

The Effectiveness of BackHealth® Technology

Back injuries are the single largest health problem in the workplace, affecting as many as 35 percent of the work force and accounting for about 25 percent of all compensation claims. The purpose of this report is to summarize the results of five case studies that demonstrate the effectiveness of workplace based strengthening in prevention of back pain and injury.

*The case studies all support the premise that by exercising and strengthening the muscles of the back, workplace back strains and injuries can be significantly reduced, leading to lower workers' compensation costs and absenteeism. The published studies are: *The Effect of Workplace Based Strengthening on Low Back Injury Rates: A Case Study in the Strip Mining Industry*¹; *Strength and Fitness and Subsequent Back Injuries in Firefighters*²; *Primary Prevention of Back Symptoms and Absence from Work*³; *Physical Measurements as Risk Indicators for Low-Back Trouble Over a One-Year Period*⁴, and a documented program performed at the Coca Cola sales distribution centers in Atlanta, Georgia by the Northeast Georgia Medical Center⁵.*

Each of the four studies and the Coca Cola project supports exercise of the back muscles as the most effective means of reducing back injury. All five studies concluded that strengthening and conditioning of the back muscles reduced back injuries. The Mooney et al study of strip miners focused primarily on lumbar extensor strengthening and reduced workers compensation cost from \$14,430 per month to \$380 per month for the study year. The program at Coca Cola bottling resulted in 78% decrease in missed workdays. The Gundewall study of personnel at a geriatric hospital showed reduced absenteeism among participants of 96%. Including the cost of the exercise director, the resulting cost benefit ratio was greater than 10 (i.e. for every dollar spent on the program, \$10 was saved). The Cady study of firefighters concluded that physical fitness and conditioning are preventatives of back injuries.

Los Angeles County Firefighter Study

The Lee D. Cady, M. D. et al study, published in the Journal of Occupational Medicine in April 1979, took place from 1971 through 1974 in Los Angeles County. In this study 1652 firefighters ages 20 to 55 were rigorously tested and examined to determine their physical fitness and conditioning as well as their back and leg flexibilities and back and leg strengths. They were placed into 3 groups according to fitness levels: less fit, middle fit, and most fit. Individuals who had not completely recovered from any previous back injury were removed from the study. Those individuals who had thoracic and lumbar injuries (strains, ligamentous tears, and discongenic conditions) not due to auto accident trauma were included in the study.

Prior to fitness testing the firefighters were in a voluntary individualized exercise program developed through the results of a preplacement examination given by the Occupational Health Service of Los Angeles County. The subsequent exercise examinations using five measurement variables produced data on the 1652 firefighters to

offer some valid conclusions regarding the importance of exercise in reducing back injuries and costs related to those injuries.

The subsequent worker's compensation back injuries and costs for these firefighters were then analyzed in relation to their prior fitness values. The least fit, the middle fit and the most fit were contrasted with regard to subsequent injuries per worker and costs of injuries per worker. The results were that the frequency of subsequent injuries was ten times higher to the least fit group than for the most fit group. The cost per claim for the 19 injured men from the least fit group was 13% more than for the 36 injured men from the middle-fit group. There were too few claims from the most fit group for an accurate estimation of future costs per claim.

These results demonstrate validity in the concept that the most physically fit employees had both fewer and less costly back injuries than the least physically fit employee. There is a significant protective effect for increasing levels of fitness and conditioning (least fit 7.1% injured, middle fit, 3.2% injured, and most fit, 0.8% injured). It was concluded that physical fitness and conditioning are preventive of back injuries.

Swedish Nurses and Nurses Aides Study

In 1988 sixty-nine nurses and nurses aids between the ages of 18 and 58 were randomly placed into two groups at a geriatric hospital. One group was allowed to exercise during working hours to improve back muscle strength, endurance, and coordination. The other group (control group) did not participate in the exercise program. Age, height, weight, and years of employment did not differ between the two groups.

The workout program was performed individually at each ward during working hours and lasted for approximately 20 minutes. The participants in the exercise group were instructed by two physiotherapists how to perform the workout program for the back muscles. The program was intended to increase the dynamic endurance the isometric strength and the functional coordination. During the 13 months program, only one subject from the training group had been absent for 28 days; however, 12 subjects in the control group had missed a total of 155 days because of low back pain.

The prevention program tested in this study not only lowered the incidence of back pain, but reduced the intensity of back pain, as well as the work absence due to back problems. In addition, the participants in the training group increased their back muscle strength on an average of 20 per cent. The cost-effectiveness of the training regimen was 1 physiotherapist working hour/1.3 workdays gained among the participants of training group, or a profit of 10 times greater than the cost of the program.

