



Post-Polio Sequelae

Energy Conservation, Occupational Therapy, and the Treatment of Post-Polio Sequelae

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Abstract

Individuals experiencing post-polio sequela (PPS) are usually advised to make significant lifestyle changes to lessen symptoms and prevent further decline in function. The individuals have spent most of their lives equating success with over-achievement and find it difficult to implement such recommendations. As specialists in energy conservation and work simplification, occupational therapists increasingly are being called on to evaluate and treat these patients. Over the past 2 years, an occupational therapy educational program has been developed to educate patients about their condition and about ways to implement lifestyle changes while preserving the ability to do valued activities. This article describes the components of a thorough occupational therapy evaluation and the design and functional outcomes of a successful occupational therapy educational program to treat PPS.

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A significant percentage of the 1.6 million polio survivors in this country have developed post-polio sequelae (PPS) -- new muscle weakness, pain, excessive fatigue, and respiratory difficulties -- that interfere with activities of daily living. Areas frequently affected are mobility, homemaking, driving, bathing, dressing, eating and/or swallowing, and bladder or bowel Function. [[1-3](#)]

Because the etiology of PPS is thought to be the overworking of polio-damaged nerves, individuals who develop symptoms are usually advised by physicians and occupational and physical therapists to make significant lifestyle changes to prevent a further decline in function. Changes may include rest periods, work simplification, energy conservation, modification of the work and home environments, the use of orthoses, adaptive equipment, or mobility aids, and may even encompass changing jobs or terminating employment. [[2,4-7](#)]

This therapeutic regimen is not acceptable to most polio survivors, because they equate success with discarding assistive devices and doing all of the activities that other people do.^[8] However the current physical problems that affect this group necessitate learning new coping styles that are totally at variance with those learned during their initial rehabilitation. The prevailing ideology in the treatment of acute polio stressed intense physical effort while ignoring pain and fatigue to achieve independence without the use of mechanical assistance.^[9] "Persistence in strenuous activity was *the* great rehabilitation virtue and the pursuit of ambulation second only to the quest for the Holy Grail." ^[10]

Because occupational therapy addresses problems in daily living, occupational therapists throughout the country are increasingly being called on to evaluate and treat polio survivors who often resist lifestyle changes needed to treat their new symptoms. This article describes the design and Functional outcome of an occupational therapy educational program created over the past 2. years for the treatment of PPS.

Program Rationale

There are no published studies on the effectiveness of educational programs for polio survivors. However, many such studies have been reported with individuals who have other chronic disabling conditions (eg, rheumatoid arthritis) that provide insight into the elements that contribute to constructive behavioral changes.

Successful educational programs incorporate elements such as setting behavioral change goals, pre-program and post-program questionnaires, audiovisual programs, consultation with health professionals, and take-home materials. The most structured and well-documented educational program was conducted by the occupational therapy department at the National Institutes of Health for patients with rheumatoid arthritis. A pilot study compared three control groups receiving standard energy conservation programs with an experimental group receiving a workbook-based program. Three months after training, 22% of the control group and 50% of the experimental group achieved at least one of the behavioral objectives.^[11-14]

The occupational therapy educational program designed for PPS patients incorporates elements that have been shown to contribute to successful behavioral changes in patients. These include setting treatment goals, using a group format rather than individual teaching, the use of audiovisual aids and take-home materials, and lectures and discussions. Pre-program and post-program assessments also are used to quantify learning and behavioral change, because patient education is a process of influencing behavior, rather than of only giving information.^[15]

Initial Occupational Therapy Evaluation

Individual evaluations are performed prior to the start of the educational program. Although the classes contain generic information about many aspects of energy conservation, these pre-evaluations allow the tailoring of specific solutions for individual problems.

Individual evaluations collect information in several areas:

A history regarding the initial attack of polio, including parts of the body that were initially paralyzed or weakened and those still paralyzed or weakened after maximum recovery. The therapist must keep in mind that any muscle group that was affected during the acute attack is at risk for new problems, even if symptoms are not manifested at the present time.

A history of the present problems. After maximum recovery from polio, when did new symptoms appear?

Description of new symptoms, eg, new weakness in muscles originally affected and/or in those thought to be unaffected (new weakness in extremities which were previously asymptomatic can be caused by subclinical damage during the acute attack and/or from overuse while compensating for a weaker extremity); pain in muscles or joints; fatigue that is overwhelming and out of proportion to the level of activity; and inability to do activities that were previously possible.

