined. Furthermore, because different medical populations often feature significantly different symptom profiles, the variables that critically affect adherence may vary among different treatment populations. To date, no known studies have specifically examined adherence vis-à-vis FS. The purpose of the present study is to explore factors that influence adherence to rehabilitation treatment protocols among an FS sample. To this end, the present study will explore the relationship between adherence and treatment characteristics such as group membership, and subject characteristics such as self-efficacy, outcome expectancy, depression, and demographic variables.

**METHOD**

**Participants**

Participants for the present study were part of a prospective rehabilitation clinical trial study for FS. Potential participants were referred by rheumatologists and physiatrists at a midwestern university hospital and from a rheumatology private practice.

Potential participants were excluded for any of the following: (1) organic brain syndrome, (2) psychotic disorder, (3) unstable or uncontrolled medical condition, (4) major communicative disorder, (5) rheumatoid arthritis, (6) widespread osteoarthritis, (7) subjective pain of less than four on a 10-point scale, (8) current participation in regular aerobic exercise, and (9) biofeedback training within the past year.
Because the American College of Rheumatology (ACR) criteria (Wolfe et al., 1990) were not available at the beginning of the project, Yunus’s diagnostic criteria (Yunus, 1984; Yunus, Masi, Calabro, Miller, & Feigenbaum, 1981; Yunus, Masi, Calabro, & Shah, 1982) were used to confirm FS in potential study participants.

Medical charts of 916 prospective participants were reviewed. Of these, 133 persons were successfully recruited, though 14 did not qualify either because of other medical problems or failure to confirm the FS diagnosis. In the end 119 individuals were entered into the study. Post hoc analyses revealed that 73% of this sample also satisfied the ACR criteria.

The mean age of those in the study was 43.96 (SD = 9.18) years. Mean years of education was 13.41 (SD = 2.58). Mean socioeconomic status, as measured by the Hollingshead index (possible range 11 to 77), was 38.64 (SD = 15.96). Average FS symptom duration (since onset of first symptoms) was 12.20 (SD = 9.38) years.

Groups

Participants were randomly assigned to one of the three treatment groups (listed below) or to an attention control condition. The drop-out rate was evenly dispersed across the four groups. Because those in the attention control condition did not receive a treatment intervention that required adherence, this group will not be further discussed.

The three active treatment groups were organized as follows:

**Biofeedback/Relaxation Training Group** (*n* = 30, 1 dropout). Individuals in this group received 1-1.5 hours of individual instruction, once a week for 6 weeks. The intervention focused on muscle relaxation strategies that could be applied to daily living, and on cognitive restructuring techniques. The biofeedback component focused on reducing muscle tension in trapezius and frontalis muscles, and on finger temperature control to help regulate autonomic arousal. Participants also were challenged to examine their life styles and to make changes consistent with the program goals of improved coping.

**Exercise Group** (*n* = 30, 1 dropout). Participants in this group also received 1 to 1.5 hours of individual instruction, once a week for 6 weeks. The intervention focused on a structured exercise program. Basic components included: (1) active range of motion exercises, (2) strengthening exercises, (3) low to moderate intensity aerobic exercise (walking at 60% to 70% of the subject’s age predicted submaximal heart rate), (4) instruction on proper posture and body mechanics, and (5) the use of heat, cold, and self-massage.

**Combination Biofeedback/Exercise Group** (*n* = 30, 1 dropout). Participants in the combination group received 2.5 to 3 hours of individual training, once a week for 6 weeks. During these sessions, participants learned both the exercise and the biofeedback/relaxation interventions in their entirety.
Rehabilitation Interventions for Individuals With Fibromyalgia

Procedures

Participants in the three groups were assessed before a six-week individual training phase. All assessments were scheduled during the afternoon to control for diurnal fluctuations in symptomology. Assessments included: (1) completing a packet of questionnaires to obtain current demographic information and other dependent measures, and (2) a physical exam by one of two physicians. Physicians were trained for tenderpoint exams with a videotape and instructions developed for the ACR multicenter criteria study (Wolfe et al., 1990). Physical examination techniques were standardized with a 4-hour training program that used both FS and control participants.

