

Preface

Extensive scientific research shows that regular physical activity and playing sport improves health in many ways. An active lifestyle is one of the best preventative medicines for reducing the risk of developing life-threatening diseases like heart disease, colon cancer and diabetes.

Most of the research into the health benefits of sport and physical activity has been carried out on Caucasian populations. This review was commissioned by the Hong Kong Sports Development Board (SDB) to identify evidence of the health benefits of sport and physical activity for Chinese and Asian people. The review also presents new information about the levels of physical inactivity in Hong Kong and looks at the extent of health problems related to physical inactivity. Potential savings in health care costs that would result from a more active population are discussed. More education is recommended to increase awareness among Hong Kong Chinese about the benefits of sport and physical activity.

SDB commissioned this review as part of its research programme to demonstrate the value of sport for Hong Kong. Reviews of the economic and community and social benefits of sport also are being carried out as part of this programme.

Health and Physical Activity in Hong Kong - A Review

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SDB *Research Report* – No. 4

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February 2001

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Introduction

In the 2000 World Health Report, the World Health Organization (WHO) recognised the ten leading killer diseases worldwide (WHO, 2000). Coronary heart disease (CHD) was ranked number one, killing 7.09 million people. Cancers followed with 7.06 million deaths. The remaining top worldwide killer diseases are cerebrovascular disease, acute lower respiratory infection, tuberculosis, chronic obstructive pulmonary disease, diarrhoea (including dysentery), HIV/AIDS, and malaria. A number of these diseases can be reduced and even prevented by living a healthy lifestyle, which includes regular physical activity, exercise and sports.

Cardiovascular diseases, CHD in particular, are health problems of global proportion. Coronary heart disease is the overall leading cause of death worldwide and is the number one cause of death in the United States and other industrialised countries (WHO, 2000). CHD is not only a problem in industrialised countries. Populations in non-industrialised countries are developing lifestyles and disease risk factors similar to industrialised countries. They have increasing numbers of sedentary occupations, unhealthy diets, tobacco use, obesity, and physical inactivity (WHO, 2000). Due to the current status of CHD in developed countries, as well as increasing incidence rates of CHD in non-developed countries, risk factor analysis and prevention techniques of CHD are necessary throughout the world.

Regular physical activity is considered to be one of the most important preventive medicines to successfully lower the risk of major diseases and health concerns such as obesity, CHD, diabetes, cancer, stroke, hypertension, osteoporosis, and mental distress (U.S. Department of Health and Human Services, 1996). Numerous studies have been conducted on the positive effects of physical activity on these health issues.

The majority of the current research on this topic has been conducted on Caucasian populations with little emphasis on the correlation to Asian populations. This report was designed to review existing data on the effects of physical activity on some of the leading health problems in Hong Kong Chinese, as compared to the United States and other populations. It also demonstrates the need for public education on the negative health effects of a sedentary lifestyle, as well as the importance of physical activity for improved quality and quantity of life. In addition, it stresses the importance of, and provides recommendations for, regular physical activity as a prevention technique for obesity, CHD, diabetes, colon cancer, stroke, hypertension, osteoporosis, and mental distress in Hong Kong Chinese.