What equipment has the individual been using since maximum recovery? This includes upper extremity orthoses such as hand splints, mobile arm supports; adaptive equipment such as built-up handles on utensils, raised toilet seats; mobility aides such as canes, crutches, wheelchairs, and electric carts. Does the person feel that the equipment is functioning as well as it used to? For instance, does the mobile arm support still enable the person to accomplish the same activities as before; is the crutch or cane causing numbness or tingling in the arm and hand? Upper extremity aids and equipment should be checked for fit and proper function.

What are *the patient's occupational roles* (parent or grandparent, worker, homemaker, student, volunteer, retiree)? What are the responsibilities of each role? What are the individual's recreational interests?

Living arrangements (eg, house or apartment). Is the interior all on one floor or is it multi-level? Are there exterior steps? What is the type of bathing arrangement (tub or stall shower)? Does the patient live alone? Who is responsible for the house cleaning, cooking, marketing, and laundry?

Work environment (if applicable). Can the individual park close to the work site? Are there any exterior or interior steps? Does the job require much standing or walking? Is there a need to carry books, files, or heavy objects? Is the work repetitive or diversified? Is a computer used? If so, for how many hours?

What activities produce weakness, pain or fatigue? At what times of the day do these symptoms occur? Are there activities that have had to be discontinued since the onset of the late symptoms? Why? Would the individual want to resume the activity if problem-solving made it more manageable?

At this point, the occupational therapist needs to perform a hands-on assessment of the patient's physical abilities, including. 1) range of motion assessment. Is there tightness in the upper or lower extremities, trunk, or neck that interferes with function? 2) Assessment of muscle strength in the upper extremities. Because the polio virus attacks the spinal cord in a random fashion, there is no typical pattern of muscle weakness. Manual testing of polio muscles can be very deceptive. What you see when you give resistance is not necessarily what you get in the way of functional ability. A muscle can lose up to 50% of its motor units and still appear clinically normal. Muscles testing as Grade 4 or 5 may actually have significant denervation. Electromyography has shown that polio muscles that test as Grade 5 can be only 75% as strong as non-polio muscles, and Grade 4 in a polio muscle can be only 40% as strong as a non-polio muscle. Therefore, a polio muscle which tests as Grade 4 may actually have to work 2.5 times as hard as a normal muscle to do the same job.[2] These muscles fatigue quickly because the remaining motor units are working for longer periods of time. Therefore, the therapist must not be misled into expecting adequate endurance for functional activities based on manual muscle testing. Upper extremity strength can vary in different positions. Elbow flexors that are Grade 4 at 90° flexion may be Grade 2 when the elbow is fully extended; shoulders may have greater strength at a lower elevation than when raised above 45°.[2] This may indicate that the individual can perform functional activities less stressfully with the elbow flexed and the arm at the side. Grip and pinch strength also should be tested; and 3) Observe a simple functional activity such as upper extremity dressing to see what compensations are used.

The Occupational Therapy Educational Program

The occupational therapy educational program is presented to small groups rather than to individuals. Group teaching uses staff time economically, helps patients learn from each other through shared experience, and fosters the development of a positive attitude.^[15] The group experience also helps to reduce the feelings of isolation that have been frequently expressed by polio survivors.^[16]

Table 1

DEMOGRAPHIC AND SYMPTOM DATA ON PROGRAM PARTICIPANTS		
	Male (N=12)	Female (N=23)
Mean Age	55.0 (39-68)*	52.5 (38-73)
Mean Years Since Onset	46.3 (35-67)	43.0 (33-64)
Weakness	8§ (67%)	19 (83%)
Pain	10 (83%)	13 (57%)
Fatigue	2 (17%)	13 (57%)
Breathing/Swallowing Problems	0 (0%)	3 (13%)
<p>* Mean, with range in parantheses § Number of patients with percent in parentheses</p>		

Groups are limited to a maximum of seven persons to allow meaningful discussion and interaction. Patients are encouraged to invite a spouse or significant other to attend the classes with them. [Table 1](#) lists demographic and symptom data of the 35 participants in the program during the past 2 years.

Initially, the program consisted of four weekly, 2-hour classes. Later it was condensed into three classes, as some patients are employed full time and find it difficult to take too much time off work. Patients are asked to commit to attending all three classes and completing the workbook assignmrnts.

