
Work Hardening: Occupational Therapy in Industrial Rehabilitation

(rehabilitation, vocational; work capacity)

Leonard N. Matheson

Linda Dempster Ogden

Kris Violette

Karen Schultz

Work hardening, presented in this paper as a "new" service for the industrially injured, is actually well grounded in the traditional models and practices of occupational therapy. From the profession's early roots in industrial therapy to the development of a variety of programs for the industrially injured through the 1950s and 1960s, the historical and philosophical bases of occupational therapy support the use of work as an evaluative and therapeutic medium. What is actually new is the adoption of terminology, technology, and a program format that fits in with the needs of consumers in the 1980s.

Recent developments that created the need for the specialized services that occupational therapists are uniquely qualified to provide include growth of private sector vocational rehabilitation, changes in workers' compensation laws, and increasing costs of vocational rehabilitation. This paper describes work hardening in its present form. A case example is given that demonstrates how work hardening can be a cost-effective and time-saving bridge which spans the gap between curative medicine and the return to work.

Work hardening is a work-oriented treatment program that has an outcome which is measured in terms of improvement in the client's productivity. This is achieved through increased work tolerances, improved work rate, mastery of pain (through the effective use of symptom control techniques), improved work habits, increased confidence, and proficiency with work adaptations or assistive devices. Work hardening involves the client in highly structured, simulated work tasks in an environment where expectations for basic worker behaviors (e.g., timeliness, attendance, and dress) are in keeping with workplace standards. The ultimate goal of work hardening is to help the client achieve a level of productivity that is acceptable in the competitive labor market. This productivity improvement is achieved at various levels through the following techniques.

- Decrease in secondary impairment effects. Impairment is often magnified through disuse. Work hardening improves strength, flexibility, and endurance.

- Decrease in functional limitations. The client's style of work and the quality of his or her work behavior often increases the functional decrement due to the impairment. Work hardening helps the client learn effective adaptive behaviors.
- Decrease in disability. Disability is the impact of functional impairment on the client's societal roles, among which work roles are prominent. Work hardening helps the client reestablish many of these roles. Improvement in these other areas generalizes to work roles and results in a concomitant decrease in work-related disability.

Leonard N. Matheson, PhD, is Director, and Linda Dempster Ogden, OTR, is Associate Director; both at Employment and Rehabilitation Institute of California, Anaheim, CA 92801; Kris Violette, OTR, is WORC Program Director, La Palma Intercommunity Hospital, La Palma, CA 90623; and Karen Schultz, MS, OTR, is Director, Los Angeles Hand Rehabilitation Center, Santa Monica, CA 90402.

- Improvement of vocational feasibility. Feasibility, which is the client's acceptability as an employee, is a key issue in work hardening. Most clients with chronic industrial injuries have not worked for several months. Thus, work hardening identifies and remedies potential problems with productivity, increases safety in the workplace, and strengthens interpersonal relations.
- Improvement of employability. Employability, which is the probability that the client will achieve employment, is a consequence of the levels of the client's work tolerances (e.g., ability to lift, carry, and stand) compared with the tolerances of other workers in the general labor market. Work hardening identifies and develops these work tolerances.
- Decrease in vocational handicap. The match between the client and job can be improved by increasing the client's level of function and by modifying the job's critical work demands. Work hardening involves both the client and the employer to address these issues.

Historical Roots

Although work hardening is presented here as a new service, in the sense of its recently recognized importance within industrial rehabilitation, the origins of many of its current concepts and techniques are found in occupational therapy (1).

In the early 1900s, several societal trends culminated in a nationwide awakening to the rehabilitation needs of the physically disabled. Before, care for the disabled

usually took the form of custodial public support.

Meanwhile, occupational therapists were actively involved with the development of industrial therapy programs in mental hospitals. Industrial therapy was well developed by the late 1930s and was defined as "the prescribed use of activities inherent to the hospital operation, planned for the mutual benefit of patient and institution" (2, pp 1-7). Various jobs within the institution were analyzed according to skill level, physical and mental demands, and potential therapeutic benefits. Working as part of a professional team, the occupational therapist coordinated work assignments in keeping with the patient's aptitudes, interests, experiences, and therapeutic goals (3, 4).