Hong Kong Health Problems

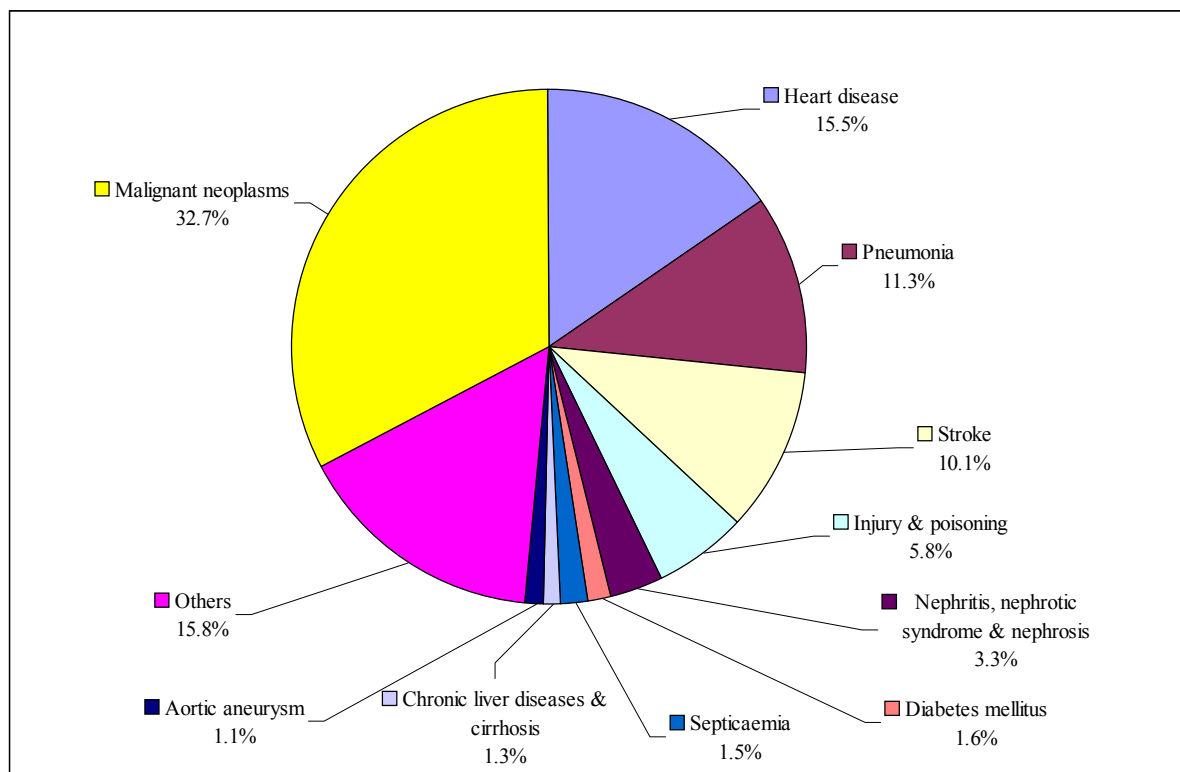
Unlike the United States, the leading cause of death in Hong Kong is cancer, accounting for 32.7% of total deaths in 1998 (Hong Kong Department of Health, 1999). The top five cancers affecting this population are lung, liver, colon, stomach, and rectum. Heart disease is the number two killer and a major health concern in Hong Kong, contributing to 15.5% of the deaths in 1998 (Figure 1). Other leading causes of death of Hong Kong Chinese include pneumonia, cerebrovascular disease, injury and poisoning, nephrosis, septicaemia, liver disease and cirrhosis, diabetes mellitus, and aortic aneurysms (Hong Kong Hospital Authority Statistical Report, 1999). In order to ease the heavy burden of health problems, recent focus has been placed on preventive medicine rather than treatment. Regular physical activity has been found to be one of the most important strategies in preventive medicine (U.S. Department of Health and Human Services, 1996). In order to improve the overall health of Hong Kong, it is important to investigate the effects of physical activity on certain disease risk factors in the Hong Kong population.

Obesity

One way to determine obesity is by calculating the body mass index or BMI of an individual. This is done by dividing body weight (in kilograms) by height (in metres) squared. Or simply, $BMI = \text{kg/m}^2$. A BMI of 25-30 kg/m^2 is considered overweight by Caucasian standards, 30-35 kg/m^2 is obese, and a BMI of 35 kg/m^2 or higher is termed severely or morbidly obese (Allison, Fontaine, Manson, Stevens & VanItallie, 1999). According to the Asian standards, individuals are deemed overweight with a BMI of 23.5 kg/m^2 , obese with a BMI of 25 kg/m^2 , and severely obese with a BMI of 30 kg/m^2 or higher (Janus, 1997a).

During the past few decades, there has been a growing trend in the number of overweight and obese individuals. According to results from the Third National Health and Nutrition Examination Survey, it has been determined that more than half of all adults living in the United States qualify as being overweight or obese when using the guidelines set forth by the National Institutes of Health (Must et al., 1999). In comparison, according to the Asian standards, it was established that over half (58% of men and 49% of women) of the Hong Kong population qualifies as being overweight ($BMI > 23$) (Janus, 1997a). The health risks associated with obesity are numerous. For example, obesity is a known risk factor for several diseases, including CHD, cancer, and diabetes mellitus.

Figure 1. The Leading Causes of Death in Hong Kong
(From Annual Report of Department of Health 1998-99).