The core of the program is a workbook, "Energy Conservation and Work Simplification -- A Workbook for Persons with the Postpolio Syndrome" adapted from "Rehabilitation Through Learning: Energy Conservation and Joint Protection -- A Workbook for Persons with Rheumatoid Arthritis."^[17] The chapters in the workbook correspond to and reinforce the information given in each class. Appropriate chapters in the workbook are given as take-home material at the end of each class.

First Class. After brief introductions, the goals of the educational program are listed: 1) to understand PPS to appreciate the necessity for lifestyle modifications; 2) to be aware of daily behavior and activities as they relate to energy conservation; 3) to learn how to select activity modifications which are appropriate to particular life situations; and 4) to gradually incorporate energy-saving modifications into daily behavior. Participants are reassured that the goal is not to take the fun out of living, but to help learn to conserve energy in less important areas so activities that are most meaningful to them can continue.

Next, the participants are given the Knowledge of Polio Test ([Table 2](#)). This consists of 24 true-false questions covering the history of polio, the nature of acute polio, etiology and symptoms of PPS, the role of exercise, and the polio vaccines. Content validity was determined by submitting the test to four researchers who are recognized experts in the field of post-polio research and treatment. Correct answers are given while each participant grades his own test, and the tests are collected for later comparison with the post-test.

Table 2

KNOWLEDGE OF POLIO TEST			
		Pre-Test	Post-Test
1.	The late effects of polio are primarily from aging. (False)	86%*	89%
2.	All polio survivors will get the post-polio syndrome. (False)	94%	89%
3.	Muscles which are becoming weaker should be put on a vigorous exercise program to increase strength. (False)	94%	100%
4.	The Sabin (live) vaccine is thought to give more lasting protection to polio than the Salk (killed) vaccine. (True)	37%	86%
5.	Un-immunized adults should receive the Salk (killed) vaccine instead of the Sabin (live) vaccine. (True)	43%	86%
6.	Marked fatigue occurring after moderate activity is often one of the symptoms of the post-polio syndrome. (True)	97%	100%
7.	The late effects of polio are related to Amyotrophic Lateral Sclerosis (Lou Gehrig's disease). (False)	71%	94%
8.	Muscle pain or aching may be one of the symptoms of post-polio syndrome. (True)	86%	94%
9.	The post-polio syndrome usually progresses slowly. (True)	77%	91%
10.	Muscles affected by polio which are graded "normal" or "good" during muscle testing may actually be much weaker than they appear to be. (True)	77%	97%
11.	The late effects of polio are from the polio virus becoming active again. (False)	86%	94%
12.	Vigorous exercise can cause weak muscles to become weaker. (True)	100%	100%
13.	Hypersensitivity of limbs to cold temperatures may be one of the late effects of polio. (True)	54%	94%
14.	The late effects of polio are thought to be the result of chronic high intensity use of weakened muscles. (True)	77%	94%
15.	Only muscles that were clinically affected by polio become weaker. (False)	86%	86%

16.	Because of the vaccines, there are almost no new cases of polio in the world. (False)	74%	91%
17.	The occurrence of late symptoms, many years after polio, has appeared in medical literature only in the past few years. (False)	23%	37%
18.	Some research has found that even muscles that are not getting weaker show signs of denervation (partial loss of nerve supply). (True)	71%	100%
19.	In acute polio, most of the motor neurons in the spinal cord tend to be affected, even though there may be little paralysis. (True)	66%	94%
20.	Polio is the number two cause of paralysis in America, second only to stroke. (True)	46%	91%
21.	Polio is one of the oldest diseases known to man. (True)	49%	100%
22.	Paralytic polio usually occurs only in young children. (False)	83%	94%
23.	All cases of polio result in paralysis. (False)	89%	97%
24.	The post-polio syndrome is not usually life-threatening. (True)	83%	91%
* <i>Percentage of patients correctly answering questions.</i>			

This is followed by a lecture on the neurophysiological basis of polio and PPS, the causes of excessive fatigue, and the role of energy conservation. Hand-drawn charts are used to depict: 1) normal motor units, 2) the death of motor neurons during acute polio, showing "orphaned" muscle fibers, 3) reinnervation of orphaned muscle fibers by axon sprouting, 4) the dying back of the axon sprouts during PPMA. The lecture also includes information covering the questions on the Knowledge of Polio Test. Although some of this information may not seem to have immediate relevance to the patient's current problems, polio survivors should have as much knowledge as possible about the disease which has affected their lives so profoundly.

