

Exercise, Chronic Disease and Immunology

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Exercise has been shown to prevent, relieve, heal, and/or manage many chronic diseases. Since exercise has these effects on the human body, then by default, it strengthens the immune system because the immune system does not have to work as hard to protect these systems since they are protecting themselves.

INTRODUCTION

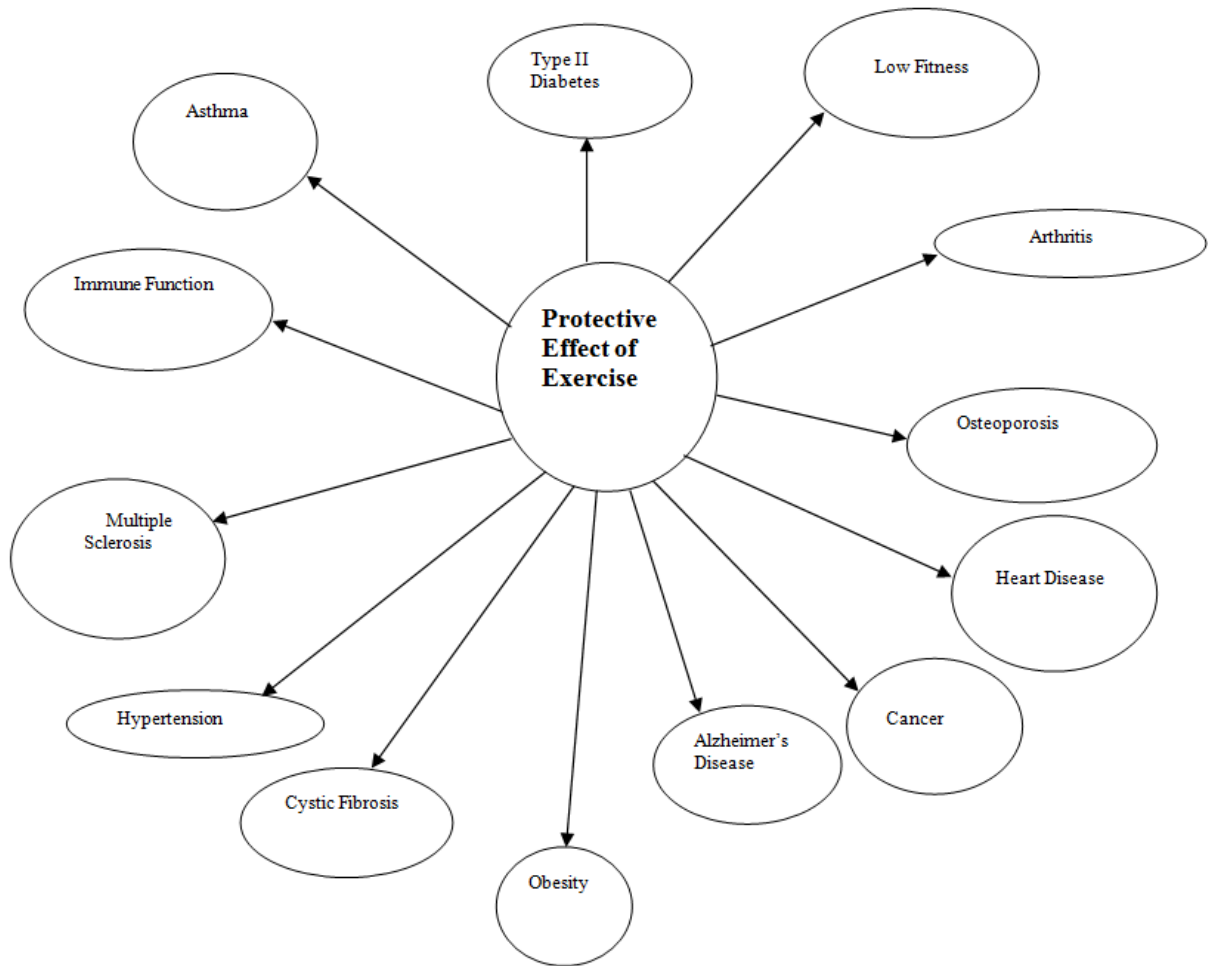
Chronic disease may be one of the more difficult conditions to manage. However, research has shown that exercise, under proper supervision, is probably the most crucial variable to prevent as well as manage most chronic disease conditions. It is probably the least expensive prescription physicians can make for their patients, but is probably the least used. It may be easier for physicians to prescribe drugs to manage many chronic disease conditions rather than recommend exercise. This is not surprising considering the pharmaceutical industry's presence in the medical profession.

