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Long Slow Distance Running as a Treatment for Moderate Depression of Outpatients

Dalene DeGraaf VandenHoek
Western Michigan University

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LONG SLOW DISTANCE RUNNING AS A TREATMENT
FOR MODERATE DEPRESSION OF OUTPATIENTS

by

Dalene DeGraaf VandenHoek

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
August 1983
LONG SLOW DISTANCE RUNNING AS A TREATMENT FOR MODERATE DEPRESSION OF OUTPATIENTS

Dalene DeGraaf VandenHoek, M.A.
Western Michigan University, 1983

The purpose of this study was to determine the effect of "long slow distance" (LSD) running as a treatment for moderate depression. Clients diagnosed with "moderate primary depression" were randomly assigned to one of two treatments. Individuals receiving the running treatment walked and ran slowly for forty minutes three times a week for ten weeks. Those receiving psychotherapy participated in behavior therapy one hour a week for ten weeks. According to biweekly scores on the Symptom Checklist-90 and Beck Depression Inventory, the anxiety and depression of the clients who ran improved as much as those receiving behavior therapy.
ACKNOWLEDGEMENTS

I would like to express my appreciation to my husband, Wayne, who cheerfully worked his life around the research and writing of this thesis.

I am greatly indebted to R. Wayne Fuqua for his methodological and editorial assistance. I would also like to thank Chris Koronakos for his assistance with the Human Subjects Committee and for joining my committee on such short notice. Additional thanks go to Malcolm H. Robertson for his suggestions.

I would like to extend my gratitude to Thomas E. Laberteaux for his clinical supervision and Grey Larison, who introduced me to the idea of using running as a treatment for depression.

Much gratitude also goes to Shari Pleune for her clerical assistance.

Dalene DeGraaf VandenHoek
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INTRODUCTION AND REVIEW OF SELECTED LITERATURE

Although many clinicians would assert there is a relationship between physical fitness and mental health, few clinicians prescribe any activity which would systematically improve physical fitness as a means for improving mental health. With increasing interest in exercise, therapists are looking more closely at the role it can play as a treatment modality. Recently there has been an increase in the number of studies which have documented a significant change in mood after an increase in physical capacity.

Mood related disorders such as depression are the most common found in those seeking therapy (Beck, 1967). Current treatments for depression include psychotherapy and antidepressant medication. Psychotherapy is expensive and is not always successful. Antidepressant medications are not very effective for nonendogenous depression and have many side effects (Klein & Davis, 1969), thus limiting the utility and creating compliance problems. The absence of a widely effective and highly efficient treatment for depression has prompted researchers to explore alternative means of treating mood disorders. One intervention which has received increasing attention as an alternative treatment for depression in recent years is aerobic exercise such as running.

As is characteristic of all clinical research on depression, the studies of exercise have relied on standard psychological tests to assess and quantify depression. These psychological tests rely on some form of
self-report or self-rating and include the depression scale of the Minnesota Multiphasic Personality Inventory (MMPI-D) which consists of 60 statements which a person evaluates as true or false. The items in the Multiple Affective Adjective Check List (MAACL) are adjectives frequently used to describe subjective states from which a person makes selections. The Zung Self Rating Depression Scale (SDS) and the Symptom Checklist-90 depression cluster (SCL-90-D) and anxiety cluster (SCL-90-A) are lists of diagnostic symptoms calling for a rating of degree of severity on a four point scale. The Beck Depression Inventory (BDI), used in this study, includes 21 major symptoms of depression with a series of specific statements for each major symptom reflecting varying degrees of depression. The individual selects the statement which most accurately describes himself or herself. As with any self-report, these tests are of questionable validity and reliability and are susceptible to distortion effects. These limitations should be considered when reviewing studies assessing the response of anxiety and depression to any treatment.

Several studies have reported significant decreases in psychological tests which assess anxiety and depression following exercise programs. Folkins, Lynch, and Gardner (1972) showed a significant decrease in both anxiety and depression scores on the MAACL for women in a jogging course and no significant decrease in anxiety and depression in archery and golf courses. Young (1979) reported a decrease in anxiety, but no change in depression for both men and women who participated in an adult exercise program. Men at risk of coronary heart disease showed greater decreases in anxiety and depression after a twelve week
exercise program than those in the no exercise group (Folkins, 1976). An exercise program for both normal and post-infarct males showed significant decreases in anxiety for both groups, but the level of depression was not measured (McPherson, Paivio, Yuhasz, Rechnitzer, Pickard, & Lefcoe, 1967). Lion (1978) used exercise in a clinical setting with chronic psychiatric patients. Runners had a decrease in anxiety while those randomly assigned to the no exercise group showed an increase. Lion did not measure depression.

Systematic exercise programs have decreased depression scores in non-clinical subjects of several studies. Brown, Ramirez, and Taub (1978) noted decreases in SDS scores in college and high school students enrolled in wrestling, mixed exercise, and jogging courses, but not for those enrolled in softball. Sharp and Reilley (1975) found decreased depression (MMPI-D) scores for males in an aerobic conditioning class. Morgan, Roberts, Brand, and Feinerman (1970) studied university professors in a fitness program. He found no significant change in SDS scores of the 101 men at the end of six weeks. However, for eleven of the men who had initial scores indicating depression of clinical significance, a statistically significant reduction in their scores was obtained.

In addition to the previously reviewed studies with non-clinical populations, running has also been used in the clinical treatment of depression. Blue (1979) presented case studies of two patients who were not responding to combined psychotherapy and antidepressant medication. They ran two or three times a week for three weeks. Pretests and posttests on the SDS showed marked decreases in depression scores of
both subjects. Kavanagh, Shephard, Tuck, and Qureshi (1977) presented a one-group pretest-posttest study of 44 depressed postcoronary patients. They used long slow distance (LSD) running as a part of a cardiac rehabilitation program over a period of four years. There were substantial gains in conditioning. As a group, there was a statistically significant improvement in MMPI-D scores, however, of 44 cases: 27 improved, 10 showed no change, and seven became worse. The reasons for the between subject variability in response to running are unclear. The study took place over four years, there were compliance problems, and possible interactions with medications so the results may be attributable to many things other than exercise. A control group is necessary to demonstrate that exercise was the factor causing the decreased depression.