Measures

Adherence. At each individual training session, participants filled out a questionnaire which asked if they had practiced their respective intervention three or more times over the previous week. Three or more weekly practice sessions was selected as the criterion for adherence in light of exercise frequency recommendations by the American College of Sports Medicine (1986). An answer of “yes” was scored as “1,” while an answer of “no” was scored as “0.” Participants in the combination group answered separate questionnaires for the exercise portion and for the biofeedback portion of their intervention. For those in the combination group, adherence was conceptualized as completing both the exercise and biofeedback components of the intervention. Consequently, participants in the combination group who did not receive a “1” on both treatment components were considered nonadherent (i.e., scored as “0”). For all groups, an overall adherence score was derived by summing the scores over the entire 6-week training session (range 0-6).

Outcome Expectancy. At the first training session, participants’ expectancies about treatment efficacy were measured with the following question: “How confident are you that this treatment program will be successful in helping you manage your fibromyalgia?” Participants marked a 7-point Likert scale, with “not at all” and “very definitely” at the poles.

Tender-Point Index (TPI). During the tender-point examination, the physician, who was unaware of the subject’s treatment group, palpated 10 bilateral tender-point sites. The subject’s behavioral reaction for each site was rated on a 5-point scale, with zero indicating “no hurt/pain” and four indicating “patient untouchable/withdrawal without palpation.” The TPI for each subject was calculated by averaging the sum for all 20 tender-point sites (Wolfe et al., 1990).

Physician’s Rating of Disease Severity. After conducting the tender-point exam, the physician rated disease severity by checking an unmarked horizontal
10 cm. line that was anchored with “absent” to “very severe.” Marks on the line were measured from the left end point and rounded to the nearest .10 of a centimeter, with higher numbers indicating greater disease severity.

**Myalgic Scores.** Using the procedure outlined in the ACR multicenter criteria study (Wolfe et al., 1990), a dolorimeter (Chatillon Instruments, Kew Gardens, NY) was used to palpate six tender-point sites on each subject’s right side. Dolorimeter values for each site could range from zero to nine, and the myalgic score represented the overall sum of dolorimeter values for the six sites. Hewett et al. (1995) established that, with the present sample, an estimate for the reliability of change parameter was .685.

**Visual Analog Scale (VAS).** The VAS allows participants to rate their pain by checking an unmarked horizontal 10 cm. line anchored with “no pain” to “pain as bad as it could be.” Adequate reliability and validity for the VAS have been reported (Huskisson, 1974; Huskisson, 1983; Revill, Robinson, Rosen, & Hogg, 1976). Marks on the line were measured from the left end point and rounded to the nearest .10 of a centimeter, with higher numbers indicating greater disease severity.

**Arthritis Self-Efficacy Scale.** Self-efficacy (SE) was assessed with a scale developed by Lorig and colleagues (Lorig, Chastain, Ung, Shoor, & Holman, 1989). Factor analyses have identified subscales for physical functioning, pain management, and for controlling other symptoms. Both construct and concurrent validity of the scale have been demonstrated (Lorig, Chastain, Ung, Shoor, & Holman, 1989). Given the theoretical relatedness of the subscales, and in light of an acceptable coefficient alpha both between subscales (.76) and within subscales (SE pain, .82; SE function, .93; SE other, .87) for the present study sample, the subscales were summed to provide a single marker of self-efficacy.

**The Arthritis Impact Measurement Scales (AIMS).** The AIMS (Meenan et al., 1984; Meenan, Gertman, & Mason, 1980) is a multidimensional index that measures the health status of individuals with arthritis, and contains 45 health status questions grouped into nine standard component subscales. The AIMS is both reliable and valid (Meenan et al., 1984; Meenan, Gertman, Mason, & Dunaif, 1982). For the present study, only the subscales for depression, anxiety, and pain were used.