The information presented here is a brief summary of exercise research in the management of chronic disease. It will give physical educators, physicians and other health professionals that work in the chronic disease area information and insight into how exercise can have a significant effect on the healing/management process of chronic diseases. And, lastly, since exercise strengthens all systems, the immune system is significantly improved since it does not have to interact as often or as intently because "the systems" themselves become self-sustaining.

OVERVIEW OF RESEARCH ON CHRONIC DISEASE AND EXERCISE

This information is a snapshot of the research on some chronic diseases. It will highlight these diseases and how exercise can prevent, relieve and/or manage these conditions without drugs. In general, it has been reported (Lee, Paffenbarger, and Hennekens, 1997) that numerous studies have demonstrated that higher levels of physical activity are associated with decreased risk of chronic diseases such as coronary heart disease, hypertension, non-insulin-dependent diabetes mellitus (NIDDDM), cancer, as well as osteoporosis.

Although children may not have some of these diseases now, they may have the propensity for them based on their genetic history and/or environmental practices, such as having diets high in sugar and carbohydrates which will lead to overweight and adult-onset (Type II) diabetes. In fact it has been reported that children as young as four have been diagnosed with adult-onset diabetes (American Diabetes Association, 2000).



Arthritis

One of the issues with those individuals afflicted with arthritis, whether rheumatoid arthritis or osteoarthritis, is inactivity. Inactivity often leads to reduced range of motion and when movement does occur, it is often painful! Exercise is considered an important treatment for those suffering from arthritis (Ytterberg, S.R., Mahowald, M.L., and Krug, H.E, 1994, Butler, et. al, 1998, ¹Harms, et. al., 2011). Appropriate exercise that requires as much range of motion as possible provides for muscle stimulation as well as joint mobility. Pain is usually reduced as well. Exercise results in less pain, increased mobility, and greater ability to handle daily tasks.

Alzheimer's Disease (AD)

Alzheimer's Disease is probably one of the more devastating diseases of our time, in particular because of the numbers of people who have been affected by it, not just the patient with AD. Some of the more recent research has shown a relatively high proportion of those who exercise regularly had a delay in onset of dementia and Alzheimer disease, further supporting its value for elderly persons (Larson, et al., 2006). For those already in the early stages of AD, participation and low intensity exercise the individual can successfully accomplish are very important in order to establish a regular routine the client can sustain for as long as possible. In the mid to later stages of AD, the exercises should become simpler and the exercise leader should know the criteria that will require terminating the program. Although exercise should be done in the early part of the day due to the potential for agitation and restlessness as the day

wears on, the true hallmark of a program is one that keeps the individual active for various 10-minute time blocks during the day (Durstine, et al., 2009).

Asthma

Exercise induced asthma (EIA) occurs in 7-15% of children and is found in 2–10% of the adult population. Of interest has been an increasing trend of death and disability from asthma in all industrialized countries (Watkins, 1998). Therefore, it is important to try to reduce this risk as much as possible. Exercise may be a crucial variable in risk reduction. Although exercise can induce an asthmatic attack, a proper exercise program can lead to improved threshold before stimulation of Exercise Induced Asthma (EIA) occurs (Jackson & Hough, 1995) and can help control the frequency as well as severity of asthma attacks (Harms, et. al., 2011).

Cancer

It appears that exercise has a protective effect against cancer in general and is recommended as a modifiable risk factor for both men and women (Kampert, et. al, 1996). The majority of evidence supports the fact that increased physical activity reduces breast cancer (Friedenreich, et. al, 1998) and regular exercisers compared to sedentary individuals have significantly less risk of colon cancer (Oliveria & Christos, 1997, Tavani, et. al, 1999). According to an earlier Harvard report (Golditz, 1997), it is estimated that if the entire population increased their level of physical activity by 30 minutes of brisk walking per day, there would a 15% reduction in the incidence of colon cancer.

According to the American College of Sports Medicine (Irwin, 2012) more clinicians and cancer specialists are recommending exercise as a strategy for reducing the side effects of treatment, speeding recovery, and improving overall quality of life. It is also crucial that individuals with or without colon cancer risk factors get involved in an exercise program as soon as possible.

Secondary students need to be aware of the dangers of not exercising, especially as it relates to diseases such as cancer. Again, pointing out to them relatives and/or friends who have been affected by cancer can be a starting point. Do they have to exercise to the degree that athletes do? Absolutely not, but they need to exercise.