Brown, Ramirez, and Taub (1978) presented a quasi-experimental design with a nonequivalent control group. The subjects were 561 university students, 101 of whom were clinically depressed. Subjects chose whether to participate in a jogging program for 30 minutes five times a week, three times a week, or not at all. Subjects recorded pulses and took a 12-minute fitness test, but the results of these tests were not presented. In 10 weeks, significant reductions in SDS scores were found in the exercise groups of both normal and depressed subjects with greatest improvements shown in those who were depressed initially. Greater improvements were found in those who jogged five times a week rather than three times a week. Having these subjects choose the treatment condition may have significant selection bias which would alter the results of the study.
Greist, Klein, Eischens, Faris, Gurman, and Morgan (1979) randomly assigned patients seeking treatment for depression to one of three treatment programs. Those receiving the running treatment ran three times a week for ten weeks. Others received either time-limited behavior therapy or time-unlimited nondirective therapy. No cardiovascular indexes were reported. Average SCL-90-D scores indicated that the running treatment was at least as effective as the psychotherapy. Two patients of eight in the running group showed little improvement.

There are several methodological weaknesses in the studies using running as a treatment for depression. Blue (1979) and Kavanagh et al. (1977) do not have a control group. Brown et al. (1978) used a control group, but there was selection bias. Greist et al. (1979) is the only experiment with random assignment to groups. Kavanagh et al. (1977) is the only study reporting measures of cardiovascular fitness effects. None of the studies qualified the amount of exercise. All of the measures of depression are self-report rather than objective, potentially verifiable behavioral measures. Thus, a number of methodological problems make it difficult to rule out placebo effects or inaccurate self-reports as responsible for the reported results.

This study was designed to assess changes in anxiety and depression scores in response to LSD running in outpatients diagnosed with moderate depression. The study extended the literature by replicating the Greist et al. (1979) study while trying to correct some of the methodological weaknesses. The subjects were randomly assigned to the running or time-limited behavior therapy treatment conditions. In addition,
documentation of cardiovascular functioning of those receiving the running treatment was accomplished by recording pulse, blood pressure, and time for pulse to return to resting rate after activity. The amount of exercise was quantified by recording running distance and time and translating that to aerobic points (Cooper, 1977). Depression was repeatedly assessed with standard psychological assessment tests used in other studies and through potentially verifiable self-reports of participation in reinforcing activities.
METHOD

Subjects

The subjects were individuals seeking treatment for moderate depression in response to advertisements on bulletin boards and newspapers. The ad read: "DEPRESSION MANAGEMENT PROGRAM Depressed? This program is free because it is part of a research design 10-12 weeks must be 18-35 years old call evenings 942-7493."

The subjects were asked during the intake interview why they had responded to the advertisement. They all indicated that they thought they needed help with their depression, but responded to the ad because the program was free.

The entry criteria for the study included: 18-35 years old, rank in the fiftieth percentile or higher on the SCL-90-D (Derogatis, Note 1), and met the criteria for a diagnosis of minor depression of the Research Diagnostic Criteria (Spitzer, Endicott, & Robins, Note 2). The criteria for minor depression is listed in Appendix A.

The eight subjects who met the above criteria were then asked to sign an informed consent form which described the treatment they would receive. The informed consents for each treatment are shown in Appendix B₁ and B₂. Subjects in the running treatment were also interviewed in detail regarding symptoms of cardiopulmonary or orthopedic distress or history of complications. They were required to obtain written permission from their physician to participate in a running program. A
copy of the Physician Permission Statement is shown in Appendix C. None of those in the running treatment had to be eliminated because of physical limitations.

Experimental Design

A "multiple baseline across subjects" or "time lagged control" design was implemented to evaluate treatment effectiveness (Baer, Wolf, and Risely, 1968). Potential subjects were interviewed until eight individuals with minor depression had agreed to be in the study. They were randomly assigned, four to the running treatment and four to the behavior treatment. Two of the four receiving each treatment were assigned to the time lagged control. All subjects recorded baseline for the first two weeks. Then, half the subjects in each treatment began the treatment while the time lagged control individuals continued recording baseline for two more weeks before beginning the treatment.

Independent and Dependent Variable Measures

The dependent variable was the degree of depression as measured by three indexes of depression: the SCL-90, the BDI, and the Pleasant Events Schedule (PES) (MacPhillamy & Lewinsohn, Note 3). The SCL-90, shown in Appendix D₁, was used by Greist et al. (1979). It is a self-rating instrument with nine symptom clusters including one on depression, shown in Appendix D₂, and one on anxiety, shown in Appendix D₃. The BDI has 21 items written to reflect 21 different manifestations of depression. A sample of the BDI is in Appendix E. Correlations
between psychiatric ratings and the BDI have usually been between .65 and .72 attesting to the validity of the BDI (Phem, 1976). The PES is a 320 item list of events that many find enjoyable. It is shown in Appendix F1. Subjects are asked to report how often these events happened during the last month and rate how enjoyable each of these events was during the last month. The frequency, the enjoyability, and the product dimensions are scored for each scale. See Appendix F2 for a more detailed explanation of scoring the PES. The scales used included: the Total (T) PES, a scale consisting of all 320 items; the mood related (MR) scale, shown in Appendix F3, which is made of 49 items significantly correlated with reported mood; and the "MD" scale which consists of 26 items most discriminating for depressed and others, shown in Appendix F4. One scale developed for this study is an individualized scale consisting of events rated most enjoyable (EME) by each of the subjects on the pretests, see Appendix F5 for a more detailed explanation of the scales. Normative values of these measures are found in Appendix G.

The BDI and the SCL-90 were taken biweekly throughout the ten to twelve weeks and the PES was given at the beginning and end of the study. As a follow-up, all three tests were taken 45 weeks after the initial testing. Subjects also kept a daily log of their pleasant activities. Three variables were examined from the biweekly tests: the BDI scores, the SCL-90-D scores, and the SCL-90-A scores. The initial and final scores of these three variables were also analyzed with the pretests and posttests of the PES. In all, thirteen variables were examined: the BDI; the SCL-90-D; the SCL-90-A, the T, MR, and MD
scales on the PES were each scored on the three dimensions of frequency, enjoyability and product; and the EME scale can only be scored for frequency. Correlations (Pearson r) were done to examine the relationship between the scores on the PES, the BDI and the SCL-90-D.