The first class on energy conservation focuses on body positioning and body mechanics during activity. The following areas are addressed in detail: sitting and standing posture, proper seating, position of arms, heights of work surfaces, bending, reaching, lifting, pushing, eliminating stairs, and use of mechanical help for carrying. The lecture is interspersed with demonstrations and slides. Suggestions are given for changing improper seating and work surfaces. Occupational therapists should be aware that some principles of body mechanics that are applicable to conditions such as rheumatoid arthritis may be inappropriate for persons with PPS. For example, the admonition to "Lift with your legs, not with your back" would be difficult or impossible for many of these individuals.

Participants are given the portion of the workbook corresponding to this first class. The assignments for the week are: 1) to use the information and diagrams in the workbook to explain to someone else why people with PPS fatigue easily; 2) to analyze their activities for energy-draining positions or techniques and explain how to improve those that are incorrect, and to record these on a worksheet.

Second Class. The second class starts with participants giving feedback on the previous week's assignment. Mutual problems and possible solutions are shared.

The class focuses on activity analysis. Areas addressed in the lecture are: sitting during activity; breaking activities into components; alternating light and heavy tasks; timing of activities; using efficient work methods; rearranging work areas; changing location of equipment and supplies; using energy efficient tools (such as an electric knife for cutting cheese, vegetables); and using adaptive equipment.

After showing slides of energy-efficient and adaptive equipment in use, many of the aids are demonstrated so that the participants can experiment using them. Each person is loaned a catalog of adaptive aids to take home and peruse for the coming week. This allows them to identify equipment that might be useful but was not covered during the class.

The assignment for the coming week is to choose an activity that has become difficult or impossible. Participants are told to consider whether any of the suggestions given in class would make the activity more feasible and to record their solutions on the appropriate worksheet in the workbook.

Third Class. As with the second class, the participants are asked to share the results of the previous week's assignment. These discussions facilitate learning from the experiences of others and also reinforce previous learning.

Units covered in this class are rest and joint protection. Information on rest includes techniques for interspersing rest periods with activity, pacing of activities, and guidelines for judging whether an activity is too stressful. The importance of naps and frequent rest periods is underscored by repeating some of the neurologic information from the first class, ie. weak muscles have fewer motor units that must contract for longer periods and have less time to rest.

The unit on joint protection includes: techniques for avoiding deforming positions: using the largest joints available for activities; avoiding static positioning; and the use of splints and braces for supporting joints and preventing deformity. Slides show examples of equipment to eliminate static holding, ie. book holders, card racks, and telephone head receiver sets. Slides also illustrate ways to grasp and hold objects using principles of joint protection.

Assignments for the coming week are to: 1) choose an activity that takes more than half an hour, take a 15 minute rest break for each 30 minutes of activity, then record the level of pain and fatigue on the appropriate worksheet; 2) record joint protection behaviors on the appropriate worksheet. Along with the appropriate workbook chapters, participants are given a list of resources for ordering equipment and obtaining information on PPS, home modifications, and vacation/leisure ideas for persons with disabilities.

At this point, the Knowledge of Polio Test is administered for the second time and compared to the pretest. Participants again grade their own tests to reinforce learning.

The final phase of the educational program consists of showing a videotape (University of Michigan Medical Center, Post-Polio Research and Training Program) to stimulate discussion of coping strategies, "Coping Successfully with Polio's Late Effects." Some of the participants in the classes have not been members of post-polio support groups, and this provides their first opportunity to express feelings of loss. Some of them have joined support groups after completing the occupational therapy educational program.

Quantifying Functional Outcomes

Knowledge of Polio Test. The Knowledge of Polio Test ([Table 2](#)) was developed to objectively measure the increase in patients' knowledge about their condition. For the 35 participants trained during the past 2 years, the mean score on the pre-test was 17.5 (± 3.50) and the post-test mean score was 22.3 (± 1.70) ($t = 5.1$; $P < .005$), reflecting a significant increase in knowledge.

