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## Health Maintenance And Reduction Of Disability Through Physical Exercise

by Kristijan T. Ragnarsson, MD

The impact of regular physical activity on health and longevity has been debated by both physicians and lay persons for centuries. The ancient Greeks promoted in their culture the philosophical concept of "a sound mind in a sound body" and Hippocrates (460–377 BC), their best known physician and father of the medical profession, indeed noted that "all parts of the body which have a function, if used in moderation and exercised in labors in which each is accustomed become thereby healthy, well developed, and age more slowly, but if unused and left idle, they become liable to disease, defective in growth and age quickly." In contemporary terms, this view has been expressed as "use it or lose it." The pursuit of physical and mental health through physical exercise and sports, even in times of peace, became an important part of the life of the ancient Greeks. Competitive athletic events flourished, and of these the best known today would be their Olympic Games. Unfortunately, public interest in physical fitness through exercise declined during the days of the Roman Empire and throughout the Middle Ages, except in the military as a means to survive and conquer in times of warfare. During those many centuries, health and longevity seemed to be affected more by infectious disease, natural disasters, and armed conflicts rather than by medical conditions related to deconditioning, aging, and sedentary lifestyle.

During the 20th century, there has been a growing public consensus that physical exercise is important for good health. Numerous sports facilities have been built, athletic leagues and events have been organized, and in the United States, the President's Council on Physical Fitness and Sports was established. In the early part of the century, physical exercise and sports were considered to be more for the young than for

the middle-aged or older persons, or to be recreational activities to watch or play rather than as a means to achieve fitness and better health. During the second half of the century, it gradually became clear to the medical profession that there are numerous negative affects associated with sedentary lifestyle: prolonged bed rest during disease, and immobilization following injury (1). Muscles were found to atrophy and weaken, cardiovascular function deteriorated with reduced aerobic capacity, bones lost density, endocrine function was altered, and so on. As a result of these observations, physicians have modified their practices and, in general, their patients no longer must endure long periods of bed rest while recuperating from an illness or injury, but are encouraged to become physically active as early as possible through exercise programs of increasing intensity.

During the last quarter of a century, it has become increasingly clear that physical activity and fitness are inversely associated with morbidity and mortality from several chronic diseases (2). Large population studies have shown a strong and consistent inverse relationship between physical fitness and mortality in men and women unrelated to age and other risk factors (2). Consequently, sports and physical fitness are no longer considered beneficial just for the young and for professional athletes, but for middle-aged and older individuals as well. Since scientific data demonstrating the health benefits of exercise are relatively new and scant, the medical profession has been relatively slow to respond to these scientific observations and it vigorously advocates physical exercise as an important means toward preventing illness and restoring health. However, as individuals, physicians are generally known to pursue regular exercise for themselves in high

numbers while regrettably often failing to recommend this intervention for their patients. The curricula for most medical schools still place little emphasis on teaching students about the preventive and therapeutic effects of exercise or about the principles of exercise prescription. During the current time of revolutionary changes in the delivery of healthcare, it is interesting to note that some managed healthcare companies have recognized the beneficial effects of physical exercise and have offered discounts at physical fitness centers and at sporting good stores to their subscribing members. It may be speculated that in a capitated reimbursement system, where the deliverers of healthcare services carry the financial risk, health promotion and illness prevention programs will play an increasingly larger role. It is thus likely that achieving and maintaining physical fitness for all constituents of such health care delivery systems will be a major goal of their illness and injury prevention programs.

### **Sports and Fitness Training for Persons with Physical Disability**

As sports became a greater part of the culture in Western Societies, interest grew among persons with physical disabilities to actively participate in such activities. In 1944, Sir Ludwig Guttmann, MD, the founder of the National Spinal Injuries Center at Stoke Mandeville Hospital in England, first introduced sporting activities as an essential part of the medical treatment of persons with spinal cord injury (3). He found these activities to have immense therapeutic value in restoring the disabled person's strength, coordination, and endurance and in achieving psychological adjustment to the disability. His patients participated in a variety of sports, including wheelchair polo, basketball, archery, bowling, fencing, racing, field events, and weight lifting. People with other physical disabilities soon followed suit, not only in England but in many other countries, and organized their own sports programs and events. Under Sir Ludwig's leadership, the Stoke Mandeville Games for the Paralyzed were first held in 1948 and grew to be an international annual event, which, every

fourth year, has followed the Olympic Games, in the same country if possible, and consequently the Stoke Mandeville Games were renamed the Paralympic Games (i.e., they run parallel to the Olympic Games).