Independent variables were the different treatments. To quantify the amount of exercise, running distance and time were recorded and translated into aerobic points (Cooper, 1977) which is a measure of the amount of oxygen the body consumes during a specific activity. Each aerobic point is equal to oxygen consumption at the rate of 7.0 ml/kg/min. The number of aerobic points that can be earned during forty minutes of walk-run activity are shown in Appendix H. Individuals receiving the running treatment were also tested for evidence of cardiovascular changes due to the running. Data was recorded for each supervised running session. There were eight measures recorded: aerobic points earned per session, resting pulse, resting systolic blood pressure, resting diastolic blood pressure, recovery pulse, recovery systolic blood pressure, recovery diastolic blood pressure, and the time to resting pulse after session.

Treatment

Those receiving behavior therapy met with the therapist, who was also the investigator, once each week for ten weeks and participated in self management, problem solving, social skills training, and/or relaxation training. They were taught how to increase reinforcing activities and increase reinforcing verbal behavior.
Those receiving the running treatment initially walked and ran slowly with the therapist for forty minutes three times a week for the first four weeks. For the fifth and sixth week, they ran with her twice a week. For the seventh and eighth week, they ran with her once a week. They were encouraged to run at least three times a week for the 10 week period. Running with supervision assisted them to walk and work up to running gradually to promote enjoyment and prevent injuries. They were taught to use breathing rate and the ability to converse while running as an indicator of optimal therapeutic running. Running subjects were told that earlier research indicated that running may be useful in decreasing depression. Depression, anxiety, or personal problems were not discussed during the running sessions.
RESULTS

There was one individual who withdrew from the study. A woman assigned to the two week delay running treatment unexpectedly moved away. The remaining seven subjects completed the ten weeks of treatment. The results were examined to see if there were any differences between the response to the running therapy and the response to the behavior therapy.

Psychological Variables

The scores on the SCL-90-D, the BDI, and the SCL-90-A are similar and they will be discussed together. The biweekly and the follow-up scores of the four individuals participating in the running treatment are shown in Figure 1. Subject 1 and subject 3 reported nearly a complete alleviation of depressive and anxious symptoms, however, subject 2 showed no improvement. The initial scores of subject 2 were considerably higher than those of subject 1 or 3. Subject 4 dropped out.

The biweekly and the follow-up scores of the four individuals who received behavior therapy are shown in Figure 2. Subject 5 reported a complete alleviation of depressive and anxious symptoms. Subjects 6 and 8 showed limited improvement. Subject 7, a two week delay individual, had a decline in her scores before the initiation of treatment. In an anecdotal report, she stated her mother told her she wasn't depressed, just bored so she "decided not to be bored anymore" and she initiated plans to start her own business. The initial scores of subjects 6 and 8 are higher than those of subjects 5 and 7.
Figure 1. Biweekly Scores of the Beck Depression Inventory (BDI), the Symptom Checklist-90 Depression Cluster (SCL-90-D), and the Anxiety Cluster (SCL-90-A) for the Subjects in the Running Treatment.

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Figure 2. Biweekly Scores of the Beck Depression Inventory (BDI), the Symptom Checklist-90 Depression Cluster (SCL-90-D), and the Anxiety Cluster (SCL-90-A) for the Subjects in the Behavior Therapy Treatment.
The patterns of improvement for depression and anxiety are similar for both treatments. Individuals with initial scores on the SCL-90-D between 20 and 30 showed considerable improvement in their scores. Individuals with initial scores on the SCL-90-D over 40 showed either no improvement or very limited improvement.

The pretest and posttest scores on the PES are found on Table 1 with the initial and final scores on the SCL-90 and the BDI. The scores, which are higher on the posttest, have been underlined to make these changes stand out for easier discussion. The pattern for improvement in the PES product scores is similar to the decline in measures of depressive symptoms. Subjects 1 and 3, who improved with the running treatment, showed increases in PES scores. Subject 2, who did not report a decrease in depressive symptoms with the running treatment, showed decreases in PES scores. Similarly, Subjects 5 and 7, in the behavior treatment, showed increases in their PES scores, while subjects 6 and 8 showed decreases.

When the product scores on the PES scale increases, it may be due to an increase in the frequency of the events, the enjoyability of the events, or both. For the four subjects who increased their product scores, these relationships were different: Subject 1 had increases in enjoyability, Subject 3 reported increases in frequency, Subject 5 had increases in both enjoyability and frequency, and Subject 7 had limited increases. The kinds of changes were not related to which treatment the subject received.
### TABLE 1

Pretest and Posttest Scores on the Pleasant Events Schedule (PES), the Symptom Checklist-90 (SCL-90), and the Beck Depression Inventory (BDI)

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<th>PES Scale Dimensions:</th>
<th>Pretest</th>
<th>Posttest</th>
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<tr>
<td></td>
<td>Frequency</td>
<td>Enjoyability</td>
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<td><strong>RUNNING TREATMENT</strong></td>
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<tr>
<td>Subject 1, Total Scale (T)</td>
<td>.88</td>
<td>21</td>
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<tr>
<td>Most Discriminating Scale (MD)</td>
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<tr>
<td>Mood Related Scale (MR)</td>
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<tr>
<td>Events Most Enjoyed (EME)</td>
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<td>1.00</td>
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<td>SCL-90-D (Depression)</td>
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<td>4</td>
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<tr>
<td>SCL-90-A (Anxiety)</td>
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<td>Subject 2, Total Scale (T)</td>
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<td>.91</td>
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<td>Most Discriminating Scale (MD)</td>
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<tr>
<td>Mood Related Scale (MR)</td>
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<td>SCL-90-D (Depression)</td>
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<td>43</td>
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<tr>
<td>SCL-90-A (Anxiety)</td>
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<td>Most Discriminating Scale (MD)</td>
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<td>Events Most Enjoyed (EME)</td>
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<td>SCL-90-D (Depression)</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>SCL-90-A (Anxiety)</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>Subject 6, Total Scale (T)</td>
<td>.76</td>
<td>.63</td>
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<td>19</td>
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<td>SCL-90-A (Anxiety)</td>
<td>41</td>
<td>39</td>
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*All PES posttest scores which are greater than pretest scores are underlined to make them stand out for easier discussion.*
The scores on the MR scale and the EME scale on the PES and the scores on the SCL-90-D and BDI are shown on Figure 3 for the subjects completing the running treatment and on Figure 4 for the subjects receiving the behavior therapy. This shows the pre-post changes and graphically displays the inverse relationship between the PES measures and the other depression scales. Correlation coefficients between the PES, the BDI, and the SCL-90-D are shown on Table 2. The greatest negative relationship is found between enjoyability and the depression scales. A much smaller negative correlation is found between frequency and the depression scales. Thus, changes in depression scores on standard psychological tests appear to be more significantly related to changes in perceived enjoyment of events rather than changes in the frequency of occurrences of pleasant events.