**Center for Epidemiologic Studies-Depression Scale (CES-D).** The CES-D is a 20-item 4-point depression scale. Though designed to measure depressive symptomology in the general population (Radloff, 1977), the CES-D also appears to be a valid measure of depression among psychiatric populations (Radloff, 1977), and among individuals with arthritis (Blalock, DeVellis, Brown, & Wallston, 1989). The CES-D has high internal consistency, good discriminant validity, and adequate test-retest reliability (Orme, Reis, & Herz, 1986).

**The Symptom Checklist-90-Revised (SCL-90-R).** The SCL-90-R is a self-report inventory designed to measure the presence and degree of psychological distress. Totals on nine clinical scales reflect various types of psychopathol-
Rehabilitation Interventions for Individuals With Fibromyalgia

The SCL-90-R has been used in a wide variety of research and clinical settings, and excellent reliability and validity has been established (Derogatis, 1977). For the present study, only the subscales for depression and anxiety were used.

The McGill Pain Questionnaire (MPQ). The MPQ, a well validated self-report questionnaire, assesses pain on a number of dimensions (Melzack, 1975). Several investigators (e.g., Burckhardt, 1984; Byrne et al., 1982; ) have produced evidence for the construct validity of these dimensions. The present study used pain intensity scores and body-map drawing scores.

Data Analysis

Many of the measures used in the present study tap similar constructs. Therefore, as a means of data reduction, the feasibility of creating composite scores for depression, anxiety, pain, and disease severity was explored. Principal components factor analyses were conducted on the baseline values of the following conceptually related scales: the CES-D and the depression subscales on the AIMS and the SCL-90-R for a depression composite score; the anxiety subscales of the AIMS and SCL-90-R for an anxiety composite score; the VAS, the pain subscale of the AIMS, and the body map and pain intensity scales from the McGill Pain Questionnaire for a pain composite score; and the myalgic score, the tender-point index, and physician-rated disease severity for a disease severity composite score. Given the established psychometric properties of the measures, composite scores from the subscales were used, rather than the individual items that comprise each subscale.

Demographic variables and the baseline values of the composite scores were evaluated to identify possible pretreatment group differences. Kruskal-Wallis tests were employed because they do not require the populations to be symmetric.

In order to help evaluate whether treatment characteristics affected adherence, a Kruskal-Wallis test also was used to compare adherence levels between the three treatment groups.

Spearman correlations were calculated to clarify the relations between adherence and the predictor variables as well as the relations among the predictor variables.

In order to derive the best regression model for predicting adherence across the treatment groups, the “PROC REG” command from the SAS/STAT software system was used to examine all possible combinations of selected predictor variables. The criterion of largest adjusted $R^2$ was used to determine the best model. Because they have been found to be significant in other studies of adherence, baseline values for the following variables were used as predictors: self-efficacy, outcome expectancy, duration of symptoms, age, education, socioeconomic status, depression, anxiety, pain, and disease severity. Further, it was hypothesized that self-efficacy and age might be differentially related to adherence across the treatment groups. Therefore, interaction terms
for self-efficacy x group and age x group also were included as predictors. Scatter plots were used to help interpret the findings of the best model.

Results

**Composite Scores.** Because the factor loadings for the baseline values of the CES-D (.90), the depression subscales on the AIMS (.79), and the SCL-90-R (.83) were moderately high and of approximately the same magnitude, a composite score of the three measures was used to index depression. In like manner, composite scores were formed for the following constructs (factor loadings in parenthesis): anxiety, from the anxiety subscales of the AIMS (.87) and SCL-90-R (.87); pain, from the VAS (.66), the pain subscale of the AIMS (.70), and the body map (.60) and pain intensity scales (.66) from the McGill Pain Questionnaire; and disease severity, from the myalgic score (-.77), the tender-point index (.92), and physician-rated disease severity (.90).