Physical Measurements as Risk Indicators for Low-Back Trouble Study

Winning the 1983 Volvo award in clinical science, this work done in Copenhagen, set out to establish physical measurements of lumbar strength as an indicator of risk for

low-back injury. Of all 30,40,50, and 60 year-old inhabitants of Glostrup, a suburb of Copenhagen, 82% (449 men and 479 women) participated in a general health survey, which included a thorough physical examination relating to the lower back. The examination was constituted of anthropometric (human body measurement) measurements, flexibility/elasticity measurements of the back and hamstrings, as well as tests for trunk muscle strength and endurance. The principal findings were that good isometric endurance of trunk muscles (face down, holding the torso suspended in air while held at the waist for 240 seconds) prevents first-time occurrence of low-back trouble. The trend that participants with weaker trunk muscles (low holding times) more often experienced occurrence and recurrence of low-back trouble than those with strong muscles (high holding times) was uniform for both sexes. Troup¹⁶ et al found reduced dynamic strength of trunk flexor muscles to be a consistent predictor for occurrence, recurrence and persistence of low-back pain. In addition, two other longitudinal studies^{2,12} have demonstrated that isometric trunk muscle strength tests are of value in selection of workers so as to reduce back injuries in strenuous jobs.

Coca-Cola Bottling Company Program

In 1989 Coca-Cola in conjunction with the Northeast Georgia Medical Center began a program designed to examine how employee back injury rates are affected. A test was developed to measure employees' back conditions and a formal exercise program to strengthen the back muscles was implemented. Four area sales distribution centers participated in the program. Two center's employees were tested and given the exercises; one was tested and not given exercises and at the fourth center employees were neither tested nor given exercises. There was a total of 239 employees participating either in the exercise/test group or in the control group.

Individuals were tested for range of motion, isometric strength or torque, velocity, and power at two different resistance levels. Computer-generated performance scores were produced for each participant and for the group.

The results after one year were an overall reduction of back injuries of 32% and missed workdays due to back injuries were reduced by more than 78%. In the control group where no exercises or testing were done, back injuries increased 32% and lost days increased by 300%.

Strip Mining Industry Study

In 1993 with 197 volunteer male employees of the Western Energy Company Rosebud Mine Coal Strip Montana a 20 week study began. The purpose of this study was to demonstrate the effect of a once a week exercise program focused at lumbar extensor strengthening. There was a 54% to 104% increase in strength during a 20 week program. The incidence of back injuries in the exercise group was .52 injuries per 200,000 employee hours versus the industry average of 1.09 back injuries per 200,000 employee hours. The injury incidence in the workers not exercising was 2.55 injuries for 200,000

employee hours. The average workers' compensation liability dropped from \$14,430.00 per month to \$380.00 per month for the study year.

The equipment used for both testing and training allowed the isolation of the lumbar extensors in the sitting posture and testing strength in an isometric manner at equal points of the full range. Data gathered from the testing and training of the strip mining employees were compared to published data reflecting industry norms. It is also important to note that due to the high level of isolation of the lumbar region achieved by design of the equipment, the strengthening exercises performed only once a week were as effective as 2 or 3 times a week without proper equipment.

It is clear that the workers who participated in the training program had a lesser incidence of back injury claims than typical for workers in the same industry. The study clearly relates improved strength in the back to a reduced incidence of back injuries.

Conclusion

Five case studies using different methodologies generally concluded that workplace-based exercise positively impacts back injury claims, reduces absenteeism, and is highly cost effective. Each of the five studies demonstrated marked success in reducing back injuries. Each study had the following common features: (1) pretesting of participants to determine strength and fitness; (2) exercising the back muscles and; (3) allowing exercise during work time. Each of the five studies supports the premise that exercise in the workplace is good for reducing back injuries. However, the strip mining study establishes the fact that specific exercises of the lower back muscles yields the most dramatic results: back injuries and claims are significantly reduced and the economic recovery is highly meaningful. The strip mining study -- the most recent of the studies -- concentrated the testing and exercises specifically on the lower back and achieved the most dramatic reduction in workers' compensation costs. In addition to the five studies cited here, there are numerous other published studies that support exercise and body conditioning in general⁵⁻¹⁴ as an important aspect of an overall program to reduce back injuries and claims in the workplace. The conclusion of the five studies cited and the preponderance of other published data support the establishment of a workplace-based exercise program specifically designed to strengthen the lower back muscles as a means to reducing back injuries and claims.

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