In order to monitor daily changes in mood, subjects were asked to record a daily log of pleasant events and the amount of time they engaged in the activity. Subjects were frequently reminded to be consistent in the amount of detail with which they recorded activities throughout the study. When their logs were examined, however, it was noted that they all wrote fewer items in much less detail as the study progressed. Initially, subjects recorded seemingly minor pleasant events such as a shower or good night's sleep. Later, they recorded only one or two main events of the day. Because of the questionable reliability, these data are not evaluated further.
Figure 3. Pretest and Posttest Scores on the Pleasant Events Scales, the Beck Depression Inventory (BDI), and the Symptom Checklist-90 Depression Cluster (SCL-90-D) for the subjects in the Running Treatment.
Figure 4. Pretest and Posttest Scores on the Pleasant Events Scales, Beck Depression Inventory (BDI), and Symptom Checklist-90 Depression Cluster (SCL-90-D) for the Subjects in the Behavior Therapy Treatment.
TABLE 2

Computation of Pearson r between scores on the Pleasant Events Schedule (PES), the Beck Depression Inventory (BDI), and the Symptom Checklist-90 Depression Scale (SCL-90-D)

<table>
<thead>
<tr>
<th>SCL-90-D</th>
<th>BDI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PES Dimension</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total Scale (T)</strong></td>
<td></td>
</tr>
<tr>
<td>Frequency (F)</td>
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</tr>
<tr>
<td>Enjoyability (E)</td>
<td>-.43</td>
</tr>
<tr>
<td>Product (P)</td>
<td>-.39</td>
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<tr>
<td>Frequency (F)</td>
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<td>Enjoyability (E)</td>
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</tr>
<tr>
<td><strong>Mood Related Scale (MR)</strong></td>
<td></td>
</tr>
<tr>
<td>Frequency (F)</td>
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<td>Product (P)</td>
<td>-.35</td>
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<tr>
<td>Frequency (F)</td>
<td>+.14</td>
</tr>
<tr>
<td><strong>Beck Depression Inventory (BDI)</strong></td>
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</table>

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Cardiovascular Variables

The individuals receiving the running treatment were tested for evidence of improvement in cardiovascular functioning. One of the eight variables examined showed slight trends which could indicate training effect due to the running treatment. These trends were more prominent in subjects 1 and 3. Table 3 shows the number of aerobic points the running subjects were able to earn during each supervised running session. Subject 2 showed no consistent increase in the number of aerobic points she was able to earn in each forty minute session. Subjects 1 and 3 both increased the number of points they could earn. These increases occurred after seven and five weeks of running, respectively.

The pulse and blood pressure was taken on each subject before and one minute after each running session. The time it took the pulse to return to the resting rate after the running session was also recorded. Table 3 shows the biweekly mean values of these cardiovascular measures. There are no changes in these measures that would indicate a conditioning effect from the running.
TABLE 3. Mean Aerobic Points and Cardiovascular Measures During Supervised Running Sessions

<table>
<thead>
<tr>
<th>Subject 1</th>
<th>Weeks</th>
<th>Weeks</th>
<th>Weeks</th>
<th>Weeks</th>
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<td>3 &amp; 4</td>
<td>5 &amp; 6</td>
<td>7 &amp; 8</td>
<td>9 &amp; 10</td>
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<tr>
<td>Mean Aerobic Points</td>
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<td>10.0</td>
<td>10.6</td>
<td>13.0</td>
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<td>86</td>
<td>86</td>
<td>92</td>
<td>88</td>
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<td>Mean Resting Systolic Blood Pressure</td>
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<td>116</td>
<td>115</td>
<td>110</td>
<td>112</td>
</tr>
<tr>
<td>Mean Resting Diastolic Blood Pressure</td>
<td>68</td>
<td>69</td>
<td>65</td>
<td>61</td>
<td>66</td>
</tr>
<tr>
<td>Mean Recovery Pulse</td>
<td>123</td>
<td>109</td>
<td>107</td>
<td>118</td>
<td>128</td>
</tr>
<tr>
<td>Mean Recovery Systolic Blood Pressure</td>
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<td>139</td>
<td>137</td>
<td>134</td>
<td>142</td>
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<tr>
<td>Mean Recovery Diastolic Blood Pressure</td>
<td>77</td>
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<td>62</td>
<td>66</td>
</tr>
<tr>
<td>Mean Time to Resting Pulse</td>
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<td>5 &amp; 6</td>
<td>7 &amp; 8</td>
<td>9 &amp; 10</td>
</tr>
<tr>
<td>Mean Aerobic Points</td>
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<td>10.1</td>
<td>10.2</td>
<td>9.6</td>
<td>sub-</td>
</tr>
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<td>69</td>
<td>78</td>
<td>ject</td>
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<tr>
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<td>91</td>
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<td>ject</td>
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<td>57</td>
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<td>114</td>
<td>112</td>
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<td>63</td>
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<td>Mean Time to Resting Pulse</td>
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<td>35</td>
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<td>5 &amp; 6</td>
<td>7 &amp; 8</td>
<td>9 &amp; 10</td>
</tr>
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<td>123</td>
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<td>Mean Time to Resting Pulse</td>
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<td>33</td>
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DISCUSSION

This study evaluated the relative effects of a walk-run program and behavior therapy in the treatment of individuals with moderate depression. Three running subjects walk-ran for forty minutes three times a week for ten weeks. Four behavior therapy subjects met with therapist for an hour each week for ten weeks. Biweekly scores on the BDI and the SCL-90 indicated decreases in the depression and anxiety symptoms for two of the runners and two of the behavior therapy subjects. One of the subjects in the behavior therapy treatment reported a reduction of depressive symptoms before the onset of therapy. Based on the limited sample of subjects, the two treatments appear to have roughly equivalent therapeutic effects with the running treatment having a slight advantage.