**Group Comparisons on Independent Variables.** Kruskal-Wallis tests indicated no significant differences among the three treatment groups with regard to age, years of education, duration of symptoms, or socioeconomic status (see Table 1). Further, there were no significant pretreatment differences between

<table>
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<tr>
<th>Table 1. Summary Statistics for Pre-Treatment Demographic Variables</th>
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<tbody>
<tr>
<td><strong>Variable</strong></td>
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<td>---------------</td>
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<tr>
<td>Age, years</td>
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<tr>
<td><strong>M</strong></td>
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<tr>
<td><strong>SD</strong></td>
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<tr>
<td><strong>Range</strong></td>
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<tr>
<td>Education, years</td>
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<tr>
<td><strong>M</strong></td>
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<tr>
<td><strong>SD</strong></td>
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<td><strong>Range</strong></td>
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<tr>
<td>Hollingshead</td>
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<td><strong>M</strong></td>
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<tr>
<td><strong>SD</strong></td>
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<tr>
<td><strong>Range</strong></td>
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<tr>
<td>Duration of symptoms, years</td>
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<tr>
<td><strong>M</strong></td>
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<tr>
<td><strong>SD</strong></td>
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<td><strong>Range</strong></td>
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</table>
the groups on any of the following variables: self-efficacy, outcome expectancy, and the composite scores for depression, anxiety, pain, and disease severity (see Table 2).

**Group Comparisons on the Adherence Measure.** Across groups, the median adherence rate was 5, with an interquartile range (IQR) of 3. Median adherence and IQR by group is as follows: Biofeedback group (median = 6; IQR = 1); exercise group (median = 5; IQR = 3); and combination group (median = 4; IQR = 3). The Kruskal-Wallis test on adherence revealed a significant difference between the three groups ($H = 14.9, p = .006$). Post hoc comparisons revealed that participants in the biofeedback group were significantly more adherent than participants in the exercise or combination groups.

### Table 2. Group Comparison of Pre-Treatment Values for Dependent Variables

<table>
<thead>
<tr>
<th>Variable:</th>
<th>Biofeedback (n=27)</th>
<th>Exercise (n=28)</th>
<th>Combination (n=26)</th>
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<tr>
<td>Depression</td>
<td></td>
<td></td>
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<tr>
<td>$M$</td>
<td>-.24</td>
<td>.38</td>
<td>-.08</td>
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<tr>
<td>$SD$</td>
<td>2.73</td>
<td>0.58</td>
<td>2.71</td>
</tr>
<tr>
<td>Range</td>
<td>-5.1–5.4</td>
<td>-3.9–6.5</td>
<td>-4.8–5.4</td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M$</td>
<td>-.49</td>
<td>.04</td>
<td>-.13</td>
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<tr>
<td>$SD$</td>
<td>1.67</td>
<td>1.67</td>
<td>2.18</td>
</tr>
<tr>
<td>Range</td>
<td>-4.5–2.2</td>
<td>-4.7–2.7</td>
<td>-5.1–2.9</td>
</tr>
<tr>
<td>Disease Severity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M$</td>
<td>.07</td>
<td>.93</td>
<td>-.56</td>
</tr>
<tr>
<td>$SD$</td>
<td>2.42</td>
<td>2.38</td>
<td>2.88</td>
</tr>
<tr>
<td>Range</td>
<td>-5.1–3.2</td>
<td>-3.9–5.1</td>
<td>-5.7–5.0</td>
</tr>
<tr>
<td>Pain</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>$M$</td>
<td>.20</td>
<td>-.19</td>
<td>.46</td>
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<tr>
<td>$SD$</td>
<td>2.46</td>
<td>2.21</td>
<td>3.73</td>
</tr>
<tr>
<td>Range</td>
<td>-6.0–6.0</td>
<td>-5.8–4.5</td>
<td>-8.1–7.1</td>
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<tr>
<td>Outcome expectancy</td>
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<tr>
<td>$M$</td>
<td>5.59</td>
<td>5.86</td>
<td>5.38</td>
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<tr>
<td>$SD$</td>
<td>1.31</td>
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<td>1–7</td>
<td>3–7</td>
<td>1–7</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M$</td>
<td>177.0</td>
<td>178.5</td>
<td>171.3</td>
</tr>
<tr>
<td>$SD$</td>
<td>43.3</td>
<td>48.5</td>
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<tr>
<td>Range</td>
<td>100.2–263.6</td>
<td>61.5–300</td>
<td>81.2–300</td>
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</table>
Further, there were no significant adherence differences between the exercise and combination groups. Finally, within the combination group, there were no significant differences on adherence to the exercise or biofeedback components.

