Journal of Psychosomatic Research, Vol.22, pp. 259-294. 0022-3999/78/0801-0259 $02.00/0

RUNNING THROUGH YOUR MIND

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SUMMARY

While antidepressant medications and electroconvulsive therapy have been shown to be effective treatments for severe depression, mild and moderate depressions seldom respond to medications and are usually managed by a variety of psychotherapies, all of which are equally and minimally beneficial. Clinical experience suggested that physical activity might be helpful in treating moderate depression. After reviewing the available literature (analogue studies suggested a negative correlation between exercise and depression), we conducted a clinical study comparing a 10 week course of thrice weekly walking-jogging-running with 10 weeks of two different psychotherapies. Patients with moderate ("neurotic-reactive") depression were randomly assigned to the three treatments. Walking-jogging-running was at least as effective as either psychotherapy and cost a quarter as much to adminster. Follow-up shows continued freedom from depression in runners, most of whom have continued the treatment on their own. Possible mechanisms of reaction will be discussed.

INTRODUCTION

"Mens Sana in Corpore Sano" Homer

For centuries Man has had strong opinions about the importance of exercise in the maintenance of physical and mental health. Unfortunately, very little systematic study has been conducted to determine whether there is a relationship between exercise and mental health and, if a positive relationship exists, what specific factors under the broader rubric of "exercise" are responsible for its effectiveness in the maintenance and restoration of health.

THE PHYSICAL CONSEQUENCES OF EXERCISE

While recognizing that the distinction is conceptually naive, it is heuristically useful to differentiate physical from mental health because there is a substantial body of evidence concerning the positive physiological consequences of regular exercise in contrast to a paucity of data concerning psychological changes associated with exercise. The substantial interest in the effect of exercise on physical health has produced evidence that exercise reduces the risk of coronary artery disease, obesity, hypertension, and associated risk factors of cigarette smoking, elevated blood lipids and "type A" personality characteristics. All of these factors influence life span to some extent and though prospective statistical proof is difficult to obtain, it appears ever more certain that exercise *per se* reduces the risk of life-threatening physical disease and thereby increases longevity.

A recent study of 43 men, age 45 to 55, highlights the physiological implications of jogging.[1] Two-thirds of these subjects were

previously sedentary. They all participated for 6 to 10 years in a thrice weekly, 30 to 40 minute jogging program. At the end of that time, subjects showed consistent decreases in resting heart rate and increases in maximum oxygen consumption, a reversal of the "normal" decline in maximum oxygen consumption with age. Another study of 66 sedentary middle-aged men (mean age 47) who participated in an exercise program found similar results.[2] Thus, deconditioned, sedentary middle-aged men can reverse the expected decline in physical functional capacity through participation in a regular exercise program.

THE PSYCHOLOGICAL CONSEQUENCES OF EXERCISE

> "Avoid exercising either mind or body without the other, and thus preserve an equal and healthy balance between them. So anyone engaged on mathematics or any other strenuous intellectual pursuit should also exercise his body and take part in physical training. By such moderate motion he can reduce to order and system the qualities and constituents that wander through the body." Plato: Timeaus and Cortias (translated by H.D.P. Lee): Penguin Books, 1971, p. 117.

Most studies of the effects of running on mental health have been uncontrolled or conducted on analogue populations. They will be described in the context of the population examined.

DEVELOPMENTAL DELAY IN CHILDHOOD AND ADOLESCENCE

Among the most impressive studies reporting a positive relationship between fitness and emotional health are those of Johnson and co-workers.[3] They found improvement in fitness in handicapped children (mental retardation and various neurological disorders which caused visual and speech problems) to be associated with improvement in various aspects of emotional health. With improvement in physical fitness, they reported improvement in social adjustment, school work, finger skills, speech, functional intelligence and response to various forms of psychotherapy. Holden[4] reported evidence of significant improvement in body images of 69 physically handicapped children as a result of a two-week camping experience. Schultz[5] found statistically significant superiority in the body image of high school girls of high physical fitness as compared with girls of low fitness. Bonniwell[6] obtained measures of body image of 16 children with various neuromotor problems before and after individualized physical developmental programs. He reported a definite relationship between improvement in confidence, classroom performance and social adjustment.

These studies suggest beneficial psychological and intellectual effects of exercise, but do not allow the relative contribution of increased physical fitness, improved motor control and therapist-child relationship to be untangled. They do, however, support the general observation that when physical functioning of large and small muscle groups is brought under better control, the person's intellectual and emotional components have greater opportunity for maturation and expression. The American developmental sequence of gross motor development followed by fine motor manipulation succeeded by predominantly symbolic verbal

manipulation without actual physical movement obscures the importance of physical activity in adulthood. Even at earlier ages there is evidence that the television has replaced the playground as a major source of entertainment. Our sedentariness has come back to haunt us in the pandemic of coronary artery disease now afflicting all industrialized nations of the world. In this regard Morgan[7] has shown that despite the significantly more positive attitudes toward physical activity in former athletes as compared with former nonathletes, the two groups did not differ significantly ($P > .05$) in their reported frequency, duration of intensity of current exercise patterns, and these self-reported activity levels were confirmed by similar weight, percent of body fat and maximal aerobic power in the two groups. To summarize:· In a number of uncontrolled studies, children seem to respond to improved neuromuscular control and fitness with generalized improvement in many intellectual and psychological spheres.