The experiment was designed as a replication of Greist et al. (1979). They found that six of eight subjects in the running treatment showed an amelioration of depressive symptoms. These therapeutic gains were similar to the improvements of the subjects receiving behavior therapy and non-directive therapy. The present results reproduce the results of Greist in that the percentage of subjects in the running intervention approximated the percentage of subjects benefitting from a widely accepted therapy for depression. The results join the outcomes of other studies (Blue, 1979; Brown et al., 1978; and Kavanagh et al., 1977) which indicate that depressive symptoms are reduced during running programs.
The subjects who reported a reduction in depressive symptoms, were the individuals with more moderate depression scores. The subjects who did not respond to therapy, had higher initial depression scores. The individual with the pretreatment reduction in depression scores, calls into question whether any of the treatments were the cause of the reductions in depression. It is possible that all the subjects who had moderate depression scores had spontaneous remissions during the course of the study. Most depression is self limiting (Beck, 1967), which makes it difficult to assess any treatment strategy unless there is a no treatment control.

The PES was used as an objective and potentially verifiable measure of depression. It could also give useful information about the mechanisms of a therapeutic intervention by providing a separate score of increased frequency of events and increased enjoyability of events. Ferster (1973) has suggested that the most effective way to decrease the level of depression is to increase the level of reinforcement. Engaging in a greater number of pleasant activities is one way to increase reinforcement. Subjects in the behavior therapy were specifically encouraged to increase their participation in pleasant activities. In week to week sessions, they all gave anecdotal accounts of activities in which they were engaging. The data would indicate, however, that the frequency of pleasant events did not increase. Furthermore, the individual who had the most significant increase in PES product scores, had a much greater increase in the enjoyability dimension of the PES than in the frequency.
Ransford (1982) has suggested that exercise is an antidepressant that enhances aminergic synaptic transmission in the central nervous system. For the subjects in the running treatment, it was hypothesized that running might have a more significant impact on the enjoyability dimension of the PES because of these biochemical changes caused by the running. One subject, who responded to the running treatment, had most of his increase on the enjoyability dimension of the PES, while the other subject had most of his increase in the frequency dimension. The between subject variability on frequency and enjoyability of events and the limited sample preclude firm conclusions about the mechanism of action for the improvements in the running subjects.

There was a significant negative correlation between the measures of depressive symptoms, the BDI and the SCL-90-D, and the PES scores; thus suggesting the validity of the PES as a measure of depression. It offers several advantages as a research and clinical tool. Unlike standard psychological measures of depression, the PES can be frequently administered without compromising its validity, thus offering nearly continuous assessment of depression. MacPhillamy and Lewinsohn (Note 3) recommended using the PES to generate a list of things subjects found most enjoyable and have them check off the activities they engaged in each day. This method might have been more successful in assessing daily mood, without the decrement in responding on the daily activity log, as in this study.

Cardiovascular measures were taken on the running subjects to assess any training effects of the running. The pulse rates, blood pressures, and recovery time to resting pulse did not change for any of the subjects
in the running treatment. It appears that either longer duration, higher intensity, or longer training period of running; or more sensitive measures of cardiovascular changes are necessary to demonstrate training effects for the running program.

A more sensitive measure of level of fitness is the 12-minute fitness test (Cooper, 1977). Individuals are to run at maximal effort for 12 minutes. The fitness rating is categorized between very poor and superior, depending on the distance run. See Appendix I for the 12-minute fitness categories. This test was not used for this study because it seemed very important for the subjects not to run at maximal effort because this might reduce the enjoyability of the activity and thereby reduce the therapeutic effects of the running. During the study, subjects were to run at moderate effort for 40 minutes. The supervised running sessions might be called a 40-minute fitness test. Subjects who were able to run further as the study progressed were probably demonstrating some training effects. Subjects 1 and 3 were able to run further and earn more aerobic points per session as the study progressed. Subject 2 was not able to go any further at the end of ten weeks of running than she did at the beginning. Reasons for this difference in training effect response were not identified. Since subjects 1 and 3 made substantial gains in reducing depression scores, it is possible their improved level of fitness was responsible for the reduced depression scores. Subject 2's level of fitness and depression scores remained the same. Had she continued running until a training effect occurred, the depressive symptoms might also have improved.
There are several hypotheses as to the mechanism for the therapeutic effects of running. Exercise such as running could increase the level of reinforcement because it may become an intrinsically reinforcing activity. It could also be a means for acquiring social reinforcement (i.e. attention, recognition) for "nonsick" role behavior. Changes in amine levels as a result of exercise may have an impact on the biochemical correlates of depression (Ransford, 1982). It is also possible that other physiological changes associated with running could have an impact on depression.

One plausible theory presented in part by Ledwidge (1980), involves the manner in which the physical effects of running attenuate the signs and symptoms of depression. Correlational data indicates that depression is accompanied by lowered work capacity (Morgan, 1969), decreased amount of stage 4 (delta or deep) sleep (Gillen, Duncan, Pettigrew, Frankel, & Snyder, 1979; Jovanovic, 1977), and heightened muscle tension (Whatmore & Ellis, 1959, 1962). Increases in exercise are associated with increases in physical work capacity and aerobic capacity (Cooper, 1977), increases in deep sleep (Baekeland, 1970; Baekeland & Lasky, 1966), and reduction of muscle tension (de Vries, 1968; de Vries & Adams, 1972). While these studies indicate that exercise may modify some of the physiological correlates of depression, this does not necessarily mean that exercise is useful in treating depression.

There are several limitations to this study. 1) The running trainer may have had the effect of a therapist by providing reinforce-
ment for adaptive behavior. 2) The running subjects had more contact with the investigator than the behavior therapy subjects. 3) There were no baselines for the cardiovascular data. 4) More sensitive cardiovascular indicators or biochemical measures were not available. 5) The inexperience of the therapist may have resulted in less improvement of the subjects in the behavior therapy treatment. 6) Absence of a nonintervention control group to assess for spontaneous remissions.

It is very important that further study be done in this area before running can be advocated as a treatment for depression. Future studies should analyze the relationship between levels of exercise and remediation of depressive symptoms. Is it possible that walking would have been just as effective? Would running five times a week have been more effective? Is supervised running (and perhaps the social reinforcement associated with supervision) an essential treatment component or can clients begin running independently?

Since the results of this study together with other studies indicate there may be some usefulness for running as a treatment of depression, it is important to specify some areas of caution for clinicians who may want to encourage depressed clients to run. It seems very important that clients who begin running have supervision and guidance in setting up a running program. Many individuals who begin to run go at such a pace that it is probably not therapeutic and definitely not enjoyable. These individuals will usually discontinue a running program before any therapeutic effects are realized. This does not mean that all psychotherapists must also learn to be running trainers. There may be valuable programs in the local public school recreation departments or community
based recreation facility to which referrals could be made.