Activity Modification Questionnaire. This form consists of 14 questions covering various energy-saving and work simplification modifications presented during the program and is completed and returned 3 weeks after the last class ([Table 3](#))

Table 3

PERCENTAGES OF PATIENTS RESPONDING "YES" TO NEW ACTIVITY MODIFICATIONS AFTER EDUCATIONAL PROGRAM (N=33)		
1.	Identified incorrect work heights at home or at work?	88%
2.	Changed the way you use your hands or position your body to do activities?	82%
3.	Rest during activities that take 30 minutes or longer?	65%
4.	Changed incorrect work heights?	64%
5.	Changed location of equipment or supplies?	61%
6.	Become aware of energy-draining positions and changed them?	61%
7.	Eliminated a portion of an activity or have another person do that portion?	55%
8.	Avoid holding the same position for prolonged periods?	52%
9.	Started using adaptive equipment?	48%
10.	Changed the time of day you do an activity?	39%
11.	Eliminated an activity entirely or have another person do it?	39%
12.	Re-arranged a work area?	36%
13.	Started using energy-saving equipment which is available at stores (eg, food processor, electric knife, etc)?	30%
14.	Rest at least 1 hour total per day?	24%

Participants are asked to check whether they have implemented any of the modifications since the class started. Because of increasing disability, many have already been forced to integrate some of the techniques into their lifestyles. Therefore, the questionnaire asks them to mark a "B" before those modifications already in use before starting the program to identify the previously adopted changes.

The changes reported most frequently are identifying and changing incorrect work heights, changing location of equipment and supplies, changes in body and joint positioning, increasing the amount of rest,

and eliminating or delegating portions of activities ([Table 3](#)).

Table 4

PATIENTS REPORTING PAIN AND FATIGUE 3 WEEKS AFTER COMPLETING THE OCCUPATIONAL THERAPY EDUCATIONAL PROGRAM (N=31)		
	Decreased	Increased
Pain	58%	42%
Fatigue	65%	35%

Pain and Fatigue Questionnaire. This questionnaire asks whether the individual has noticed a change in pain or fatigue since starting the educational program ([Table 4](#)). Fifty-eight percent report decreased pain and 65% report less fatigue following the program. If outcomes were to be measured 3 or 6 months post-program, the percentages of modifications and symptom reduction might be increased, as some modifications require more time and/or financial expenditures to implement.

Suggestions for Individual Intervention

When polio survivors live near a facility offering a PPS clinic, the group format is the preferable form of occupational therapy intervention. This is not feasible when individuals travel a long distance to be evaluated over a 1 or 2-day period as is the case with many PPS clinics throughout the country. In these cases, the patient may be scheduled for 1 to 2 hours with each member of the rehabilitation team.

At present some PPS clinics use occupational therapy services only if the physician feels it is necessary after completing his or her examination. However, an occupational therapy consultation should routinely be scheduled for every patient's first visit to a PPS clinic, along with physical therapy, social service, and psychology.

The occupational therapy evaluation will determine which activities, responsibilities, roles, and environmental surroundings need to be modified in the patient's life. After explaining general principles of energy conservation, particular attention should be focused on those activities that produce pain and fatigue. Specific suggestions can be given for environmental adaptations, lifting and carrying techniques, evaluating work heights, re-arranging work areas or re-locating equipment, use of energy-saving or adaptive equipment, incorporating rest periods into activities, and delegating or eliminating tasks.

If the evaluation indicated a need for upper extremity orthoses, the therapist can fabricate an appliance for the patient to experiment with at home; if successful, the patient can be referred to a certified orthotist for a more permanent orthosis. If the patient is scheduled for a return clinic appointment, he or she should have a follow-up consultation with occupational therapy if any problems surfaced when the modifications were implemented.

Although some energy conservation and work simplification principles apply to all chronic conditions, it is a mistake to use printed information for rheumatoid arthritis patients, for example. Printed information

should be polio-specific and should be a supplement to, not a replacement for, an occupational therapy consultation.

After the evaluation, the occupational therapist should explain the neurological nature of PPS and the reason for interventions. The physician has a lengthy and involved examination to perform and often cannot take time to do this. If a patient does not understand his or her condition, it is difficult to implement necessary interventions. The practitioner-patient relationship is a significant determinant of compliance. This is important, because compliance is a significant problem in the Type A polio survivor. [18,19] If the patient perceives the health-care provider as being knowledgeable, interested, and concerned, compliance with recommendations is significantly increased.[20] If the occupational therapist is well-informed about PPS and the appropriate techniques of evaluation and intervention, the ensuing recommendations will more likely be accepted and implemented.

Energy conservation is a lifelong process. The successful program outlined in this article is designed to start individuals on a course of awareness of themselves, their surroundings, and their activities so as to decrease symptoms of PPS.