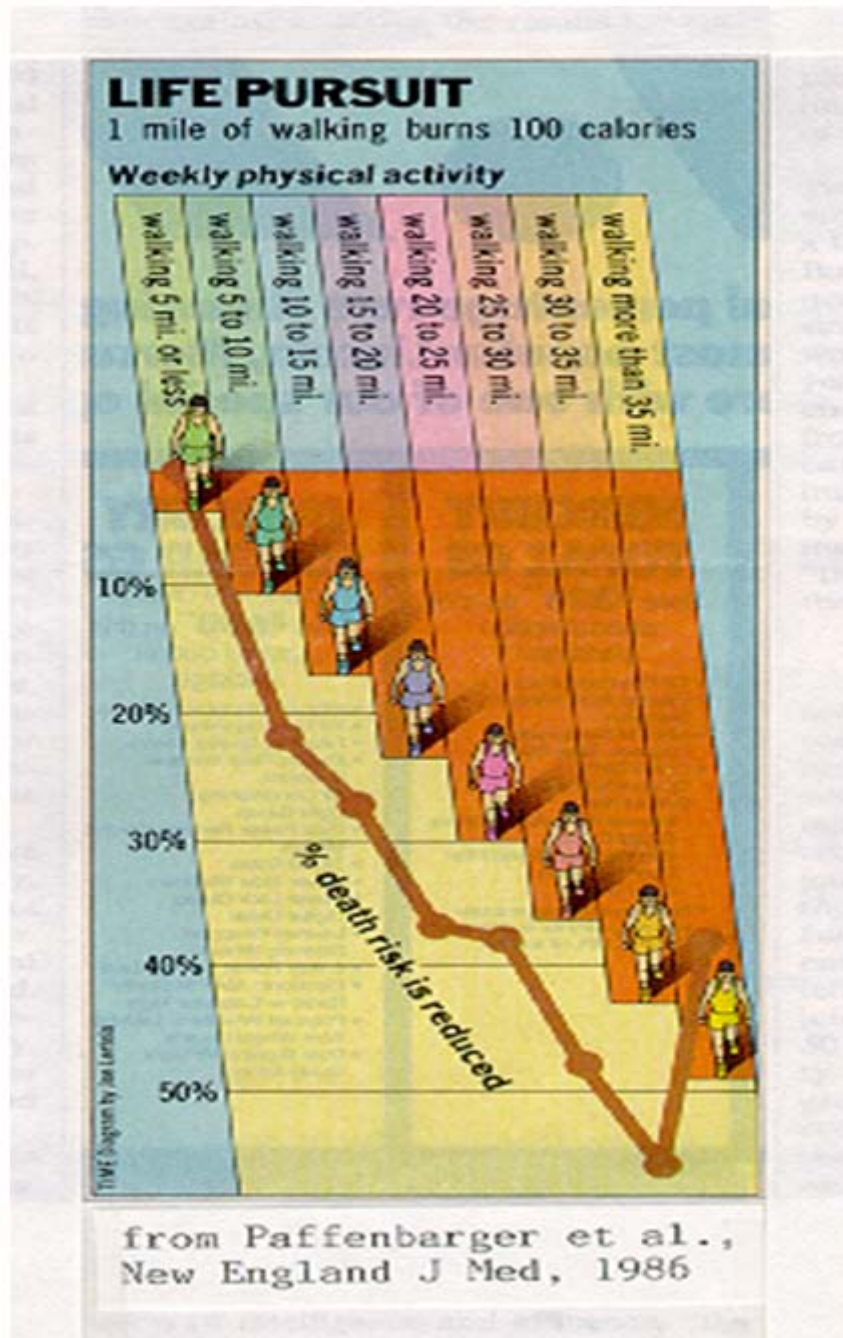
Cardiovascular Disease

Heart attack risk is 38% less for those that exercise than those who don't (LaForge, 1999). Not only does exercise reduce death rate from heart attacks, it is more effective at reducing LDL measures than diet alone (Stefanick, et. al, 1998). Without dieting, but just adding 500 additional calories of work (approximately 5 miles a week) above that normally consumed in food can have a significant effect on cardiovascular risk for the sedentary individual (LaForge, 1999). Death risk is reduced significantly (see profile below) just by walking less than 5 miles to over 35 miles per week (Paffenberger, et. al, 1986). And there are other obvious benefits that occur such as strengthening all cardiovascular musculature. How many of our youth are predisposed to this deadly disease?