ADOLESCENCE

Jankowski[8] treated 208 inpatient and outpatient adolescent boys having problems with learning, running away, alcohol or other drugs with either thioridazine (3-4 mg/kg body weight), eclectic psychotherapy or kinesitherapy (2 hours, twice weekly "intensive athletic training or hard physical activity - mainly sports activity" (emphasis added). No difference in outcome was observed. We speculate that the competitiveness of the activity employed and the failure to individualize exercise intensity may have limited any possible benefits.

THE GERIATRIC POPULATION

Powell[9] used a randomized block design to examine the cognitive and behavioral consequences of 21 weeks of exercise therapy on institutionalized geriatric mental patients. Significant improvement in the Ravens Progressive Matrices Test and Wechsler Memory Scale was found in the exercise group as compared with an untreated control group and a group participating in scheduled social activities. No effort was made to document possible increased physical fitness. Stamford et al[10] exercised nine male geriatric mental patients daily for 12 weeks. Physiological training effects were documented in this study as evidenced by decreased resting heart rate and decreased systolic blood pressure. Significant improvements on both the general information section of the WAIS and a standardized questionnaire used at the Woodville State Hospital were demonstrated by the experimental patients versus a control group.

Buccola and Stone[11] studied men between 60 and 79 years of age who jogged or cycled for 10 to 40 minutes 3 days per week for 14 weeks. Similar weight and blood pressure decreases in both groups were observed while maximum oxygen consumption increased. Based on the Cattell 16-Personality Factor Questionnaire, the walk-jog group became more sober and self-sufficient, a change not found in the cyclers. If one discounts improvements attributable to the Hawthorne effect (a subject works hard simply on behalf of the experiment and consequently improves), each of these studies support the concept of improved psychological functioning as measured by cognitive tests accompanying increases in physical fitness.

DRUG ADDICTION

Sheehan[12] clearly recognized the addictive properties of running and Glasser[13] aptly described running as a "positive addiction" for regular adherents. For these "addicts," running represents a daily activity that they feel compelled to perform. When unable to run, a withdrawal syndrome much like a drug withdrawal syndrome sets in. This was strikingly illustrated when Baekeland[14] attempted to study changes in sleep EEG's of steady exercisers deprived of their exercise for long periods. Daily exercisers refused to join the study despite substantial monetary inducements to do so and he finally had to settle for subjects who exercised only three days a week. He concluded that even in this group the month-long period without exercise resulted in impaired sleep, increased sexual tension and an increased need to be with others.

Observations of running's addictive potential suggested that regular exercise might be an effective replacement therapy for the common addictions and Guthrie[15] reported that a group of hospitalized alcoholics who jogged one mile per day for twenty days improved their cardiovascular fitness, self-esteem and slept better when compared with a group of non-exercising controls who continued usual ward activities.

Dodson and Mullens[16] studied the effects of jogging on 18 Veterans Administration Hospital inpatients with a variety of psychiatric disorders including alcoholism who ranged from being "well-oriented" to "out of contact." Three weeks of daily jogging resulted in increased fitness as reflected in a decreased resting pulse rate and increased respiratory capacity. There was a significant decrease in the hypochondriasis (Hs) and psychasthenia (Pt) scales of the MMPI during jogging

while no change was observed on these dimensions in a control group. The most provocative aspect of the study was that only ten of the eighteen study patients were still in the hospital six months later, a significant decrease in the normal length of hospitalization for the ward studied. However, the authors were concerned that, "we had no way to measure how much of this effect was halo, that is, more positive attitudes toward the patients."

ANXIETY NEUROSIS AND PHOBIAS

In an uncontrolled study, Orwin[17] described the successful treatment of eight agoraphobic patients using the vigorous physical exertion of running to compete with the anxiety response of the agoraphobic. Orwin[18] also reported using strenuous running in the successful treatment of a specific phobia. The running was usually "close to the limit of toleration...at her best speed" and produced "breathlessness for several minutes... gasping for air," although one of the agoraphobic patients ran at a "jog-trot." Orwin explained, "In the running treatment the anxiety response may be inhibited at a physiological level of competition from an already activated autonomic system coping with the urgent metabolic needs of vigorous physical activity. Moreover, the internal excitation is matched by appropriate external behavior, established before the anxiety can be produced. The patient only enters an 'anxiety zone' when in urgent need of breath and with rational external cause for the obvious inner activity, so that cognitive labeling is now appropriate. If an anxiety response is produced, it may not be recognized, being overshadowed by other needs, eg, to breathe." Muller and Armstrong[19] used running as the major intervention in the successful treatment of a single patient with elevator phobia.

A recent report by Driscoll[20] concluded that exertion (running in

place) plus pleasant fantasies produced a significant reduction in self-reports of examination anxiety, comparable to a reduction obtained by tape recorded desensitization. When administered alone, exertion and fantasies also significantly reduced anxiety, though not as much as when used in combination.

In a series of experiments, Morgan[21] has assessed anxiety by means of the State-Trait Anxiety Inventory (STAI) before and after vigorous exercise. He found that state anxiety initially fell below the pre-exercise base line with moderate to heavy exercise whereas no such drop was found after light exercise. When 15 adult males ran aerobically for 15 minutes, anxiety decreased below the base line immediately after running and remained diminished 20 minutes later. Six male anxiety neurotics and six normal males were tested before and following maximal treadmill testing to complete exhaustion, and a similar finding resulted. Neither anxiety nor symptoms were noted in either group and post-exercise lactate levels were identical in both groups, indicating comparable exercise efforts. Thus vigorous exercise was found to reduce state anxiety as measured by the STAI in both normals and anxiety neurotics.