After a running program has been initiated, maintaining running may be a problem. Therapists should teach their clients self management strategies for maintaining a regular running program. Wysocki, Hall, Iwata, and Riordan (1979) demonstrated the benefits of contracting for aerobic points to initiate and maintain exercise. Whether this intervention or other interventions will prove effective in the long term maintenance of aerobic exercise awaits further empirical research. During this study, the clients earned approximately ten aerobic points in each exercise session and they exercised three times a week. Cooper (1977) recommends 30 aerobic points a week for cardiovascular fitness.
REFERENCE NOTES


APPENDIX A

Minor Depressive Disorder - Research Diagnostic Criteria

This category is for nonpsychotic episodes or periods of illness in which the most prominent disturbance is a relatively sustained mood of depression without the full depressive syndrome that characterizes Major Depressive Disorder. (Do not include bereavement following the loss of a loved one if all of the features are commonly seen in members of the subject's subcultural group in similar circumstances unless the design of the study calls for their inclusion.) This category is distinguished from Generalized Anxiety Disorder in which there is a clear predominance of anxious mood, and from Labile Personality in which the depressed mood rarely lasts more than a few hours or days at a time. It is also to be distinguished from Intermittent Depressive Disorder. If the subject has had two or more episodes of Major Depressive Disorder in the past, this diagnosis may be skipped, unless he is currently in an episode or period of Minor Depressive Disorder.

The condition may be chronic in that the period may be of very long duration or may have continued up until the onset of another superimposed disorder such as Schizophrenia, Major Depressive Disorder, Manic Disorder, etc. If the subject has had Minor Depressive Disorder for at least two years prior to the onset of a superimposed disorder, both disorders should be noted for the present illness and the duration noted for each.
A through F are required for the episode of illness being considered.

A. An episode of illness in which a relatively persistent depressed mood dominates the clinical picture (or is coequal with anxiety). The depressed mood may be described as depressed, sad, blue, hopeless, low, or down in the dumps.

B. Two or more of the symptoms listed below have appeared as part of the episode:

1. Poor appetite or weight loss or increased appetite or weight gain (change of one pound a week over several weeks or ten pounds a year when not dieting).
2. Sleep difficulty or sleeping too much.
3. Loss of energy, fatigability, or tiredness.
4. Psychomotor agitation or retardation (but not mere subjective feeling of restlessness or being slowed down).
5. Loss of interest or pleasure in usual activities, including social contact or sex (do not include if limited to a period when delusional or hallucinating).
6. Feelings of self-reproach or excessive or inappropriate guilt (either may be delusional).
7. Complaints or evidence of diminished ability to think or concentrate, such as slowed thinking, or indecisiveness (do not include if associated with obvious formal thought disorder).
8. Recurrent thoughts of death or suicide, or any suicidal behavior.
(9) Nonverbal manifestations of depression such as tearfulness or sad face.
(10) Pessimistic attitude.
(11) Brooding about past or current unpleasant events.
(12) Preoccupation with feelings of inadequacy.
(13) Resentful, irritable, angry, or complaining.
(14) Demandingness or clinging dependency.
(15) Self-pity.
(16) Excessive somatic concern.

C. Duration of episode at least one week for probable, two weeks for definite.

D. The episode of illness being considered does not meet the criteria for Major Depressive Disorder; Schizophrenia; Schizo-affective Disorder, Manic or Depressed Type; Briquet's Disorder (Somatization Disorder); Unspecified Functional Psychosis; Manic Disorder; Cyclothymic Personality; Labile Personality; or Intermittent Depressive Disorder. [If the condition, Minor Depressive Disorder, has been chronic (i.e., two or more years), an episode of Major Depressive Disorder, Schizo-affective Disorder, or Manic Disorder may be superimposed. In that case, both disorders are noted for the present illness and the duration noted for each.]

E. The episode of illness may be superimposed on another pre-existing psychiatric disorder, for example, Alcoholism, Phobic or Obsessive Compulsive Disorder. This category should be given as an additional
diagnosis only if the depressed mood, by virtue of its intensity or effect on functioning, can be clearly distinguished from the subject's usual condition.

F. When the episode of illness is not superimposed on another pre-existing psychiatric disorder, it must result in either impairment in functioning with family, at home, at school, at work, or socially, taking medication, or seeking or being referred for help from someone.
APPENDIX B1

Sample of Informed Consent for the Running Treatment

Program Description

Program Name: Evaluation of treatment strategies for mood changes of clinic outpatients
Investigator: Dalene DeGraaf VandenBoek
Starting date: January 1982

This program is developed to compare different methods of treating mood changes of clinic outpatients. One method that has been shown in other clinics to be effective in treating mood changes is walk-running. I would like to introduce using this method in this clinic. If you participate in this program you will be encouraged to walk-run for forty minutes a day three times a week for ten weeks. For the first four weeks you will have one to one supervision with a registered nurse and an experienced runner three times a week. During the fifth and sixth week you will walk-run with supervision two times a week and be encouraged to go on your own once a week. For the seventh and eighth week you will walk-run with supervision once a week and be encouraged to go on your own two times a week. For the last two weeks you will be encouraged to go on your own three times a week. You will be taught warm up exercises and have a cool down period. You will be taught to use pulse and respiration rate and the ability to converse while walk-running to set a safe and comfortable pace.

During the program you will be asked to fill out multiple choice questionnaires every two weeks. You will also be asked to keep a daily record of pleasant activities.
Informed Consent

Program name: Evaluation of treatment strategies for mood changes of clinic outpatients
Investigator: Dalene DeGraaf VandenHoek
Starting date: January 1992

I, ______________________ (your name) hereby give my informed consent to participate in this program. I understand that I may withdraw my consent at any time. I further understand that refusal to participate in this program will in no way affect my eligibility for treatment at this clinic. I understand that all information which is obtained will be kept strictly confidential, and that all efforts will be made to keep my identity anonymous. I consent to allow this information to be presented to other professionals through reports and presentations, provided my identity remains confidential.