Cystic Fibrosis

Exercise has been shown in both short-term and long-term training to ameliorate the physical conditions for those affected with CF. There is no danger for well-trained CF patients, both boys and girls, to take part even in strenuous activities. In fact, CF patients might have a positive attitude toward physical activities as well. It should be pointed out, however, that all exercise activities need to be individually designed (Stanghelle, 1988). Although physical activity is important to those with CF, evidence for cardiovascular and pulmonary functioning improvement is not clear (Horvat, M. and Carlile, J., 1991). Also, though it has been shown that physical activity has many benefits for adults with CF, including mucus clearance, improved lung function, exercise capacity and quality of life, most research indicates the importance of participation in regular physical activity is often very low (Dwyer, 2010); however, since participation appears to be low, Dwyer (2010) found that females who exercised less than 90 minutes a week had three times as many days in the hospital than their high-activity peers. In terms of

children with CF, it becomes very apparent that physical activity needs to start early so that they can learn to make exercise a habitual part of their lives.



Diabetes

The onset of Non-Insulin Dependent Diabetes Mellitus (NIDDM), also referred to as Adult-onset or Type 2 diabetes, has increased between 600-1000% since 1940. The current rate is 6 percent per year and is expected to increase. What may be even more devastating is the alarming increase in the number of children diagnosed with Type II diabetes (Williams, 2000). In fact it has even been documented in children as young as four years-old (American Diabetic Association, 2000). However, exercise has been

demonstrated to be effective in preventing this condition, in particular in those at higher risk (Pierce, 1998). In fact, extensive epidemiological evidence has demonstrated that long term regular exercise can significantly reduce the risk of developing NIDDM (Goodyear and Kahn, 1998). In terms of glucose tolerance, moderate intensity aerobic exercise has been shown to improve the body's ability to handle glucose tolerance by 25% over a non-exercise group of older adults (DiPietro, et. al, 1998). For those individuals who have NIDDM regular exercise increases insulin sensitivity, glucose transport and disposal as well as lowering plasma insulin (Bjorntorp, et. al, 1970, Horton, 1986, and Goodyear, et. al, 1992). The occurrence of impaired glucose tolerance, including diabetes, in men in their 50's can be reduced by maintaining a high level of physical fitness while in their 30's (Takemura, et. al, 1999). Although most of the research has been done with adults, secondary school students with genetic predispositions to diabetes or who are consuming large amounts of sugar in their diets are at severe risk of early NIDDM.

Hypertension

Borderline or Stage-One hypertension can be managed with 800-1000 calories per week. This is the equivalent of walking two miles four or five days a week at any speed. However, the problem with hypertension is that by the time this is determined, say after 20 years, there may be target organ damage to the brain, heart, liver, kidneys, and peripheral arteries. With possible hypertrophy of the left ventricle, this would render exercise more risky at the more intense levels (LaForge, 1999). It is especially crucial to know family history, in particular, parents, so students can be alerted to the need for an exercise program

Immune Function

Although immune function is not a chronic disease, the strength of the immune system can determine one's ability to manage different types of chronic diseases such as cancer. Immune function has been reported as superior in highly conditioned versus sedentary elderly subjects (Nieman, 1997). How much exercise is enough to positively stimulate the immune system? Moderate physical activity may reduce lower respiratory tract infection (LRTI) (Karper and Hopewell, 1998), upper respiratory tract infection (URTI) symptomatology (Nieman, 1997), stimulate many immune functions (Shepard and Shek, 1996), including enhancement of natural killer (NK) cell activity and check the decline in T-cell function (Shinkai, Konishi, and Shephard, 1997). Unusually heavy acute or chronic activity, however, may increase the risk of URTI (Nieman, 1997) as well as suppress various other immune response parameters (Shepard and Shek, 1996). According to Harvard Health Publications (Anonymous, 2013), exercise may contribute more directly to immune function by promoting good circulation, which provides for cells and substances of the immune system to move through the body without restraint and do their job efficiently.

Everybody, including children and youth should know the protective effective exercise provides.

Low Fitness

Low fitness is a *significant disease* problem. Although technically not a chronic disease, it is more serious than the risk factors of high cholesterol, smoking, and obesity. Individuals with moderately high fitness have significantly lower death rates than those who are low fit and have no risk factors (Blair, 1994).

Metabolic Syndrome(-X)

This is a combination of a number of exponents that include the following: small increases in blood pressure, serum insulin, waist circumference, triglycerides, and a decrease in HDL. If metabolic syndrome (MetS) is maintained long enough, Type II diabetes will result. Once an individual has Type II diabetes, weight loss is much more difficult and the cost of managed care is significant if an individual passes from MetS to Type II diabetes. However, by far the most responsive therapy to prevent and/or eliminate MetS is exercise (LaForge, 1999). Brisk walking for at least 30 minutes daily can be recommended as the exercise of choice for most individuals in this category. Unstructured and low-intensity exercise may also

decrease the likelihood of developing MetS, especially when substituted for sedentary behaviors such as watching television (Lakka and Laaksonen, 2007) How many children fit into this category? Kids Health (²Anonymous, 2013) reports that almost 1 in 10 teens and more than a third of obese teens have MetS.