References

1. Brooke M, Stolov W, Shillam L, Kelly B. The importance of symptom pattern in evaluating post-polio neuromuscular changes. In: Halstead L, Wiechers D, eds. *Research and Clinical Aspects of the Late Effects of Poliomyelitis*. White Plains, NY: March of Dimes Birth Defects Foundation; 1987:49-53. [\[PubMed Abstract\]](#)
2. Halstead L, Rossi C. New problems in old polio patients: results of a survey of 539 polio survivors. *Orthopedics*. 1985; 8:845-850. [\[PubMed Abstract\]](#)
3. Kaufert J, Syrotuik J, Kaufert P, Gilbert P. Epidemiological issues in follow-up studies of the impact of poliomyelitis. In: Halstead L, Wiechers D, eds. *Late Effects of Poliomyelitis*. Miami, Fla: Symposia Foundation; 1985:135-152.
4. Codd M, Kurland L. Polio's late effects. In: *1986 Medical and Health Annual*. Chicago, Ill. Encyclopaedia Britannica; 1985:249-252.
5. Holman K. Post-polio syndrome: the battle with an old foe resumes. *Postgrad Med*. 1986; 79(8):44-53. [\[PubMed Abstract\]](#)
6. Owen R. Polio residuals clinic and exercise protocol: research implications. In: Halstead L, Wiechers D, eds. *Late Effects of Poliomyelitis*. Miami, Fla: Symposia Foundation; 1985:207-219.
7. Perry J. Orthopedic management of post-polio sequelae. In: Halstead L, Wiechers D, eds. *Late Effects of Poliomyelitis*. Miami, Fla: Symposia Foundation; 1985:193-205.
8. Smith L, McDermott K. Pain in post-poliomyelitis: addressing causes versus treating effects. In: Halstead L, Wiechers D, eds. *Research and Clinical Aspects of the Late Effects of Poliomyelitis*. White Plains, NY: March of Dimes Birth Defects Foundation; 1987:121-134. [\[PubMed Abstract\]](#)
9. Locker D, Kaufert J, Kirk B. Late effects of poliomyelitis. In: Halstead L, Wiechers D, eds. *Research and Clinical Aspects of the Late Effects of Poliomyelitis*. White Plains, NY: March of Dimes Birth Defects Foundation; 1987:157-171. [\[PubMed Abstract\]](#)
10. Mailhot A. Age and the old polio: do the virtuous fade first? *Rehabilitation Gazette*. 1980; 23:6-7.
11. Kaye R, Hammond A. Understanding rheumatoid arthritis. *JAMA*. 1978; 239:2466-2467. [\[PubMed Abstract\]](#)
12. Rand P. Evaluation of patient education programs. *Physical Therapy*. 1978; 58:851-856. [\[PubMed Abstract\]](#)
13. Furst G, Gerber L, Smith C, Fisher S, Shulman B. A program for improving energy conservation

- behaviors in adults with rheumatoid arthritis. *Am J Occup Ther.* 1987; 41:102-111. [[PubMed Abstract](#)]
14. Gerber L, Furst G, Shulman B, et al. Patient education program to teach energy conservation behaviors to patients with rheumatoid arthritis: a pilot study. *Arch Phys Med Rehabil.* 1987; 68:442-445. [[PubMed Abstract](#)]
 15. Rankin S, Duffy K. *Patient Education: Issues, Principles, and Guidelines*. Philadelphia, Pa: J.B. Lippincott Co; 1983.
 16. Frick N. Post-polio sequelae and the psychology of second disability. *Orthopedics.* 1985; 8:851-853. [[PubMed Abstract](#)]
 17. Furst G, Gerber L, Smith C. *Rehabilitation Through Learning: Energy Conservation and Joint Protection -- A Workbook for Persons With Rheumatoid Arthritis* (GPO Stock No. [017-045-00107-4](#), NIH Publication No. 85-2743). Washington, DC: US Government Printing Office; 1985.
 18. Bruno R, Frick N. Stress and "type A" behavior as precipitants of post-polio sequelae: the Felician/Columbia survey. In: Halstead L, Wiechers D, eds. *Research and Clinical Aspects of the Late Effects of Poliomyelitis*. White Plains, NY: March of Dimes Birth Defects Foundation; 1987:145-155. [[Lincolnshire Library Full Text](#)]
 19. Bruno RL, Frick NM. The psychology of polio as prelude to post-polio sequelae: behavior modification and psychotherapy. *Orthopedics.* 1991; 14: 1185-1193. [[Lincolnshire Library Full Text](#)]
 20. McCord M. Compliance: self-care or compromise? *Topics in Clinical Nursing.* 1986; 7(4):1-8. [[PubMed Abstract](#)]

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