The aftermath of World War I focused society's attention on the increasing numbers of disabled unemployed veterans who wanted to lead economically productive lives. Public awareness soon expanded to include even greater numbers of disabled civilians, who faced a similar dilemma as the mechanization of American industry caused more industrial accidents. To return to the workplace, injured workers often needed retraining, sometimes for an entirely new occupation (1, 3, 5).

In response to these needs, private agencies began to develop programs to provide rehabilitation services. In 1920, the passage of the federal Vocational Rehabilitation Act added important governmental support to these private efforts. The purpose of this law was to provide funds to reclaim persons who would not otherwise be employable by retraining them "around the disability" and placing them in suitable jobs. Amendments in 1943 and 1954 to the 1920 Act

increased funding for vocational rehabilitation services and allowed these services to be expanded to include programs for psychogenic illness and for physical restoration (1, 5).

The expanded opportunity to develop vocational rehabilitation services resulted in temporary lags between theory and practice. Occupational therapy responded to the challenge, and several programs emerged. Among the earliest efforts was the establishment of "curative workshops." The practice of occupational therapy within the curative workshops supported the concept that the profession provided an important service to bridge the gap between a physical restoration and the return to work.

In the hospital, an injury or disease is treated sufficiently to enable the patient to return home, but it remains for the curative workshop to continue the treatment until the patient is capable of returning to his occupation (8, p 223).

Treatment in the curative workshop was geared toward restoring the impaired body part to as normal function as possible, with the return to work as the eventual goal. Graded activities were used to improve function, and these were often planned along the lines of the physical demands of the patient's original job (7). Therapeutic activities were adapted so that "the muscles he has always used and must use again in his job are brought into play and restored to the patient's functional and economic needs" (8, p 164).

The "work evaluation" program in the 1940s at the Rochester Rehabilitation Center in New York represents another step in the conceptual development of work hardening (9). This program was recognized not only as a treatment

center to recondition a person for the return to work, but also as an evaluation center that supplied initial information for the identification of appropriate vocational goals. Individuals who had gained maximum physical restoration were admitted to the work evaluation program. In this program, they were presented with a variety of industrial jobs in work conditions that simulated the industrial environment. Over the course of several weeks, clients would learn to work at maximum efficiency to meet industrial standards. Performance was carefully observed and analyzed in terms of general worker traits (e.g., strength, tool handling, work habits, dexterity) to determine areas of employability. In the approach used at the Rochester Rehabilitation Center, as in work hardening today, vocational interests were formally evaluated only after work tolerances were relatively stable and well defined. Stevens (9), an occupational therapist who helped develop the program, said, "To direct the client's interest and then to determine the capability produces a 50-50 chance that the interest will have to be undirected afterwards" (p 158).

In the late 1950s, many rehabilitation programs were divided into "prevocational" and "vocational" services. In addition, there was movement toward using more standardized vocational testing procedures. This led to the development of the profession of vocational evaluation. Vocational evaluation was seen as a comprehensive assessment process that used standardized work samples and psychometric tests to determine assets and limitations in the areas of work aptitudes, interests, temperaments, and skills. Separate prevocational programs, such as that developed

at the Institute for the Crippled and Disabled in New York (10), helped prepare clients for the pressures and demands of vocational evaluation. The prevocational program was concerned with developing a client's work habits, work tolerances, coordination, and productive speed to levels acceptable for entry into vocational evaluation and eventual employment. The decision as to whether a client should undergo prevocational evaluation and training, begin vocational evaluation, or go directly into a job training program was made by the rehabilitation team. This team often used information gained from structured "work tests" (11) or from "physical capacity evaluations" (12) developed and administered by occupational therapists.

Perhaps the best example of an early work hardening program can be found in Wegg's (13) description of the "work therapy" program at the May T. Morrison Center for Rehabilitation in San Francisco.

This program consists of those activities which are simulations of actual on-the-job conditions of the individual patient and can be used both as an estimate of ability and as an exercise medium to develop work habits, confidence, increase physical and emotional tolerance, improve strength, range of motion, coordination, and dexterity. The familiar working situations promote good physiological effects. The clear treatment objectives provide motivation. The availability of the tools used in his trade allows the injured worker to begin developing the speed and skill he had attained during his employment. The occupational therapist is provided with an opportunity to grade activities as to length of time, resistances used, distances that weights are lifted and carried, positions of work, and so on (p 252).