Benefits of participating in this program:
1. You will learn a safe and effective method of exercising by walking and running slowly.
2. Regular participation in a walk-running program has been correlated with cardiovascular fitness.
3. Walk-running may become a pleasant relaxing activity that can be implemented by you alone in the future.
4. Your mood level will be carefully monitored through biweekly questionnaires and daily recording of pleasant activities so that appropriate clinical action can be taken if your mood level decreases.
5. Trained therapists will be available for emergency consultation in addition to regular sessions.

Risks of participating in this program:
1. As with participation in any exercise program, there are risks of physiological injury including pulled muscles, abrasions from a fall, cramps and cardiovascular complications. To mitigate against these risks we will teach you warm up exercises, have a cool down period, and supervise walk-running so a slow safe rate of progress is made. Pulse, blood pressure, and respiration rate will be monitored by a registered nurse.
2. People who walk-run may be exposed to social pressures by people who do not run.

___________________________  ________________________
Your name                   Date

___________________________  ________________________
Witness                     Date

___________________________  ________________________
Investigator                Date
APPENDIX B

Sample of Informed Consent for Behavior Therapy

Program Description

Program name: Evaluation of treatment strategies for mood changes of clinic outpatients
Investigator: Dalene DeJaaaf VandenHoek
Starting date: January 1982

This program is developed to compare different methods of treating mood changes of clinic outpatients. You will be receiving the time-limited psychotherapy treatment. You will see a therapist at the clinic once a week for ten weeks. You will be receiving the same type of therapy as you would normally receive. During the program you will be asked to fill out multiple choice questionnaires every two weeks. You will also be asked to keep a daily record of pleasant activities.
Informed Consent

Program name: Evaluation of treatment strategies for mood changes of clinic outpatients
Investigator: Dalene DeGraaf VandenHoek
Starting date: January 1982

I, ____________________________ (your name) hereby give my informed consent to participate in this program. I understand that I may withdraw my consent at any time. I further understand that refusal to participate in this program will in no way affect my eligibility for treatment at this clinic. I understand that all information which is obtained will be kept strictly confidential, and that all efforts will be made to keep my identity anonymous. I consent to allow this information to be presented to other professionals through reports and presentations provided my identity remains confidential.

Benefits of participating in this program:
1. You will learn new ways of coping so you can deal more effectively with circumstances which may lead to mood changes in the future.
2. Your mood level will be carefully monitored through biweekly questionnaires and daily recording of pleasant activities so that appropriate clinical action can be taken if your mood level decreases.
3. Trained therapists will be available to you for emergency consultation in addition to regular sessions.

Risks of participating in this program:
1. As with any psychotherapy there is a risk involving talking through emotion laden experiences and trying out new ways of coping with mood changes.

____________________________  ____________________
Your name  Date

____________________________  ____________________
Witness  Date

____________________________  ____________________
Investigator  Date
APPENDIX C

Physician Permission Statement

Program name: Evaluation of treatment strategies for mood changes of clinic outpatients
Investigator: Dalene DeGraaf Vandennoer
Starting Date: January 1992

Program Description

A program of moderate aerobic exercise will be utilized to treat mood changes of clinic outpatients. Clients will be encouraged to walk-run for forty minutes a day three times a week for ten weeks. They will have one to one supervision with a registered nurse who is an experienced runner three times a week for the first four weeks, two times a week for the fifth and sixth week, and one time a week for the seventh and eighth week. Client's pulse, respiration and blood pressure will be monitored immediately after running for the first four weeks and at intervals throughout the remainder of the study. Clients will be taught warm up exercises and have a cool down period. They will be taught to use pulse and respiration rate and the ability to converse while walk-running to set a safe and comfortable pace.

I, ___________________________ (physician's name) examined
____________________________________ (client's name) on ________, 1992.

Check one:

( ) This patient has no physical limitations which would limit his/her participation in the exercise program outlined above. I hereby give my permission for this patient to participate in the program without restriction.

( ) This patient has a physical limitation which would limit his/her participation in the exercise program outlined above. I hereby withhold my permission for this patient to participate in the program.

( ) Because this patient has some physical limitations I permit his/her participation in the exercise program outlined above only with the following restrictions:

__________________________________________

I understand I will be contacted if this patient develops any untoward symptoms while participating in this program.

__________________________________________

physician's signature
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These consist of pages:

40-43, SAMPLE OF SYMPTOM CHECKLIST-90
44-45, SAMPLE OF BECK DEPRESSION INVENTORY
46-55, SAMPLE OF PLEASANT EVENTS SCHEDULE

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Scoring the Pleasant Events Schedule

The Pleasant Events Schedule is designed to measure the frequency and enjoyability of activities and situations that many people find pleasant. Subjects go through the list of 320 items twice.

The first time they score the items according to how often the events happened in their lives in the past month. 

(a) This has not happened in the last thirty days," is given a weighted score of zero.
(b) This has happened a few times (1 to 6) in the last thirty days," is given a weighted score of one. 
(c) This has happened often (7 or more) in the past thirty days," is given a weighted score of two. The frequency on any scale is determined by adding the weighted scores and dividing the sum by the total number of items of that scale. Frequency ranges between zero and two on any scale.

The second time they score the item according to how enjoyable, pleasant, or rewarding the item was, or they think it would have been, during the past month. 

(a) This event was not pleasant," is given a weighted score of zero. 
(b) This event was somewhat pleasant," is given a weighted score of one. 
(c) This event was very pleasant," is given a weighted score of two. The enjoyability on any scale is determined by adding the weighted scores and dividing by the total number of items of that scale. Enjoyability ranges between zero and two.

A product is determined by multiplying the weighted enjoyability
score by the weighted frequency score for each item. The weighted products are added together and divided by the number of items on the scale. The possible range of the product is zero to four. Thus, an item that is either not enjoyable or is not engaged in has a weighted product score of zero. Items marked "b" for both enjoyability and frequency have a weighted product score of one. Items marked "b" on one dimension and "c" on the other have a weighted product score of two. Items engaged in very frequently and which are very enjoyable have a weighted product score of four.