A review by Khaodhlar, McGowen & Blackburn (1999) stated that obesity has a negative effect on the psychological wellbeing of those struggling with this problem as well. For example, according to the literature review, eating disorders and depression were found to be much more prevalent in obese individuals (Khaodhlar, McGowen & Blackburn, 1999).

Central Obesity

Central obesity is the term used to describe the excess of visceral adipose tissue (VAT) in an individual. Central obesity is determined by calculating the waist-to-hip circumference ratio (WHR). In a literature review conducted by Ross (1997), it was determined through cross-sectional research that central obesity was more closely related to disease risk factors than evenly distributed obesity, proving that fat distribution has an important role in overall health. A study by Megnier, Denarie, Cocaul, Simon, & Levenson (1999) observed 552 men and 160 women from the Paris area who were at risk for cardiovascular disease. This study found that abdominal fatness, or central obesity, was associated with an increase in disease risk factors and complications. High VAT levels are usually more prevalent in men, causing more disease risk factors in the male population. In addition, Ross' review (1997) stated that more health problems are found in individuals that have high levels of VAT when compared to individuals that have an even distribution of fat.

Hill and Melanson (1999) suggested in a review that decreases in physical activity during the past few decades have contributed to increasing obesity in the United States. Moreover, the growing number of obese individuals can be associated with the growing, industrialised, high-tech society. In the past, more people had jobs that required them to obtain a substantial amount of physical activity. Today, more and more people are working in jobs that require them to remain quite sedentary, resulting in a decrease in daily energy expenditure. Unfortunately, this decrease in energy expenditure is not resulting in an equal decrease in energy intake. Simply put, people are consuming more calories than they are burning and are therefore, becoming obese (Hill & Melanson, 1999).

Blair and Brodney (1999) summarised the results of 24 obesity-related articles in order to determine the effects of obesity and physical inactivity on morbidity and mortality. Based on the results of the review, Blair and Brodney (1999) were able to conclude that overweight and obese individuals that are physically active and fit have lower disease and early death rates than overweight and obese individuals that are sedentary and unfit. Therefore, it is

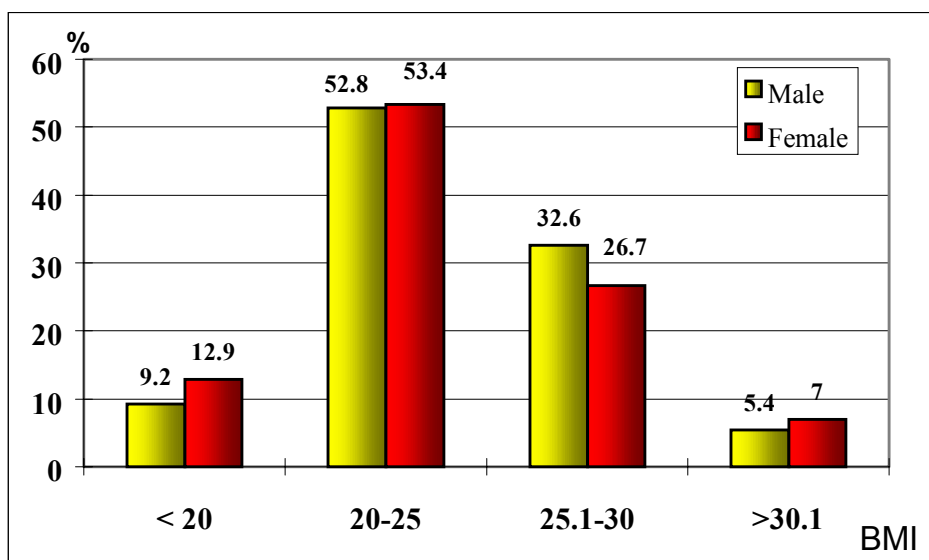
important to incorporate regular physical activity into one's life in order to prevent obesity-related and all-cause morbidity and mortality.

As people age, they normally accumulate a few additional pounds each year. It has been proven that physical activity plays a major role in eliminating age-related weight gain (DiPietro, 1999). It is possible to not only prevent weight gain, but also to lose weight by raising daily energy expenditure through regular physical activity (Blundell & King, 1999). Ross et al. (2000) conducted a clinical trial in Canada in which 52 obese men were observed for three months. Increased levels of physical activity were found to significantly decrease the occurrence of obesity resulting in an 8% decrease in body weight in the subjects. Furthermore, physical activity has a particular reduction effect on abdominal fat and serves as a prevention technique for additional weight gain (Ross et al., 2000). A similar study conducted by Utter, Nieman, Shannonhouse, Butterworth & Nieman (1998) observed the effects of diet and exercise on body composition in 91 obese women during a 12-week trial. For obese women in the study, a combination of both diet and exercise yielded an average loss of 8.1kg, while those participating in exercise alone had an average loss of only 1.45kg at the end of the 12-week period. Therefore, a combination of physical activity and a proper diet are key elements of reducing and preventing obesity.