In the United States, the medical profession has paid relatively little attention to sports as a therapeutic intervention in disease and physical disability. Sports medicine focuses more on treating the injured athlete than on the therapeutic benefits of sports. Athletes with disability have largely organized their own sports programs and events and have had special athletic gear designed and manufactured with little support of physicians or rehabilitation professionals. Third-party reimbursement for athletic activities by disabled persons has been nonexistent during both inpatient and outpatient rehabilitation; as a result, a relatively small proportion of the disabled population has had the opportunity to participate regularly in sports. However, healthcare providers and third-party payers have gradually accepted the value of therapeutic exercise supervised or delivered by professional physical therapists during rehabilitation after disabling injuries and disease. While regular aerobic exercise and fitness have been shown in numerous scientific studies to have preventive value for different medical conditions, as noted above, including cardiovascular disease (2,4–6), hypertension (7–9), non-insulin dependent diabetes mellitus (10), colon cancer (11), osteopenia (12), obesity, and mental health problems (13), such exercise is still not considered a reimbursable medical expense.

People with spinal cord injury (SCI) and other forms of severe physical disability are limited in their ability to participate in physical exercise, both because of their physical limitations and because of environmental barriers, such as, lack of transportation, appropriate athletic facilities, and the need for special equipment. Consequently, their cardiovascular fitness may be severely diminished and a series of degenerative physiological changes predictably occur that negatively affect the person's health sooner or later. According to data from the Spinal Cord

Injury Model Systems Uniform Data Base, heart disease now accounts for 18.7 percent of all deaths following spinal cord injury, ranking second only to respiratory conditions as the cause of death (14). It is possible that such heart disease and other cardiovascular causes of death following SCI may be related to immobility. It has also been shown that individuals with paraplegia have a high incidence of myocardial ischemia upon cardiac stress testing with thallium 201 imaging studies (15). Numerous other studies have indicated the presence of other risk factors for cardiovascular disease in persons with SCI: risk factors frequently related to inactivity, such as, high lipoprotein cholesterol concentrations (16), reduced lean body mass (17), and abnormal glucose tolerance test (18,19).

Despite such observations, health care providers generally still do not include aerobic exercise programs in the rehabilitation or long-term follow-up of persons with SCI. Professionals in the field of rehabilitation medicine have traditionally emphasized several specific forms of physical exercise for their patients with SCI during the rehabilitation process that follows the onset of the disability. Such exercises include muscle strengthening and range of motion exercises, as well as functional training for self-sufficiency and mobility, but, in general, aerobic exercises, which increase endurance and have certain health benefits in people without disability, do not have a large role. Following rehabilitation, which usually is completed during the first year after injury, continued physical exercise for fitness is not emphasized. Unfortunately, most individuals with SCI are completely wheelchair-bound and sedentary and do not pursue any form of regular fitness training. Relatively few, and mostly persons with paraplegia, participate in wheelchair sports and upper body training. Ordinary manual wheelchair propulsion and performance of the activities of daily living, in general, are insufficient to maintain physical fitness, since it has been shown that activity count and circulatory strain for persons with SCI are low compared to normal controls (20,21). It may, therefore, be concluded that additional aerobic exercise—several times each

week—is needed if persons with SCI are to reach and maintain the level of physical fitness that is desirable for their health and function.

Since most people with SCI have paralysis of the largest muscles of the body (i.e., those of the buttocks and lower limbs), it has been speculated that exercise of the non-paralyzed muscles in the upper limbs may not be enough to achieve a state of fitness. Aerobic exercises that involve the use of the upper limbs not only may be less effective in enhancing fitness and health than exercises of the lower limbs, but may even have some drawbacks for persons with SCI. Exercise with the upper limbs clearly involves smaller muscle mass and elicits smaller physiological response than lower limb exercise and consequently may be less effective in producing cardiopulmonary fitness. Additionally, persons with high-level tetraplegia may not be physically capable of participating in wheelchair sports or fitness training, which requires the use of the upper limbs. Aerobic exercise of the upper limbs may, therefore, not be the final answer to the exercise needs of persons with SCI. As a result, it has been suggested that active exercise of their paralyzed muscles through computerized functional electrical stimulation ergometry may also be helpful to improve the level of fitness for persons with SCI. Several studies have shown that such form of exercise may increase the mass and strength of the stimulated muscles and have a modest beneficial effect on cardiovascular performance and some of the risk factors for cardiovascular disease (22). While such form of physical exercise does not replace upper limb exercises for persons with paraplegia, it may prove to be a valuable alternative for those persons with SCI who, for some reason, are unable to exercise using their upper limbs.

## CONCLUSION

Scientific evidence shows that physical and mental fitness may be improved through exercise, and, by this means, health and longevity may be improved. Clinicians,



An archer prepares his recurve bow for practice.

therefore, should actively advocate some form of physical exercise and pursuit of fitness for all their patients. Life-long physical exercise may be of particular importance for persons with SCI who, by nature of their disability, are profoundly sedentary and develop prematurely different medical conditions that are often associated with lack of exercise and aging.

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