Increases in the product score may be due to different factors. The subjects may find more items enjoyable or may be engaging in the events more often. If subjects chose to do things they do not enjoy less frequently and spend that time doing things they do enjoy more frequently, the product scores will increase while the enjoyability and frequency scores may decrease or stay the same.
APPENDIX F

Items of the Pleasant Events Schedule (PES) Mood Related Scale (MR)

1. Being in the country
5. Meeting someone new of the same sex
9. Planning trips or vacations
22. Reading stories, novels, poems, or plays
25. Driving skillfully
26. Breathing clean air
29. Saying something clearly
38. Thinking about something good in the future
41. Laughing
53. Being with animals
56. Having a frank and open conversation
60. Going to a party
70. Wearing informal clothes
74. Being with friends
93. Being popular at a gathering
94. Watching wild animals
101. Sitting in the sun
105. Seeing good things happen to my family or friends
109. Planning or organizing something
114. Having a lively talk
117. Having friends come to visit
133. Wearing clean clothes
144. Seeing beautiful scenery
145. Eating good meals
154. Doing a job well
155. Having spare time
158. Being noticed as sexually attractive
163. Learning to do something new
165. Complimenting or praising someone
166. Thinking about people I like
179. Kissing
185. Feeling the presence of the Lord in my life
186. Doing a project in my own way
202. Having peace and quiet
215. Being relaxed
219. Sleeping soundly at night
238. Petting, necking
239. Amusing people
243. Being with someone I love
248. Having sexual relations with a partner of the opposite sex
255. Watching people
265. Being with happy people
273. Smiling at people
276. Being with my husband or wife
277. Having people show interest in what I have said
282. Having coffee, tea, a coke, etc., with friends
291. Being complimented or told I have done well
292. Being told I am loved
311. Seeing old friends
APPENDIX F_4

items of the Pleasant Events Schedule (PES) most discriminating between depressed persons and others scale (MD)

5. Meeting someone new of the same sex
14. Reading the scriptures or other sacred works
24. Going to lectures or hearing speakers
26. Breathing clean air
46. Having lunch with friends or associates
60. Going to a party
74. Being with friends
93. Being popular at a gathering
105. Seeing good things happen to my family or friends
109. Planning or organizing something
119. Introducing people who I think would like each other
141. Meeting someone new of the opposite sex
154. Doing a job well
163. Learning to do something new
183. Being praised by people I admire
185. Feeling the presence of the Lord in my life
201. Getting up early in the morning
204. Visiting friends
215. Being relaxed
219. Sleeping soundly at night
255. Watching people

61
259. Finishing a project or task
265. Being with happy people
270. Going to banquets, luncheons, potlucks, etc.
306. Making a new friend
311. Seeing old friends
APPENDIX F5

Scales used on the Pleasant Events Schedule

The Total (T) scale is simply the enjoyability, frequency, and product for all of the 320 items on the PES. It is not a scale used by Lewinsohn, but was used for the purpose of this study to detect any changes in the activity level of the subjects.

The Mood Related (MR) is a scale of 49 items which were found to be significantly correlated with reported mood. Subjects in a study by Lewinsohn recorded the frequency of activities they had given the highest enjoyability ratings. They also took a Depression Adjective Checklist each day. "Almost half of the items involve social interaction; another substantial group consists of behaviors which are intrinsically mood related (e.g. laughing, being relaxed); the third major grouping consists of items related to competence and independence" (Mac Phillamy & Lewinsohn, Note 3). A list of the items on the MR scale is found in Appendix F3.

Twenty-six items have been found to be most discriminating between depressed, normal, and psychiatric control subjects. These items form what is called the MD scale. Fifteen of the items on the MD scale are also on the MR scale. A list of items on the MD scale is found in Appendix F4.

Lewinsohn proposed that if subjects were to engage in activities which they considered most enjoyable more frequently, they would become less depressed. An individualized scale was developed consisting of
the events most enjoyed (EME) by each subject on the pretest. The EME scale for each subject is used to see if subjects are doing the things they enjoy the most more often as their depression lessens.
APPENDIX G

Normative Data of Each of the Depression Scales

Beck Depression Inventory (BDI)

Distribution of Means (X) and Standard Deviation (SD) of BDI scores according to Depth of Depression (Beck, 1967)

<table>
<thead>
<tr>
<th>Depth of Depression</th>
<th>None</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>10.9</td>
<td>18.7</td>
<td>25.4</td>
<td>30.0</td>
</tr>
<tr>
<td>SD</td>
<td>8.1</td>
<td>10.2</td>
<td>9.6</td>
<td>10.4</td>
</tr>
</tbody>
</table>

Symptom Checklist-90 (SCL-90) Depression and Anxiety Clusters

Percentile Rank of SCL-90 scores of clinic outpatients (Derogatis, Note 1)

<table>
<thead>
<tr>
<th>Percentile Rank</th>
<th>Depression</th>
<th>Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>Females</td>
<td>Males</td>
</tr>
<tr>
<td>25 percentile</td>
<td>10.92</td>
<td>15.21</td>
</tr>
<tr>
<td>50 percentile</td>
<td>18.72</td>
<td>25.74</td>
</tr>
<tr>
<td>75 percentile</td>
<td>29.12</td>
<td>34.45</td>
</tr>
</tbody>
</table>

Pleasant Events Schedule

Mean (X) and Standard Deviation (SD) of normal individuals (Mac Phillamy & Lewinsohn, Note 3)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Total Population</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency (F)</td>
<td>1.3074</td>
<td>0.2612</td>
<td></td>
</tr>
<tr>
<td>Enjoyability (E)</td>
<td>1.5114</td>
<td>0.2687</td>
<td></td>
</tr>
<tr>
<td>Product (P)</td>
<td>2.1274</td>
<td>0.6055</td>
<td></td>
</tr>
</tbody>
</table>

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APPENDIX H

Aerobic Points earned in 40 minutes over different distances

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## APPENDIX I

**Twelve-minute Fitness Categories for the 30-39 Age Group**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>12-MINUTE DISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MEN</td>
</tr>
<tr>
<td>I. Very Poor</td>
<td>Less than 1.18</td>
</tr>
<tr>
<td>II. Poor</td>
<td>1.18-1.30</td>
</tr>
<tr>
<td>III. Fair</td>
<td>1.31-1.45</td>
</tr>
<tr>
<td>IV. Good</td>
<td>1.46-1.56</td>
</tr>
<tr>
<td>V. Excellent</td>
<td>1.57-1.69</td>
</tr>
<tr>
<td>VI. Superior</td>
<td>More than 1.70</td>
</tr>
</tbody>
</table>

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BIBLIOGRAPHY


Gillen, J. C., Duncan, W., Pettigrew, K. D., Frankel, B. L., & Snyder, P. Successful separation of depressed, normal, and insomnia subjects by EEG data. Archives of General Psychiatry, 1979, 36, 85-90.