While some occupational therapists were developing sophisticated methods for vocational evaluation

and treatment for the industrially injured, the profession as a whole was responding to societal pressures to develop a more scientific rationale for its practice. In the late 1950s and 1960s, occupational therapy began embracing the medical model and moved toward developing its professional role within rapidly growing physical rehabilitation centers. As a result, occupational therapists began to leave vocational rehabilitation programs for the industrially injured. By the mid-1960s, occupational therapists in work-related programs were found mainly in prevocational or work adjustment programs that served the severely disabled or the mentally or emotionally handicapped.

The 1980s have shown a reawakening of occupational therapy to the values and beliefs of its founders and to the realization that the marketplace supports reestablishment of the profession's role in vocational rehabilitation of the industrially injured.

Work Hardening Program Characteristics

The present form of work hardening was developed at Rancho Los Amigos Hospital in Downey, CA, in the late 1970s. A survey of programs in existence in March 1984, indicated that work hardening services were being offered in 26 locations in the United States and that approximately an equal number of programs was in organization. Almost half of these programs were located in California. All of the programs served injured workers as their primary population. Only two of these programs were based in government-operated institutions. A large majority of these programs (17 of the 26) were established and/or operated

by occupational therapists, who occasionally worked with a physical therapist or vocational evaluator.

Work hardening typically takes place in a nonhospital environment, although several good work hardening programs are in hospitals or clinical environments. Work hardening requires from 600 to 1,500 square feet; the better programs typically occupy 1,200 square feet or more.

Work hardening programs use work capacity evaluation devices as the primary treatment tools. This is a new class of evaluation equipment that allows the work hardening professional to present the patient with tasks that simulate job tasks and that can be graded in terms of the level of difficulty or the length of time involved. Matheson and Ogden (15) and Matheson (14) describe several work capacity evaluation devices. Most of the devices in use are "homemade," although a few have recently become commercially available.

The work hardening client typically is supervised by a technician-level individual in a 4:1 or 6:1 ratio. The technician is closely supervised by the person responsible for the program and conducts the program based on the individualized work hardening plan written by the supervisor. This plan is developed by the professional in consultation with the client after an intake process. Typical charges for work hardening are \$85 to \$95 on a half-day basis and \$125 on a full-day basis.

Experience shows that the clients who experience the greatest benefit from work hardening programs are those who are seriously deconditioned after an impairment caused by an injury or disease. In addition, people who have major discrepancies between their symptoms and objective findings and in-

dividuals whose impairment is limited to the dominant upper extremity substantially benefit from work hardening.

Evaluation Process

To consider a client for work hardening, a clear diagnosis and specific work restrictions or impairment description must be available from his or her primary care physician. Work hardening is conducted within this context. The work hardening tasks assigned to the client must not exceed his or her work restrictions. As the client progresses in the work hardening program, these restrictions may require modification. If recent medical information is not available, an updated medical evaluation should be conducted. Under no circumstances should a work hardening program be conducted without recent and reliable medical information.

After the medical information is reviewed, an intake interview is conducted. This interview begins with a review of the client's general medical status. The programs that we developed use the *Cornell Medical Index* (16), which provides a general overview of the various body systems. Next, information about the client's functional tolerances is collected. This review begins with the WEST Tool Sort (17), which is a collection of cards that can be keyhole sorted. Each card has a tool depicted in its most typical grip. On the back of the card is a description of how the tool is used. The client sorts the tool cards in terms of physical tolerance for use of the tool. The results of the tool sort are used to develop the client's "work function themes," which are all-encompassing, usually unspoken, rules that each client uses to restrict or guide

participation in work tasks. Next, the intake interview develops the client's reported "functional tolerance profile," which is a review of work-relevant abilities based on activities of daily living. An interview technique is used to review a list of functional tolerances in terms of the client's recent experience.

After the functional tolerance information is collected, the client's goals are reviewed. He or she may have goals that fit nicely into a subsequent work hardening program. Similarly, the referral source may have specific goals.