**Correlations between Adherence and Predictors.** None of the correlations between adherence and the predictor variables was significant (see Table 3).

**Predictors of Adherence.** Using the criterion of largest adjusted $R^2$, the following variables provided the best model for predicting adherence: depression, outcome expectancy, education, self-efficacy x biofeedback group, self-efficacy x exercise group, age x biofeedback group, age x exercise group (adjusted $R^2 = .182$). The entire model was found to be predictive of adherence ($F[7,77] = 3.073, p = .007$) and explained 22% of the variance in the adherence measure.

Of the variables in the best model, both the age x biofeedback group and age x exercise group interactions were statistically significant ($b = .05, p = .03; b = .04, p = .04$) (see Table 4). These findings suggest that for both the biofeedback and exercise groups, greater age is associated with higher adherence. An examination of scatter plots did not reveal a clear age level at which adherence rates became higher.¹

**DISCUSSION**

Adherence to rehabilitation training programs among an FS sample appears to be multidetermined. For the study sample, overall adherence rates were relatively high across treatment groups. Nevertheless, treatment characteristics appear to meaningfully influence adherence given that participants in the biofeedback group were significantly more adherent than participants in either the exercise or combination groups.

Research suggests that adherence tends to be lower when a treatment regimen is difficult or inconvenient (O'Brien, Petrie, & Raeburn, 1992). Participants with an exercise component to their treatment (i.e., exercise or combination group) may have found their intervention more difficult than those in the biofeedback group. Generally, modifying physical activity and exercise behavior is difficult (Dubbert, 1992). Further, people with FS often experience increases in subjective fatigue and pain during and after exercise (Norrregaard, Bulow, Mehlisen, & Danneskiold-Samsoe, 1994; Sietsema, Cooper, Caro, Leibling, & Louie, 1993). Thus, general difficulties in exercise adherence and increases in pain secondary to exercise may have mitigated adherence for both the exercise and combination groups. Those in the combination group also may have been less adherent than those in the biofeedback group simply because they were expected to practice both the exercise and the biofeedback interventions in their entirety.

The findings in the present study also suggest that subject characteristics impact adherence. The age x group interaction was a significant predictor

¹ Copies of the scatter plots may be obtained from the corresponding author.
<table>
<thead>
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<th>Subscale:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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<td>Adherence</td>
<td>.5</td>
<td>.19</td>
<td>- .05</td>
<td>.13</td>
<td>.06</td>
<td>.06</td>
<td>.06</td>
<td>.06</td>
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<tr>
<td>1. Self-efficacy</td>
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<td>.24</td>
<td>.07</td>
<td>.03</td>
<td>.03</td>
<td>.03</td>
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<td>2. Outcome Expectancy</td>
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<td>.07</td>
<td>.07</td>
<td>.07</td>
<td>.07</td>
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<td>3. Duration of Symptoms</td>
<td>-.14</td>
<td>- .46</td>
<td>.20</td>
<td>.20</td>
<td>.20</td>
<td>.20</td>
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<td>4. Age</td>
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<td>5. Education</td>
<td>-.57</td>
<td>-.57</td>
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<td>-.57</td>
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<td>6. Socioeconomic Status</td>
<td>-.82</td>
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<tr>
<td>7. Depression</td>
<td>-.02</td>
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<td>8. Anxiety</td>
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<td>9. Pain</td>
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<td>10. Disease Severity</td>
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Note: For each variable, the first numeral listed in each respective column is the correlation coefficient. The second numeral listed is the p-value for that correlation.
within the best overall model, where greater age was significantly associated with greater adherence in both the exercise and biofeedback groups, but not in the combination group.