From 1999-2000, it was found that 7.9 and 32.8% in overweight and obese adolescents, respectively, fell into this category (Duncan, Li, and Zhou, 2004). Among children and adolescents evaluated in a weight management clinic, 39% of the moderately obese and 50% of the severely obese met the criteria for MetS (Weiss, et al., 2004). This makes it very clear that exercise should be an even more important part of a *daily* routine for pre- and young teens that are in the pre-MetS category!

Multiple Sclerosis

For a long time, patients with multiple sclerosis (MS), have been told to avoid exercise. Symptoms can temporarily worsen when exposed to heat or during physical exercise. Exercise programs should be designed to activate working muscles, but avoid overload that results in conduction block. Fatigue can be severe and affects about 85% of MS patients. Physical activity and recreation are usually reduced in patients with MS (Petajan and White, 1999).

A short-term, 4-week, exercise program demonstrated improvement in aerobic fitness, health perception, an increase of activity level, and a tendency to less fatigue (Mostert and Kesselring, 2002). Not only was there improvement in aerobic function, but symptom exacerbation by physical activity was lower than expected (6%).

Slawta, et al, (2002) found that women, ages 23 to 72, with MS who exercised in the low to moderate intensity leisure-time physical activity range for twelve months had significantly less abdominal fat, lower levels of triglycerides, and lower levels of glucose than those that did not exercise. This has important significance when one considers that exercise is a crucial component of coronary heart disease (CHD) risk factor management, noting that cardiovascular disease is the number one killer of both men and women in the United States. Often there are perceived barriers that frequently prohibit women with MS from participating in traditional, structured exercise programs, that any intensity of physical activity may improve health and reduce CHD risk.

Obesity

Weight loss that combines regular exercise and diet are twice as effective as programs focusing on diet alone (LaForge, 1999). One of the major issues of obesity is that it increases the risk for cancers of the uterus, breast and kidney, and possibly of the colon and gall bladder. Other problems caused by excessive weight include diabetes, hypertension and heart disease (McPherson, 1999), however, exercise can have a significant effect on all of these by reducing unwanted weight. As mentioned earlier, just adding 500 more calories of work a week for the sedentary individual can significantly decrease cardiovascular risk (LaForge, 1999), but it will also help reduce fat weight at the same time. As a rule, teenagers do not have these types of diseases, with the exception of diabetes as mentioned earlier, however, the pattern for them is set during these years.

Osteoporosis

Osteoporosis is really a disease of childhood with consequences in adulthood. As such, regular physical activity, if started in childhood and adolescence is the best way of improving bone strength (Kannus, 1999) and is the intervention that provides considerable other health benefits (Blair, et. al, 1992).

Exercise is most beneficial on bone tissue variables when it is intense, regular, and weight bearing in nature (Piehl-Aulin and Brahm, H., 1999). In terms of women's health, it is crucial that an increase in physical activity occur throughout life, but particularly in the early years to prevent osteoporosis (Ulrich, Gillis, & Snow, 1999). However, exercise, even two days per week for twelve minutes, using flexion and extension weight bearing was enough to add 20% of bone structure back to an 84 year-old woman's vertebral column (Nelson, et. al, 1994). Just think what can be done if teenage girls grasp what exercise will do in terms of long-term health care.

COST EFFECTIVENESS OF EXERCISE ON DISEASE MANAGEMENT

Exercise is probably the most cost efficient way of managing chronic disease and improving immune function. By providing good and varied exercise programs, health and physical education teachers as members of health care practitioners can provide a significant preventative service that will help stave off or reduce the potential for more expensive medication and treatment. For example, in 1999 if a diabetic treatment center had to go to early medication in one out of five cases, that would have saved approximately \$30-40 million alone just by stalling off the need of glucose enhancing agents (LaFarge, 1999a). Today, the value of that change would be \$42-56 million (Manuel, 2013). Answers are there, but we need to make adults and their children aware of what and how their habits/practices can lead to very serious consequences.

CONCLUSION

The goal of exercise as a modality is to improve the TOTAL FUNCTION of the human body. To this end, individuals as well as health and physical education health care professionals need to be aware of the importance of exercise as both a preventative and immune-strengthening feature as well as treatment for many chronic diseases. Everybody who oversees any activity program need to be personally involved in an exercise program. Without personal experience, it is very difficult to tell someone the value of the health benefits of exercise.

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