Obesity in Hong Kong

In addition to Western countries, the growing concerns of obesity can be seen in Asian populations, including Hong Kong (Janus, 1997a; Lee et al., 2000; Woo et al., 1999). Lee et al. (2000) designed a study to examine the relationship between obesity and cardiovascular risk factors in Hong Kong Chinese. For this cross-sectional, clinic-based study, 767 men and women were observed. Results from this study concluded that in Hong Kong Chinese increasing disease risk factors can be associated with obesity, which accounts for increasing degrees of BMI, waist circumference, plasma insulin level, and insulin resistance. Lee et al. also determined that the lowest disease risk was found in individuals that were not obese. A related study by Janus (1997a) found that overweight and obesity were very common among a sample of 2900 Hong Kong subjects. Of the sample, 58% of men and 49% of women had a BMI above 23.5 kg/m². A BMI above 25 kg/m² was observed in 38% of the men and 34% of the women. In 5% of the men and 7% of the women, a BMI above 30 kg/m² was noted (Figure 2).

Figure 2. Body Mass Index of Hong Kong Males and Females



Women over 45 years old were found to be much more obese than the rest of the population. The BMI of the women over 45 exceeded 25 kg/m^2 in 47% of them and exceeded 30 kg/m^2 in 9% of them. According to these findings, about half of the Hong Kong Chinese population is considered overweight when using BMI as the criterion (Janus, 1997a). Results from the Hong Kong Dietary Survey show lower percentages of overweight and obesity in Hong Kong Chinese with high education levels, especially in women (Woo et al., 1999). Therefore, the need for improved education on the health benefits for Hong Kong Chinese are critical.

A study in Japan compared physical activity levels and metabolic risks in relation to BMI and waist circumference (Hsieh, Yoshinaga, Muto, Sakurai & Kosaka, 2000). This study found that the male Japanese subjects with a waist to height ratio (W/Ht) greater than or equal to .50 had high health risks even if they had a moderate BMI. Even in individuals with an acceptable BMI, the odds ratios were higher in the groups with high waist to height ratios for hypertension, hyperglycemia, hypertriglyceridaemia, fatty liver, and hypercholesterolaemia. It is important to note that the individuals with high waist to height ratios had significantly lower levels of regular physical activity than their counterparts (Hsieh et al., 2000). These findings are similar to those of the Aerobics Center Longitudinal Study (ACLS) which found that fit overweight men had a much lower risk for all-cause mortality than the unfit men with healthy weights (Blair, Wei & Lee, 1998). These data further exemplify the important role of physical activity for a disease-free life.

In addition to the prominent overweight problem in Hong Kong Chinese adults, Leung, Ng, & Lau (1995) reported that childhood obesity in Hong Kong has been on the rise. Results from the 1993 Hong Kong Growth Survey showed that in children between the ages of 6 and 18, 10-13% qualified as being obese. However, due to changes in lifestyle, such as poor diet (high fat foods and junk foods) and physical inactivity, percentages of childhood obesity have been increasing since that study (Guldan, Cheung & Chui, 1998; Leung, 1995; Leung, Ng & Tam, 1994). A cross-sectional survey in 1998 of 9 to 12 year old Hong Kong children found that 23% of boys and 10% of girls were obese, using the criterion of >120% weight for height of local references (Guldan, Cheung, Chui, 1998). Unfortunately, the obese children were reluctant to participate in physical activity (Au & Leung, 1995). Hui, Lau, & Yuen (2000) reported the results of a six-month weight loss intervention program with 107 obese Hong Kong children ages 6 to 14. The Fat-Fun-Fit Project (FFF) was successful at decreasing the weight of the participants by 5.61% for girls and 7.14% for boys. These results further reinforce the need for education on the importance of physical activity for overall health of Hong Kong Chinese.