Kostrubala[22] describes a thrice weekly running-group psychotherapy treatment which has had positive results in two uncontrolled studies. Individuals with depression, schizophrenia, anorexia nervosa, and "life style changes" have all reported symptom reduction and improved functioning in important roles. Kostrubala feels that running immediately before psychotherapy "stimulates...openings into the unconscious and is a valuable tool in the therapeutic process."

SCHIZOPHRENIA

Linton et al[23] found that schizophrenic patients scored significantly lower than normals on exercise tests designed to measure cardiovascular fitness. McFarland,[24] who investigated schizoid adults and Nadel,[25] who studied schizophrenic children, reported similar results. Schizophrenics scored significantly lower than normals on standard tests of muscular strength and endurance. However, hospitalized schizophrenics have been found to be quite similar in fitness to nonschizophrenic patients who have been hospitalized for prolonged periods. Thus the decreased physical fitness in schizophrenia might reflect sedentary institutional life styles rather than debility attributable to schizophrenia. The contribution of the decreased fitness to schizophrenic symptoms or severity of illness is at present unknown.

"NORMAL" ADULTS

Here we are dealing with that large population of individuals who often appear to function "normally" in major life roles (student, worker, parent, spouse, etc.) and may or may not manifest symptoms and signs of emotional distress. Valliant[26] reported that athletic success in high school was not subsequently correlated with more mature psychological defense patterns. However, he did find that 76% of 45-year-old males with mature defense patterns engaged in "competitive athletics" while only 23% of those men with immature defense patterns did so. Folkins et al[27] measured aspects of physical and psychological "fitness" in college students at the beginning and end of a semester-long jogging course (the control group participated in archery or golf). They found significant

increases in physical fitness as measured by decreased heart rate and improved running time in a 1.75 mile course. At the outset of the study, women in the jogging course were found to be less psychologically fit than women in the control group. In a within group analysis, significant improvement correlated with improved physical fitness was noted for the women in the jogging course. Subjects in the poorest physical and psychological condition show the greatest improvement. Gutin[28] also concluded that the beneficial psychological effects of physical fitness programs are most pronounced in those persons with the lowest initial physical fitness scores. Ismail and Tractman[29] studied a group of sixty middle-aged men who jogged three times a week for four months using the Cattell 16-Personality Factor Questionnaire. High and low physical fitness groups were isolated and the low fitness group showed significant increases in emotional stability, imaginativeness, guilt proneness and self-sufficiency on completion of the program and approached the pre-test scores of the high fitness group on these measures. These studies suggest that unfit "normals" begin to approach fit normals in certain psychological characteristics and functioning as a result of progressive exercise training. Deconditioned "normal" individuals show evidence of more psychological distress and dysfunction than conditioned individuals. In general the more deconditioned people are, the less "normal" their psychological test scores and the more change they demonstrate as they achieve an improved level of physical fitness.

Tillman[30] maintains that basic personality structures do not change as a result of improved physical fitness. However, he holds that mood variables in particular do appear to be altered by changes in fitness.

In a recent review, Morgan[7] discusses the "personality versus mood" dichotomy in terms of state versus trait variables emphasizing that physical activity can demonstrably modify state variables such as anxiety and depression but did not modify trait variables such as extroversion-introversion in his study.

Work efficiency is also susceptible to change through increase in physical fitness. Reviewers of cardiac reconditioning programs in West Germany cite a study in which absenteeism decreased 68% for workers with cardiovascular symptoms following an exercise program (Raab).[31] Petrushevski[32] reported increased efficiency in teletype operators following a physical fitness program.

An interesting universal phenomenon in normals engaged in exercise programs is the "feel better" sensation experienced during and after exercise. To date no psychometric correlates have been discovered for this commonly reported experience and its significance vis-a-vis mental well-being has not been investigated.

DEPRESSION

Morgan[33] compared grip strength, muscular endurance, and reaction time in populations of depressed and non-depressed adult male psychiatric patients. Two groups differed only in muscular endurance. Because endurance was measured only for small muscle activity, the significance of this difference was hard to evaluate. But Morgan also made the interesting observation that strength of grip and endurance measured at the time of admission to the hospital were inversely correlated with the length of hospitalization. Thus the short-term (and presumably less ill)

group possessed significantly higher levels of fitness from the outset. Utilizing a bicycle ergometer test to measure physical work capacity, Morgan[34] showed that depressed male patients had significantly lower capacity than non-depressed male patients. While a later study compared depressed female patients versus non-depressed females failed to extend this observation to women, Morgan[35] did report that hospitalized female patients of all diagnoses were significantly less physically fit than non-hospitalized adult females.

Morgan et al[36] studied the relationship of depression to a variety of parameters in a "normal" adult population consisting of 67 college faculty members. He concluded that depression and physical fitness were not correlated in normal adult males. However, eleven of this group scored in the depressed range on the Zung depression scale at the outset of a six-week physical activity study. Each of these eleven men increased their physical work capacity and scored in the non-depressed range on the Zung scale at the end of the study. None of the other 56 subjects had fallen into the depressed range at the study's completion.

Morgan[7] recently reported two additional studies with one hundred adult male volunteers from each of two different prison populations. Subjects were free of recognized mental or medical problems and adequate psychological data was available on the fifty-four subjects from each study (subjects excluded were discharged from prison, transferred to another prison, injured, withdrew themselves from the study, or had high probable response distortion). Jogging problems of different frequency and individual session duration produced a subjective improvement in sleep and sense of well-being as well as subjective reductions of tension

and depression when compared with sedentary control groups. These individuals scored in the normal (non-depressed) range on psychological instruments before, during and after termination of the study.