The reasons for this relationship between age and adherence are unclear. Some studies have found that adherence to regimens like maintenance hemodialysis (Gonsalves-Ebrahim, Sterin, Gulledge, & Gipson, 1987) and skin cancer protective behaviors (Carmel, Shani, & Rosenberg, 1994) is significantly lower in younger participants. However, a study of age differences in adherence to health behaviors like exercise and a low-fat diet found that elderly participants were less likely than younger participants to follow standard health behaviors, except when the elderly participants were unfit (Vetter, Charny, Lewis, & Farrow, 1990). Older participants in the present study may have had higher health motivation, especially if they sensed they were unfit. Alternatively, possibly greater career and child-care responsibilities for younger participants militated against greater levels of adherence. The time commitment required of those in the combination group may have negated the effect of any interaction between age and adherence. In any case, the relationship between age and adherence in the FS population warrants further attention.

In combination, the following variables also were part of the statistically significant “best model” for predicting adherence: educational level, depression, outcome expectancy and interactions between self-efficacy x exercise group and self-efficacy x biofeedback group.

Generally, the literature suggests that those with higher levels of self-
Rehabilitation Interventions for Individuals With Fibromyalgia

Efficacy will be more adherent (Desharnais, Bouillon, & Godin, 1986; Kavanaugh, Gooley, & Wilson, 1993; Walker & Franzini, 1985). Somewhat surprisingly, the present study did not find a strong positive association between self-efficacy and adherence. In fact, though the relationship was non-significant, in both the biofeedback and exercise groups, self-efficacy was negatively associated with adherence. The reasons for this counterintuitive direction are not clear. It is possible that participants with higher levels of self-efficacy more quickly gained a sense of mastery over their respective intervention and, consequently, did not feel the need to practice as much as those with lower levels of self-efficacy.

The present study is not without limitations. Because the ACR criteria were not available when the study commenced, the sample contained some subjects (27%) who did not meet the ACR criteria for FS. However, all analyses were rerun using only those participants that satisfied the ACR criteria. The statistical outcomes for ACR subsample matched those of the original study sample. Therefore, the results of the present study appear to generalize to FM patients diagnosed with both the Yunus and the ACR criteria sets.

A dichotomous self-report measure was used to measure adherence. In retrospect, a continuous measure of adherence might have granted finer discrimination than the measure used in the present study. Future studies also should use additional objective measures of adherence to control for the possible bias of self-report. Furthermore, adherence was measured during the first 6 weeks of individual training. In light of evidence that adherence is inversely related to duration of treatment (Van Wanghe & Dequeker, 1982), a longer-term measure of adherence would have helped explore whether the results of the present study would hold over longer periods of time. Finally, a measure of not only frequency, but also of the quality of adherence for home interventions would be helpful.

Though statistically significant, the multipredictor model in the present study accounted for only 22% of the variance. In order to develop models that explain a greater proportion of the variance, future studies should consider other factors that may significantly impact adherence. For example, evidence suggests that type of social support may significantly impact adherence (Mermelstein, Cohen, Liechtenstein, Baer, & Kamarck, 1986). Other evidence suggests that provider (or trainer)-patient interactions significantly affect adherence (Geertsen, Gray, & Ward, 1973).

The present study suggests that adherence among an FS sample is multidetermined. In addition to evidence that treatment characteristics (i.e., group membership) affect adherence, the significant multipredictor model also suggests that subject characteristics (e.g., age or education level) are influencing factors. Further understanding of the interrelations of these factors may promote greater levels of adherence to treatment interventions among people with FS.
REFERENCES


Rehabilitation Interventions for Individuals With Fibromyalgia


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