The last stage of the intake interview is to design the individualized work hardening plan, which is described in a document prepared by the practitioner. This document lists treatment issues, goals, time frame, schedule, and the procedures and personnel involved. It is reviewed constantly and updated frequently.

Application of Work Hardening—A Case Example

Work hardening practitioners today take a highly systematic approach to treatment, with the type of intervention predicated on the stage in the rehabilitation process at which the patient is functioning. Figure 1 presents the stage model of industrial rehabilitation. Work hardening programs routinely address *stages 2* through *7*, and the type of intervention depends on the stage.

Mr. Jones is referred to the XYZ work hardening program after having sustained a lumbosacral strain/sprain. He is a paint container packager and loader; this is a job to which he believes he cannot return. His physician restricts him to lifting no more than 50 pounds and allows only infrequent bending and stooping. Mr. Jones reports a

Figure 1
Stage model of industrial rehabilitation*

Stage	Area Assessed	Measured By or in Terms Of
One	Pathology	Studies of tissue and bone.
Two	Impairment	Evaluation of anatomy, physiology, and psychology.
Three	Functional limitation	Patient's report of symptoms and limitations. Observation of function.
Four	Disability	Social consequences of the functional limitations; how they affect the patient's customary roles.
Five	Feasibility	Acceptability of the patient as an employee. Work behavior of the patient.
Six	Employability	Ability to become employed within a particular labor market.
Seven	Vocational handicap	Ability to become employed in a particular occupation.
Eight	Earning capacity	Income measured over the worker's lifetime.

*. Model developed by the Employment and Rehabilitation Institute of California.

current tolerance for lifting ten pounds "occasionally" and believes that he could not perform this task on an all-day basis. An outline of his work hardening program with treatment modules and program schedule follows. It is delineated in terms of the pertinent stages from the model depicted in Figure 1.

Stage Two (Impairment)

Decreased strength is identified in the erector spinae and quadriceps muscle groups. Mr. Jones is assigned to a lifting/lowering task (*Treatment Module 1*) on a 10-pound, twice-per-minute basis, from knee to shoulder height, for 15 minutes. This module is repeated once per hour for two hours for two days. *Module 1* is increased to once every hour for four hours for *days 3* through *5* and maintained at four times a day with an increase in frequency to twice per hour in *days 6* through *8*. Increases in load at five-pound increments begin at *day 7* as tolerated.

Stage Three (Functional Limitation)

As Mr. Jones begins *Module 1*, he is observed to be using poor body mechanics and work posture. A 15-minute videotape feedback session (*Module 2*) once every day

for five days brings Mr. Jones to the realization that his work behavior is tied to increases in pain, which limit his productivity. He receives instruction on appropriate work behavior, including body mechanics, and continues his program with the requirement that these be in constant use to develop the work habits which optimize his function.

Stage Four (Disability)

Mr. Jones reports that he cannot return to his previous job as a paint container packager and loader. In addition, he cannot repair his pickup truck, clean his yard and garage, prune his fruit trees, work at his garage workbench, or continue with his volunteer job as a maintenance man at his church. His "critical work function themes" are analyzed. He is found to avoid activities that require him to lift or carry more than 10 pounds, to perform whole-body push or pull tasks, or to reach to retrieve anything over two pounds at shoulder level or above. As he progresses with *Modules 1* and *2*, Mr. Jones is assigned to a "disability tasks" module (*Module 3*), which replicates these task demands while performing simulated work. The tasks are arranged so that he is allowed to

successively approximate (under his control) the level of task demand that he avoids. This expansion of the concept of disability beyond the client's work roles is crucial. Most clients are ambivalent about returning to the job on which they were injured. Conversely, very few clients are ambivalent about returning to the other social roles for which they have become disabled. The generalization to the work role of the client's motivation to perform these roles is one that the practitioner undertakes with a great deal of care.

Stage Five (Feasibility)

Mr. Jones works beyond his tolerance on the third day of the program. He has such bad back pain afterwards that he is unable to sleep and misses the next day of work. When he returns to the program on the fifth day, he receives instruction in the use of the "Feasibility Evaluation Checklist" (14) and the "feasibility hierarchy." He begins to learn to balance work pace (quantity of productivity), workplace tolerance, and attendance—the three feasibility areas that cause him the most trouble.