Brown (personal communication, 1977) investigated the relationship between thrice weekly exercise and depression in 167 college students. Students rated themselves on the Zung Depression Inventory before and after 8 weeks of either wrestling, tennis, "varied exercises," jogging or softball. Joggers were unsupervised and averaged 1.24 kilometers per session. The softball players and 6 control individuals who did not exercise showed no reduction in depression scores, while all other subjects did, with joggers showing the greatest reductions. Subjects who initially scored in the range of clinical depression (Zung score greater than 50) also showed a significant reduction in depression with activity ($p < 0.001$).

Kavanaugh[37] administered the MMPI to 101 patients 16 to 18 months after myocardial infarction. He isolated a population of 56 with severe depression and followed them for 2 to 4 years. In a regular running program these patients showed significant improvement in the D (Depression) score of the MMPI Scale, while the other indices remained unchanged. "There seemed to be a correlation between improvement in depression, adherence to the program and increase in physical fitness" (personal communication, 1976).

RUNNING AS TREATMENT FOR DEPRESSION: A PILOT STUDY

In a pilot attempt to determine whether running might have beneficial effects for actual patients seeking treatments for neurotic or reactive

depression, 13 men and 15 women patients were assigned randomly either to running or to one of two kinds of individual psychotherapy (ten-session time-limited or time-unlimited). Entry criteria required that patients be between 18 and 30 years old, have prominent depression as the first target problem, Symptom Checklist-90 (SCL-90) depression cluster score at the 50th percentile or above, minor depression according to the Research Diagnostic Criteria,[38] and absence of psychosis, significant suicide risk or need for antidepressant medication. Patients in the running group were interviewed in detail regarding symptoms of cardiopulmonary distress and received a resting electrocardiogram and maximal stress exercise treadmill test. No patients had to be excluded from the running group. Ten patients received running treatment, six patients time-limited psychotherapy, and 12 patients time-unlimited psychotherapy in this pilot study.

RUNNING THERAPY

The running leader initially met individually with his patients three to four times per week for one hour. Occasional running in small groups (2 to 4 individuals - some of whom were not in the study) was done when such groups formed spontaneously, but this accounted for no more than 25% of the runs for any patient. During the fifth week of treatment, only two sessions were scheduled with the leader, and during the seventh and eighth weeks, only one session was planned. Patients were encouraged to run at least three times weekly either with the leader or on their own. The intention in this sequence was to ensure that patients participated in treatment, learned the correct approach to running and became independent runners, capable of continuing treatment by themselves

after the ten-week study ended.

During each session, the leader ensured that patients ran and walked comfortably and taught them to use their breathing rate and ability to converse while running as feedback and guides to a comfortable pace. Pace and distance covered increased gradually and steadily as treatment progressed. The emphasis was on avoiding pain and fatigue by interspersing walking periods with runs of varying length. Discussion during the runs focused on running itself (sensitivity to biofeedback, foot strike, stride, arm carry, body lean, diet, running equipment, etc). No discussion of depression per se was encouraged or reinforced either during the running session or after. This approach worked well since depressive cognitions and affect seldom emerge during running, and when they do, they are virtually impossible to maintain. On those occasions when depressive affect and ruminations persisted during a run, the leader suggested a sequential focus on breathing, the sound and feeling of foot falls and an awareness of the spine in an erect position. This technique of concentrating on separate physical elements of running was successful in breaking through depressive ruminations in all of our patients.

CASE HISTORY

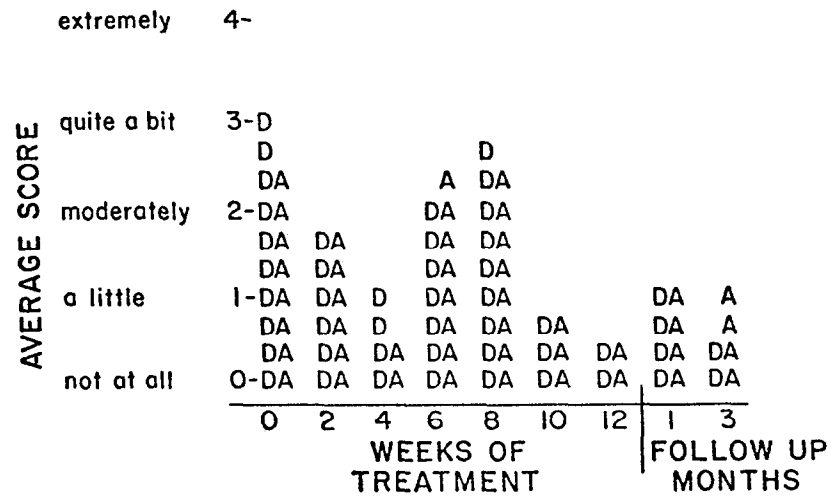
Ms X, a 28-year-old professional student who had previously completed a master's degree in another field, complained of a two-year depression characterized by depressive mood, a sense that nothing could or would change, a lack of meaningful relationships (she lived at home and seldom went out), difficulty going to class and studying, and excessive cigarette smoking (three packs per day). She scored at the

91st percentile on the depression cluster of SCL-90.