Coronary Heart Disease

Despite the growing amount of information and public awareness on the prevention of certain risk factors for CHD, it remains the world's number one cause of death (WHO, 2000). Unfortunately, deaths caused by CHD are often premature and preventable. Many of the risk factors for CHD are modifiable and can be eliminated by healthy lifestyle choices. These risk factors include smoking, high blood pressure, high blood lipid levels, obesity, diabetes, and physical inactivity. Regular physical activity not only decreases the risk of CHD, but it also contributes to the reduction of various other disease risk factors resulting in overall better health (NIH Consensus Panel on Physical Activity and Cardiovascular Health, 1996). Several well-documented studies serve as proof of the positive health benefits, including a decrease in CHD risk factors, of regular physical activity (Blair et al., 1996; Dunn et al., 1999; Kujala, Kaprio, Sarna, & Koskenvuo, 1998; Fletcher et al., 1996; Pate et al., 1995).

Aerobics Center Longitudinal Study (ACLS)

The Aerobics Center Longitudinal Study [(ACLS) Blair, Wei, & Lee, 1998] is a cohort study designed to determine the effect of disease risk factors on mortality rates. In this study, 25,341 men and 7,080 women were observed between 1970 and 1989. It was determined that

physical activity and physical fitness greatly reduce the risk of disease mortality. Individuals in the ACLS study that were at least moderately fit had lower death rates than those who were in the low fitness range. These findings occurred even if the moderately fit individuals had other disease risk factors. In addition, men in the study that were not fit had a higher risk for all-cause mortality than individuals with some degree of fitness.

Harvard Alumni Health Study:

The Harvard Alumni Health Study (Paffenbarger & Lee, 1998) is a prospective, observational study with a focus on the mortality rates of 52,500 men that entered Harvard College or the University of Pennsylvania between 1916 and 1950. The men in the study were observed from their entrance into college until the present. This study found that any level of physical activity resulting in energy expenditure decreased the risk of CHD. Greater risk reductions were seen in individuals who participated in more vigorous activities and death rates declined steadily as activity levels increased. The low risks of CHD associated with physical activity only remained in those who continued an active lifestyle after college. It was also found that otherwise sedentary students could improve their CHD risk factors if they became active at some point after college.

Nurses' Health Study:

The Nurses' Health Study (Stampfer, Hu, Manson, Dimm & Willett, 2000) was developed in order to determine the effects of CHD risk factors in women. The study observed 84,129 women who were free of previous cardiovascular disease, cancer, and diabetes. The women were put into different categories according to their risk factors. The low risk group was comprised of those individuals who were non-smokers, had a BMI < 25 kg/m², consumed an average of one-half of an alcoholic beverage a day, usually engaged in moderate-to-vigorous physical activity for at least 30 minutes a day, and adhered to a proper diet. It was found that 82% of coronary events effecting the women in this study occurred in those individuals who were not in the low risk group. Therefore, it can be said that women who live a healthy lifestyle, including physical activity, have a very low risk of developing CHD.

Coronary Heart Disease in Hong Kong

A retrospective study in which CHD incidence and prevalence rates were compared in heart patients admitted to Hong Kong hospitals in 1997 was conducted by Hung, Cheung, Ip & Fung (2000). It was determined that Hong Kong has a common occurrence of heart disease which can be associated with a high CHD mortality rate (Hung et al., 2000). A study by Dohi, Stoedefalke, Hodgson, and Puhl (1997) compared CHD risk factors of 34 Eastern Rim and 60 North American executives. The executives from the Eastern Rim were from China, Hong Kong, Japan, South Korea, Malaysia, The Philippines, Singapore, and Thailand. The findings of the study showed no significant difference in risk factors between the two populations, proving that risk factors for CHD in Asian countries are increasing to levels similar to that of American populations. These data suggest that decreasing physical activity levels in East Asia along with poor diet and an increase in the number of smokers may be associated with an increase in disease risk factors. The Hong Kong statistics on risk factors are similar to these results. Janus (1997a) found that more than half of Hong Kong Chinese men (55%) and about one-fourth (28%) of women had at least one risk factor for CHD, while 12% of men and 8% of women in Hong Kong had at least two risk factors. Neither obesity nor physical inactivity was considered to be a risk factor in Janus' analysis. Therefore, the percentages would be much higher if obesity and physical inactivity had been taken into consideration.