Stage Six (Employability)

As Mr. Jones progresses in the program to the point at which a return to his usual and customary occupation may be considered, *Module 1* is modified to simulate his job's critical work demands, based on a job analysis conducted in consultation with the work hardening program staff. The frequency and range of motion targets for the work hardening program are obtained from the job analysis. A work hardening program is designed to increase his work tolerance for range of motion under load (lifting and lowering),

so that he can safely lift 50-pound boxes from knee to shoulder height once every three minutes and 10-pound cans from waist to shoulder height five times per minute when both tasks are intermixed on an eight-hour-a-day basis.

Stage Seven (Vocational Handicap)

After four weeks, Mr. Jones progressed to a full eight-hour workday at the range of motion under load and frequency targets. A "supervised work trial" is arranged at his usual and customary job. A work hardening staff member travels to Mr. Jones' workplace and observes him on the actual work task for one hour. The customary work layout is such that Mr. Jones turns his body at the waist during lifting and lowering tasks much more than had been anticipated; this is necessary because of his placement between two work surfaces. In a discussion with the work supervisor, a slight modification of the placement of these work surfaces is made so that the surfaces stand each other with Mr. Jones standing at their intersection. Thus, turning while lifting is reduced to within Mr. Jones' tolerance.

Mr. Jones returned to his usual and customary employment and performed successfully in that position.

This treatment approach can yield significant improvement very quickly. Table 1 depicts the effect of work hardening on 25 clients with lumbosacral injuries for whom pain was the primary disabling factor. Most clients had been off work for two or three years, and only a few clients were expected, at the time of referral, to be able to return to work. Work hardening services were provided by a vocational evaluator as part of a work

capacity evaluation program, which was graded to provide the patient with increases in work demand as his or her work tolerances improved.

Improvement in Work Capacity—Career Development Center

In Table 1, the general level of physical demand characteristics (PDC) of this group at intake is compared with the level seven to 10 days later when the patients left the program. Typically, patients improved from the sedentary range of PDCs to the light-medium range of PDCs. PDC refers to the general strength demands of work as defined by the US Department of Labor. Strength is probably the most important factor. In industrial rehabilitation, the types of injuries that most chronically disabled people have sustained directly affect their ability to bring strength to bear on the job tasks. Figure 2 depicts the Employment and Rehabilitation Institute of California's version of the Department of Labor's system.

Physical Demand Characteristics of Work

Typically, clients depicted in Table 1 improved from the sedentary to the light-medium PDC level. This is a significant improvement from the point of view of employability. It greatly improves the like-

lihood that these people are going to be able to find jobs that match their aptitudes, interests, and temperament.

While work hardening results in several important consequences, clients most frequently indicate increased employability as its most important effect. Work hardening improves employability in four specific ways.

1. Improvement of specific work tolerances through conditioning of the work hardening patient. As in the example presented above, work hardening develops strength, flexibility, and endurance through the use of work simulation as conditioning tasks. As work tolerances increase, employability improves because a greater number of jobs become possible.

2. Clarification of work tolerances in general. While work hardening is primarily a treatment program focusing on a few specific tolerances, a considerable amount of knowledge is gained about the patient's work tolerances in general. Clarification of these work tolerances improves employability by providing a better definition of jobs the client is able to perform.

3. Symptom control through the use of work pacing, proper body posture, proper body mechanics, and the substitution of productivity for symptomatology as the method of self-assessment. Symptoms are controlled (not nec-

Table 1
Improvement in Work Capacity-Career Development Center

	Physical Demand Characteristics Level							
	S	S-L	L	L-M	M	M-H	H	V-H
Intake	11	4	5	1	0	2	0	2
Exit	0	2	5	10	1	7	0	0

Values are for *n* = 25. S, sedentary; S-L, sedentary light; L, light; L-M, light medium; M, medium; M-H, medium heavy; H, heavy; V-H, very heavy; No change, 8%; 1 level, 16%; 2 levels, 32%; 3 levels, 32%. Avg length of program = 7 days. Range = 5-12 days.