Within three weeks of beginning running, her mood subjectively improved and both depression and additional items (largely vegetative symptoms and signs of depression) cluster scores on the SCL-90 began to fall (Figure 1). These improvements continued until she hurt her ankle during week 5 while exceeding her recommended distance and running frequency and had to stop running until week 8 to recover. Her depression

Figure 1

SCL-90 DEPRESSION (D) AND ADDITIONAL ITEMS (A)



promptly returned with cessation of running, but when her ankle had healed and she could run again, depression again rapidly disappeared and she said, "I'm out of shape, but I know I'll get back in shape again, and I felt better (less depressed) the first time I ran."

She has remained in remission to the present (by subjective report on SCL-90 scores), and we often encounter her running and smiling along a lake path.

RESULTS

"Better to hunt in fields for health unbought
Than fee the Doctor for a nauseous draught.
The wise for cure on exercise depend."

Dryden, circa 1675

There were two dropouts from the running group. One patient never ran since he moved away before completing the initial assessment and the second patient was an individual with a protracted psychiatric illness including a six-month hospitalization and a strong sociopathic flavor in his relationship who dropped out after three weeks. Dropout rates for the two psychotherapy groups were very similar: one of six patients in time-limited psychotherapy and three of twelve time-unlimited treatment dropped out (terminated before the sixth session).

Results of Running

Of the eight patients who remained in running treatment for ten weeks, two women showed little improvement. One had scheduling difficulties early in the treatment and did not participate actively. She was also unable to run because of a very low fitness level but did initiate a regular program of walking during the sixth week of the treatment program. She had a dramatic remission of symptoms during the sixth week of the follow-up period. The second woman who failed to improve while running never felt that running "could be treatment" though she ran regularly and had a marked increase in physical fitness as measured by maximum oxygen uptake (all eight patients who ran demonstrated this training effect). After ten weeks of running, this women had four sessions of exploratory psychotherapy which strongly suggested an underlying oedipal problem of attachment and separation from significant males. When her male friend returned to town, her depression promptly remitted. While this single case shows that completion of ten weeks of running treatment is not always effective for moderate depression, it also suggests that the therapist, a likable and physically attractive male, did not provide a "transference cure" for the running group, and that elements of the running itself are probably therapeutic.

Running Compared with Psychotherapy

Outcome comparisons for the three pilot study groups indicated that the running treatment was as effective in alleviating depressive symptoms and target complaints as either the time-limited or time-unlimited psychotherapy treatments. However, some procedural problems that emerged with the pilot study made us reluctant to base firm conclusions on these data, and we have turned to an on-going study of psychotherapy of depression for outcome comparisons with the pilot study running patients.*

Procedures in the second study were essentially the same as for the pilot study except that the time-limited and time-unlimited psychotherapy were both carried out in the outpatient clinic under close supervision, with care taken to see that time-limited therapists set time-limited contracts. Also, patients were selected only if their depression scores exceeded the 65th percentile (as compared to the 50th percentile for the pilot study) on the SCL-90 depression scale, yielding groups more comparable to the runners. In all other respects procedures were identical to that for the pilot study.

Results on change outcome measures taken at two week intervals for the eight running patients from the pilot study and sixteen patients from the later psychotherapy study (nine time-unlimited and seven time-limited) are shown in Figures 2-4. For Depression Symptom Checklist scores (Figure 2), running and the time-limited treatment groups show quite similar levels of improvement over 12 weeks. Similar patterns are apparent for changes in the initial target complaints (Figs. 3 and 4). The

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*Some of the therapists doing time-limited therapy had failed to set clear time-limited contracts. Some of the psychotherapy was not as closely supervised as had been planned. Despite random assignment, the runners as a group had depression scores somewhat higher than either of the two psychotherapy groups.

lesser change of the time-unlimited group probably reflects the fact that treatment is not complete.