Heart disease is the second leading cause of death in Hong Kong and was responsible for approximately 5,000 deaths in 1998 (Hong Kong Department of Health, 1998). The largest percentages of deaths caused by all forms of heart disease were due to CHD, which represented 59.4% of deaths. This number is on the rise from 55.1% in 1982 and 38.6% in 1972. Moreover, CHD, which claims the life of one Hong Kong citizen every three hours, would be the leading cause of death in Hong Kong if diseases were counted as single entities (Hong Kong Department of Health, 1994). The impact of physical activity on CHD shown in western studies has not been fully researched in Hong Kong Chinese, with the exception of two studies. Donnan et al. (1994) determined the correlation between acute myocardial infarction and smoking, history of hypertension, diabetes, body fatness, and physical activity in cases from four Hong Kong hospitals. This study found that acute myocardial infarction and physical activity had a significant association. In addition, Woo et al. (1998) compared physical activity and CHD risk factors in population of Chinese individuals that were 70 years old or older. The authors of this study observed that stroke and heart disease mortality

had a negative association with participation in physical activity. These two studies lack the necessary research on determining the role of physical activity at reducing CHD risk factors in Hong Kong Chinese and demonstrate the need for further research on this topic.

Diabetes

Among various non-communicable diseases, diabetes mellitus is one of the top killers because it accounted for more than 777,000 lives in 1999 (WHO, 2000). In the WHO 2000 World Health Report (WHO, 2000), a substantial rise in the number of diabetes cases was predicted for the coming years. It is estimated that the 1997 statistic of 135 million cases will escalate to 300 million cases by the year 2025. This rise in the prevalence rate of diabetes can be accredited to obesity, unhealthy diets, aging, and sedentary life styles (WHO, 2000). Diabetes can be either insulin-dependent (IDDM or type 1) or non-insulin-dependent (NIDDM or type 2). Non-insulin-dependent diabetes mellitus (NIDDM) is one of the major causes of disability and mortality (Wallberg-Henriksson, Rincon & Zierath, 1998). Roughly 90% of the worldwide diabetes cases are NIDDM (WHO, 2000). Although there is inconsistent evidence that adaptations to routine exercise improve glucose control in IDDM, there is evidence that shows improved glucose control in individuals with NIDDM (Zinker, 1999). Nevertheless, both IDDM and NIDDM benefit from regular exercise. Campaigne et al. (1985) prescribed a 12-week exercise program (three 45-minute sessions per week) to 14 adolescents with IDDM. Exercise consisted of calisthenic warm-up and stretching (ten minutes), aerobic movement to music (25 minutes at 80% VO₂ max), and cool-down (ten minutes). Campaigne et al. found a significant decrease in low-density lipoprotein cholesterol concomitant to an increase in VO₂ max with no change in glycemic control. These findings support the beneficial effects of regular exercise for individuals with IDDM. Mosher et al. (1998) found that aerobic circuit training helped adolescents with IDDM improve cardiorespiratory endurance, muscle strength, lipid profiles, and glucose regulation. Lehmann et al. (1997) also showed that adults with IDDM safely reduced cardiovascular risk factors such as abdominal fat content, blood pressure, and adverse lipid levels by exercising 135 minutes per week. Other studies (Ebeling et al., 1995; Tuominen et al., 1997), however, suggest that the changes in IDDM are not that substantial or lasting.

Wannamethee, Sharper, & Alberti (2000) designed a prospective study with 5,159 men from England who were previously free of disease in order to determine the effect of physical activity on the incidence of CHD and NIDDM. After an average 17-year follow-up,

the authors concluded that the risk of developing NIDDM decreased with increasing amounts of physical activity (Wannamethee et al., 2000). Similar results were collected from The Finnish Diabetes Prevention Study conducted by Uusitupa et al. (2000). The Finnish Diabetes Prevention Study is an ongoing study designed to investigate the effects of a diet and exercise program on 523 overweight subjects at risk for NIDDM. After the first year, 43.4% of those in the intervention group lost at least 5kg and displayed great reductions in glucose and insulin levels, blood pressure, and serum triglycerides. Therefore, physical activity is an effective way to reduce the risk of NIDDM even if other risk factors are present. In a literature review prepared by Wallberg-Henriksson et al., (1998) it was established that physical activity can be used as a form of treatment for NIDDM as well as prevention. Regular physical activity increases insulin sensitivity, decreases lipid profile, lowers blood pressure, and increases cardiovascular fitness in those individuals who have been previously diagnosed with NIDDM (Wallberg-Henriksson et al. 1998).