Figure 2
Physical demand characteristics of work

Level	Weight Lifted	Frequency of Lift	Walking/Carrying	Typical Energy Required
Sedentary	10 lb or less	Infrequently	None	1.5 METS
Sedentary light	15 lb 10 lb or less	Infrequently Frequently	Intermittent self-paced No load	2.0 METS
Light*	20 lb 10 lb or less	Infrequently Frequently	2.5 mph no grade Slower speed with 10 lb or less	2.5 METS
Light medium	35 lb 20 lb or less	Infrequently Frequently	3.0 mph no grade Slower speed with 20 lb or less	3.0 METS
Medium	50 lb 25 lb or less	Infrequently Frequently	3.5 mph no grade Slower speed with 25 lb or less	3.5 METS
Medium heavy	75 lb 35 lb or less	Infrequently Frequently	3.5 mph no grade with 35 lb load	4.5 METS
Heavy	100 lb 50 lb or less	Infrequently Frequently	3.5 mph with 50 lb or less load	6.0 METS
Very heavy	In excess of 100 lb 50 lb to 100 lb	Infrequently Frequently	3.5 mph with 50 lb or more load	7.5-12.0 METS

* Even though the weight lifted may be negligible a job is considered light if it requires a significant amount of walking or standing or frequent use of arm and/or leg controls.
MET, measure of energy expenditure.

essarily decreased) and made much more predictable. Because the symptoms are recognized as being tied to certain job tasks that the patient must perform, the client is able to work around the symptoms as they become more predictable. The client understands the relationship between job tasks and symptoms and thus is able to determine strategies to work around or modify the method by which these job tasks are accomplished.

4. Tool or job modifications. Tool and job modifications occur in almost every job, whether or not the worker is disabled. In rehabilitation, experience has shown that most modifications are developed by the client working in his or her own work environment, without the benefit of the professional's in-

put. Work hardening gives us an opportunity to work with the client in a laboratory setting. Because it uses work simulation tasks with the client on a daily basis for several days in a row, the work hardening environment allows experimentation with different job and tool modifications; therefore, by the time the client goes out to the workplace, most of the "bugs" have been worked out.

Work hardening continues until a) the client has reached a work tolerance goal or plateau or b) the client has conclusively demonstrated that he or she is nonfeasible for employment. Both types of goals are worthwhile to obtain. The first goal helps the client to increase his or her chances of suc-

cess in the labor market. The second goal often is not readily accepted by rehabilitation professionals. However, such a resolution of the client's case not only facilitates adjustment to disability, but also provides the client with better access to the governmental support services that may otherwise be unavailable. For example, persons with true pain disorders that are based on a moderate level of pathology or a collection of minor pathologies often are not granted a Social Security Disability Insurance (SSDI) award, even though they are unable to perform substantial gainful employment. This is because the SSDI system measures employability in terms of impairment and does not directly evaluate employability. In cases in which work hardening has been unsuccessfully attempted, the fact that the work hardening program resolved the client's work status in an unequivocal manner led to successful pursuit of SSDI awards. Conversely, success in work hardening facilitates a client's return to the labor market.

Typical referrals for work hardening come from two sources: a) the rehabilitation counselors and rehabilitation nurses who supervise the vocational rehabilitation programs for people who have suffered industrial injuries whose vocational rehabilitation programs are being underwritten by either workers' compensation carriers or their self-insured employers and b) the primary care physician and the insurance claims person. Primary care physicians who are working with people who are significantly deconditioned or for whom there is a major discrepancy between subjective symptomatology and objective findings greatly prefer to have a short trial of work harden-

ing available before work restrictions are set or before the client is cleared to return to work.

Insurance claims persons will readily support work hardening if it is used as a means to conclude a medical rehabilitation program that can be shown to be effective in promoting subsequent placement or a resolution of the case. Experience has shown that individuals who can benefit from work hardening can be identified early in the program. Hence programs can be time limited and their outcome is often predictable. This is quite attractive to claims persons.

In California, a substantial number of injured workers who might benefit from vocational rehabilitation services choose not to take part in the vocational rehabilitation process or are excluded from the program because they are found to be not suitable for competitive employment. Some of these people could have benefited from the rehabilitation process if work hardening had been available.

Summary

Work hardening is a new specialty within rehabilitation. It is addressed by several different disciplines among which occupational therapy has taken a leadership position. Work hardening is an important new approach to the rehabilitation of injured workers and others whose entry into the work force is under consideration.

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