Figure 2

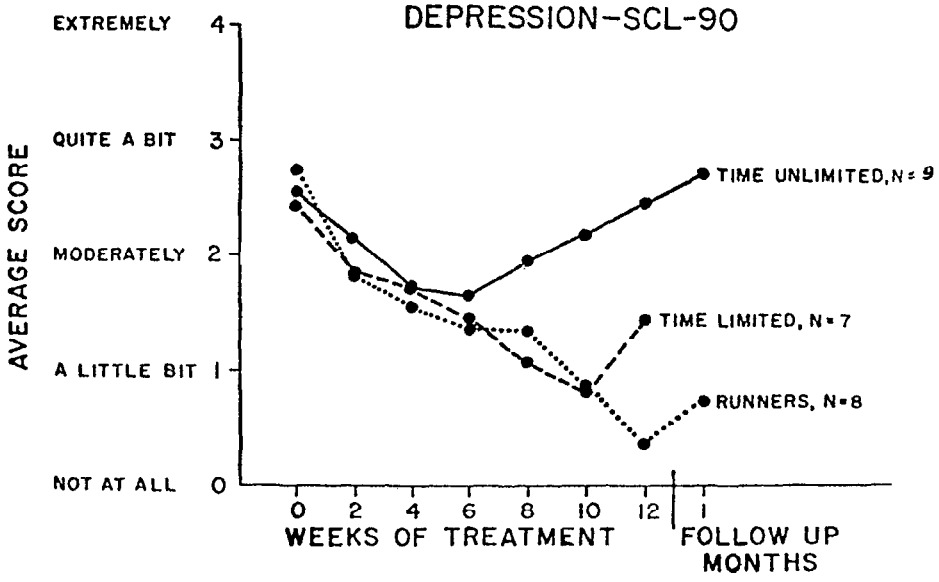


Figure 3

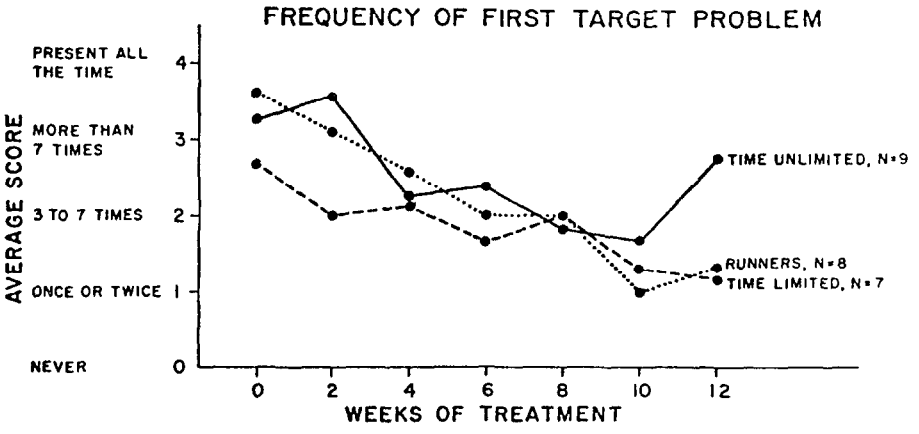
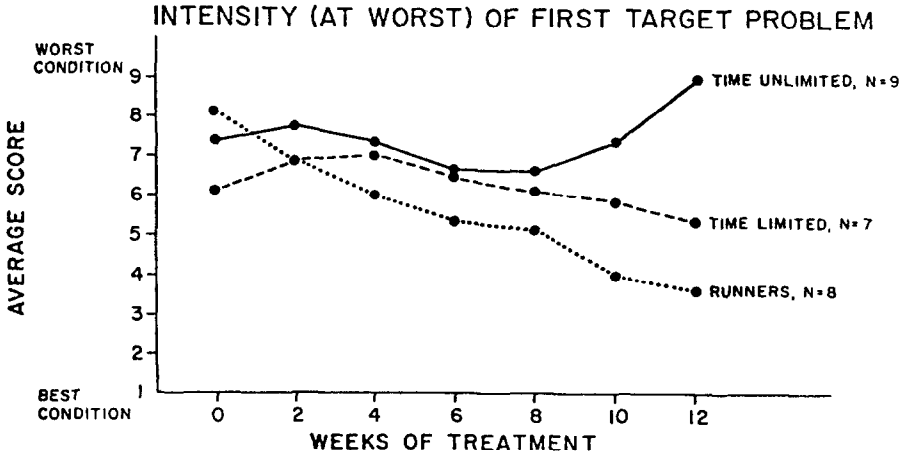


Figure 4



To summarize, in our pilot study of running as treatment for moderate depression, running was at least as effective in alleviating depression symptoms and target complaints as either time-limited or time-unlimited psychotherapy.

DISCUSSION

> "Patients should have rest, food, fresh air, and exercise - the quadrangle of health."
>
> William Osler

In our clinical practice, we had observed several moderately depressed individuals who responded to a simple increase in physical activity with prompt alleviation of their symptoms. It was our impression that this response was more prompt and dramatic than that obtained with psychotherapy alone and similar to that which follows a positive response to antidepressant medication in major ("psychotic-endogenous") depressive illness. We wondered whether running treatment for moderate depressions might prove more effective than psychotherapy in alleviating symptoms, just as anti-

depressant medications are more effective than psychotherapies for symptomatic treatment of major depression.[39]

Possible Explanation of a Therapeutic Effect

This approach to the treatment of depression can be conceptualized as graded skill training or practice with built-in positive reinforcement. By regularly filling time with comfortable, rhythmical movement of large muscle groups, the positive reinforcements of physical adaptation (cardiovascular-pulmonary capacity and musculoskeletal strength) and psychological benefits follow. Movement within adaptive limits is easily monitored by the ability to talk while running and modeled by the running therapist who starts to walk before the patient grows fatigued. Injuries from running occur when people cannot control their feet and legs as signaled by loud flapping during the foot strike. In conditioned runners, this occurs either during very fast or very long runs, conditions found most often in racing. With most deconditioned individuals, the possibility of injury occurs at much lower levels of speed and distance than with fit runners. Part of the success we have had in getting depressed people to become independent runners (runners who will continue running by themselves after the active treatment is completed) lies in avoidance of serious injury. Emphasis is placed on a gradual increase in physical capacity, patience necessary to achieve increased capacity without injury, and sensitivity to individual feedback from breathing rate, gait, and footfall, upper extremity, fatigue, and pain. This graduated and gentle approach to frequent running produced an 11% dropout rate in depressed individuals who often have difficulty initiating and sustaining any activity. Dropout

rates of 30% to 70% are commonly reported for jogging groups of normal individuals, with most attrition occurring in the first 6 weeks.[40,41]

Several other hypotheses may each partially explain the beneficial effect running appears to have on depression:

1) Mastery - Individuals who become independent runners develop a sense of success and mastery of what they correctly perceive as a difficult skill. Many people in our society try to become runners and fail, usually because they push too hard and expect too much of themselves too soon.

2) Patience - To become an independent runner takes time, and one learns again the necessities of patience and making regular efforts until running becomes a habit.

3) Capacity for change - Our subjects also learned, often dramatically, that they can change themselves for the better. Running improves their physical health, appearance, and body image with concomitant increases in self-acceptance.

4) Generalization - Some subjects who described a new and positive image of themselves as competent at running explicitly stated that this change helped them feel capable of becoming competent in other areas.