Diabetes in Hong Kong

In Asian-Pacific populations, annual health costs of diabetes-related complications are four times that of the non-diabetes population (Leung & Lam, 2000). Similar to the United States, some of the health problems associated with diabetes in Asian countries include blindness, renal failure, amputations, stroke, and CHD. Janus (1997a) found that diabetes was very common among a sample of 2,875 men and women who participated in the 1995-1996 Hong Kong Cardiovascular Risk Factor Prevalence Study. The prevalence rate for diabetes in Hong Kong men and women was found to be one in ten, which is substantially higher than can be observed in Mainland China and in Caucasian populations (Janus, 1997a). The occurrence of diabetes in Hong Kong Chinese was even higher in individuals over the age of 65. However, types of diabetes were not identified in Janus's study. As specified in a review of recent studies conducted by Leung and Lam (2000), physical inactivity is considered to be a modifiable risk factor for diabetes in Hong Kong Chinese and the risk of developing this disease decreases with increasing levels of physical activity. Increasing physical activity levels also decreases the risk of diabetes by reducing another risk factor, obesity. Hence, one proven method for the prevention of diabetes, particularly NIDDM, in Asian populations is regular physical activity.

Colon Cancer

Cancer was the second overall worldwide cause of death in 1999, killing a total of 7.1 million people (WHO, 2000). In Hong Kong, cancer is the leading cause of death, attributing to 10,691 deaths in 1998 (Hong Kong Department of Health, 1999). Colon cancer, which is responsible for 8.3% of the overall deaths in Hong Kong in 1998, is one of the major mortality causing cancers effecting people today. Lee (1995) prepared a literature review of studies from China, Denmark, Japan, New Zealand, Sweden, Switzerland, Turkey, and the United States in order to evaluate the association between physical activity and cancer susceptibility. Lee (1995) found a significant inverse relationship in work-related physical activity and colon cancer in 83% of the studies. In addition, the more sedentary an individual was, the greater the risk of developing colon cancer. Results obtained by comparing the occupational physical activity of 1,225 patients with colon cancer and 4,154 controls in an Italian case-control study confirm that there is a definite inverse relationship between occupational physical activity and colon cancer in men and women (Tavani et al., 1999). Similar results were observed in reviews prepared by Hill (1999) and Shephard & Shek (1998). Therefore, regular physical activity is a key prevention strategy for colon cancer.

Colon Cancer in Asian Populations

Despite the statistics of colon cancer rates in Hong Kong, there is currently a lack of studies comparing the relationship of physical activity and cancer in Hong Kong Chinese. There are, however, some studies on this topic in regards to Mainland China. Chow et al. (1993) compared occupational information on 2,000 cases of colon cancer in Shanghai in order to classify incidence rates by the amount of work-related physical activity. An increased risk of colon cancer was observed in the men and women in the study with low occupational physical activity levels, such as business professionals (Chow et al., 1993). Another study compared data from 391 colorectal cancer patients in hospitals in China and Japan (Lin, Hanai, Wan, Du & Gui, 1995). Due to lifestyle and socioeconomic differences between the two countries, China reported a higher rate of colon cancer with the average age of those effected being 8.5 years younger than those in Japan (Lin et al., 1995). In comparison, Whittemore et al. (1990) performed a population-based, case-control study of colorectal cancer risk of Chinese Americans and Chinese living in Mainland China. Various lifestyle factors of the 905 cases between 1981 and 1986 were analysed. Whittemore et al.

(1990) established a higher risk of colon cancer in Chinese Americans than in Chinese living in Mainland China. Sixty percent of colorectal cases in Chinese-American men and forty percent of cases in women were attributable to physical inactivity combined with the consumption of at least 10 grams of saturated fat a day. In addition, sedentary individuals had higher risks for developing colorectal cancer regardless of where they lived; proving that physical activity has a major role in the prevention of colon cancer (Whittemore et al.).