5) Distraction - Subjects noticed new and very real bodily sensations which distracted them from preoccupations with minor but annoying physical symptoms of depression.

6) Positive habit or "addiction" - Many of our subjects recognized running as a positive activity and seemed to substitute it rather consciously for more negative and neurotic defenses and habits.

7) Symptom relief - Running provided a reliable means of lysing symptoms of anger and anxiety as well as depression. All subjects who ran reported some kind of "good feeling" during the run. There was a pleasure and satisfaction in the functional act of running which became for most a sufficient justification to keep running.

8) Consciousness alteration - There is often a consciousness altering component associated with protracted running (more than 15 to 30 minute duration). While not available to the beginning runner, this state is described by experienced runners as a very positive, creative, less conscious, and more insightful interlude which is so addicting that many runners find it difficult to skip running for even a single day.

9) Biochemical changes - The biochemical hypotheses which have been advanced as explanations of depression were well summarized in a recent survey article.[42] While none of these hypotheses is firmly established, and it has been shown that some biochemical changes in depression are secondary to changes in physical activity,[43] nevertheless it seems certain that biochemical correlates of clinical depression will eventually be found. How running may interact with the "biochemical depression" is undoubtedly complex and the subject of present inquiry by Brown and Goodwin (personal communication, Robert S Brown, PhD, MD).

Before the actual treadmill stress test, we found an abnormal anticipatory blood response during a practice walk in 7 of our subjects. Blood pressure rose out of proportion to the increased physiological demands of walking. This response was not present in any subject at the time of the second treadmill test. If this substantial sympathetic dominance characterizes the depressed individual's response to minor

stress, it may have implications for patient selection, monitoring change and outcome and biochemical mechanisms underlying moderate depression.

Problems of Present Study

There are a number of factors which could vitiate the apparent comparability of running and psychotherapy as treatments for depression. 1) The experience level of the psychotherapists was not great (most were second year psychiatry residents) in contrast to the running leader who had 7 years of experience helping people learn to run. 2) The psychotherapists may not have been committed to the kinds of psychotherapy they were using. We attempted to control for this effect by having each therapist provide both kinds of psychotherapy, but there is obviously some confusion in the minds of these young therapists about how to proceed in a training setting with strong advocates for different psychotherapies. 3) Knowing that these patients were in a "research study," the therapists may not have developed as great a sense of responsibility for their patients. 4) The running therapist may have been an effective "psychotherapist." 5) The runners had more contact with their therapist than the patients did with their psychotherapists. 6) There may have been group interaction effects which are more important than the running itself. 7) Patients who ran may not have been as ill as patients in psychotherapy. Actually, the reverse is true if one uses as a criterion a widely employed 35-item symptom self-report instrument.[44] Running patients had a mean score of 78.7 versus 62.3 (higher score indicates greater psychopathology) for patients in psychotherapy. All of our treatment groups were more symptomatic than 150 patients treated in 5

private psychiatric clinics (mean score 36.8). The private clinic patients were in turn more symptomatic than individuals who applied to growth centers (mean score 23,3), national training laboratories (19.0) and a normative population (9.8). 8) In this pilot study we have looked only at the most immediate measures of symptomatic change. While symptoms of depression have been shown to be largely unresponsive to psychotherapy,[39,45] Weissman et al[39] were able to demonstrate improvements in social adjustment as a result of 8-month-long psychotherapy in depressed female patients who remained symptomatically well.

These and other variables will require more careful control in subsequent studies. Nevertheless, the rate and amount of improvement we observed in these depressed patients who ran compares favorably with outcomes we have observed clinically with a variety of therapies and therapists. Unfortunately, this "clinical experience" criterion remains largely unchallenged in a field where we as well as other workers "were not able to find a single systematic published report of the psychotherapy of depression that included more than 12 reported cases or described any attempt at a quantitative measure of outcome.[46]

Why Running?

Moderate depression, like anxiety neurosis, is a common problem in Western society and one that is often managed by general practitioners.[47] While diazepam has become a mainstay in the management of anxiety,[48] there has been no comparable medication for the treatment of moderate depression which is usually managed with supportive psychotherapy until spontaneous remission occurs. Although there is now some evidence supporting the use of tricyclic antidepressants in moderate (neurotic or reactive)

depression,[45,46] most psychiatrists have believed and prescribed as though the use of antidepressant medication in moderate depression is not indicated and may even prove dangerous in suicidal patients who are thus provided with a potentially lethal drug. If other studies replicate the findings of our pilot study, running would provide an alternative somatic treatment for minor depression which could be made available at low cost to large numbers of patients.

While there has been something of a backlash of criticism against walking-jogging-running by some who do not run or have run in such a way that it is unpleasant, running, which differs from walking in that both feet leave the ground at some part of the movement cycle, shares with walking its very naturalness. Walking and running are eminently natural activities for human beings and most people can still find satisfaction and even pleasure in having their bodies function in the regular rhythmical activities we call walking and running. Since we learn these activities very early as a part of our normal growth and development, and can continue them as long as we are physically able to do so, this familiar activity can legitimately fulfull many purposes. Running can be done at any time of the year, in any weather, indoors and out. It can be done alone and with others and at a pace that is comfortable for everyone.

The actual salary paid to the running leader for treatment of these 10 patients was $850. While treadmill tests were provided at no cost, they can be obtained privately in our community for $30 each or $300 total. If one assumes that 10 sessions would be a reasonable average for outpatient psychotherapeutic treatment of depression (as it is in our clinic and larger psychiatric community), and that psychiatrists charge

at least $50 per session (as they do in our community), the relative cost of treating one depressed patient is $115 for running versus $500 for psychotherapy. If the treatments are equally effective in terms of outcome of depression, running is 4 times more cost effective as a treatment for this common health problem. (Whether any treatment is cost effective in this characteristically self-remitting illness is a larger and more complicated question.)[49]

Running also has beneficial side effects in contrast to some other treatments where side effects can be deleterious or even dangerous, eg, drug treatment. This treatment also emphasizes the role each individual can play in treating illness and maintaining health - thereby utilizing the largest untapped health resource available - the patient.

If effective in the treatment of acute illness, this approach may also have prophylactic value against recurrence of depression since one goal of the treatment (and a frequent outcome in our pilot study) is to help individuals become independent and continuing runners.

The physiological benefits of aerobic running are well documented. If the psychological effects of running are also demonstrated to be beneficial in actual patients, the whole area of physiological-psychological interaction may yield valuable insights into the therapeutic process. The implications of this psychosomatic relationship for the psychological fitness of our sedentary population as well as the possible contributions of physiological "unfitness" to emotional problems and mental disorders will require additional investigations.

Because of the simplicity of this form of therapy, the patient's style of performing in running is also highlighted. Thus, the impact of

various styles of running (hard-driving and aggressive, meticulous and obsessive, hypochondriachal, etc) on the psychological consequences of the activity may also provide fruitful variables for further study.

CONCLUSION

> "Running is a melody of my life, of all my life: to sweat out anger, to concentrate on the tasks of life, to feel the pleasure and delight of loneliness and freedom, to be all of a human being."
>
> Fritz Schreiber, a runner for 70 of his 80 years

In our opinion, running as treatment for depression remains experimental, in need of replication by additional controlled studies and potentially dangerous to depressed individuals.

While most analogue studies of exercise treatment of nonpatients who scored in the "depressed range" on self-report measures have shown statistically significant reductions in depression with exercise and anecdotes and uncontrolled studies in clinical populations also support running's effectiveness as a treatment for moderate depression, we believe this report is the first controlled study of running in depressed individuals who present themselves for treatment.

Our results suggest that running is as effective as two kinds of psychotherapy for moderate depression. Because of the problems of research design (psychotherapist inexperience, single running leader, small populations, limited age range studied, possible group effect, etc) one cannot draw firm conclusions about running's effectiveness from this single study. As Hans Zinser said, "Two mice are no mice at all." We feel the results of this pilot study warrant carefully designed studies which can define the roles and limitations of this approach in the treatment of depression.

We are concerned that too widespread application of this technique, for whatever reasons, may actually be dangerous to depressed individuals. Beyond the obvious risk of cardiovascular misadventure which can be largely eliminated by exercise testing with electrocardiographic monitoring and a gradual increment in physiological stress, there are other problems with the casual advocacy of running as treatment for the complex process we label depression.

First, we have no evidence that running would be at all helpful in the management of major (psychotic-endogenous) depressions - the kind of depression which seems to have a life of its own. In our view, major depressions are best managed at this time by somatic therapies (antidepressant medications or electroconvulsive therapy) or, when indicated by psychosocial deficits, by a sequence of first somatic and then psychosocial therapies.

Second, there is the possibility that the treatment prescription will be incorrect or that patient adherence will be poor, leading to treatment failure and further aggravation of depression as the individual perceives this failure as still another proof that s/he is hopeless, helpless and worthless. Expertise is required to assure that the running prescription is individualized, adhered to, and monitored for effectiveness. Most physicians know a great deal about illness, but very little about health and the healthy activity of running. People over the age of 12 are not intuitive runners - they usually expect far more running of themselves than they can produce - occasionally they expect less than they are capable of. Those who overdo exceed their adaptive capacity, find running unpleasant, get sore, injured, quit, and chalk up another failure. Those

who underdo (either in frequency, intensity, or duration) fail to increase their adaptive capacity, feel "running isn't helping," quit, and add running to their list of failures. To the extent that running proves beneficial as a treatment for depression, we predict that it will be for those individuals who run within the "therapeutic window" of their adaptive capacity. Both above and below critical threshold levels for each individual, the treatment will probably not be helpful and may even make depression worse.

Even if the treatment plan is correct and the patient follows it to the letter, depression may not abate, as it did in one of our patients. It is very seldom that a single treatment is successful for all cases of a particular disorder (often because of imprecision in diagnosis) and it is necessary to remain alert for signs of failure so that alternative treatments may be employed. Psychiatry remains an inexact science, a problem in probabilities performed within the many potentialities of human psychopathology and the therapeutic interaction.

Our bias (and we purposely label it as a bias which requires additional evaluation) is that running may prove to have antidepressant properties for many individuals with moderate depression; that running treatment itself will be adequate for some patients; that it will facilitate psychotherapy in others; and that even an ideal running program either alone or in combination with ideal psychotherapy will be ineffective for some patients.

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ACKNOWLEDGEMENT

Exercise treadmill tests were provided by Francis J Nagle, PhD, Director of the Biodynamics Laboratory at the University of Wisconsin. We are also indebted to Sandra Bass, MS, and Ms Joy Danks for assistance in the performance of this work. This investigation was supported by grants 133-A253, University of Wisconsin Medical School; 135-4435, Project 170709, University of Wisconsin Graduate School; R01-MH-25546-03, K01-MH-70903-03, National Institutes of Mental Health; and the Wisconsin Psychiatric Research Institute.