Stroke

Cerebrovascular disease, or stroke, was responsible for 5.5 million deaths in 1999, making it the third leading cause of death worldwide (WHO, 2000). In Hong Kong, stroke was accountable for 10.1% of the total deaths in 1998, killing 3,297 individuals (Hong Kong Department of Health, 1999). There has been some debate as to the reliability of physical activity as a form of stroke prevention. Therefore, several studies have been conducted in order to determine the relationship between physical activity and stroke risk factors. The Nurses' Health Study evaluated physical activity and risk of stroke in 72,488 female nurses in the United States. According to relative risk calculations, this cohort study found that the risk of stroke in women can be greatly reduced by moderate-intensity physical activity, which can be in the form of walking (Hu et al., 2000). Lee, Hennekens, Berger, Buring & Manson (1999) conducted a similar study comparing physical activity and stroke risk of American male physicians in the Physicians Health Study. By using Cox proportional regression analysis, it was established that men in the study had a decreased risk of stroke if they participated in physical activity at a level that would require them to sweat (Lee et al., 1999). Similar results were found in studies from England and Norway (Wannamethee & Sharper, 1992; Haheim, Holme, Hjermann & Leren, 1993). A 15-year follow-up study in Japan found varying effects of physical activity and stroke risk in men and women (Nakayama et al., 1997). This study found heavy physical activity to be an independently significant risk factor in Japanese men subjects, while light physical activity was an independently significant risk factor in women (Nakayama et al., 1997). While there are several Hong Kong studies on cerebrovascular disease and stroke, there is a need for additional research on the effects of physical activity on stroke risk factors in Hong Kong Chinese.

Hypertension

Hypertension is characterised by having a systolic blood pressure above 140 mm Hg and/or a diastolic blood pressure above 90 mm Hg (Leuhotlz, 1998). Burt et al. (1995) published results of the third National Health and Nutrition Examination Survey (NHANES III) regarding hypertension in the United States. The prevalence of having a blood pressure reading of at least 140/90 mm Hg was found in 20.4% of those surveyed while 14.2% had a blood pressure reading of 160/95 mm Hg or higher (Burt et al., 1995). According to the 1995-1996 Hong Kong Cardiovascular Risk Factor Prevalence Study, 8.3% of men and 6.25% of women in Hong Kong have hypertension. The percentages are much higher in men and women over 65 years old (25.3% and 18.8% respectively) (Janus, 1997b). Hypertension is recognised as a modifiable risk factor for CHD and can therefore be reduced by changes in lifestyle, which include regular physical activity (NIH Consensus Development Panel on Physical Activity and Cardiovascular Health, 1996).

The effects of physical activity on the reduction and prevention of hypertension have been proven by several well-documented studies (Blair et al., 1996; Dunn et al., 1999; Pate et al., 1995). A prospective cohort study by Hayashi et al. (1999) examined the effects of walking to work on the risk of hypertension in 6,017 Japanese men. Relative risk analysis determined that for every 26.3 men that walked 20 minutes or more to work, one case of hypertension would be prevented (Hayashi et al., 1999). This suggests that regular light-intensity activity in the form of walking can reduce hypertension. Young, Apple, Jee & Miller (1999) conducted a study that compared intensity levels for the reduction and prevention of hypertension in the United States. This study examined the blood pressure of 62 sedentary elderly individuals that were participating in either a 12-week moderate-intensity aerobic program or a light-intensity T'ai Chi program. Blood pressure was lowered in both groups with no significant difference between the two activity levels (Young et al., 1999). Therefore, hypertension can be controlled by regular physical activity even at low levels of intensity.

Osteoporosis

In the United States, 24 million people suffer from osteoporosis with the most effected population being older women (Iqbal, 2000). Ho et al. (1999) found that in a sample of 769 Hong Kong Chinese women, 45% of women over 60 have osteoporosis of the spine, while over 50% of women over 70 have osteoporosis of the hip. Ulrich, Georgiou, Gillis & Snow

(1999) performed a cross-sectional study in the United States comparing the relationship of physical activity and bone mineral density in 25 premenopausal women. This study found that physical activity, especially lifelong, weight-bearing activity, reduces the risk of osteoporosis (Ulrich et al., 1999). A study in Hong Kong found similar results using 280 women and 120 men with hip fractures and 800 controls (Lau & Cooper, 1993). The relative risk of hip fracture was higher in those Hong Kong individuals in the study that did not partake in regular load-bearing physical activity. Comparable studies from Finland and Australia conducted respectively by Kujala, Kaprio, Kannus, Sarna & Koskenvuo (2000) and Nguyen, Center & Eisman (2000) show further proof of the benefits physical activity has on the prevention of osteoporosis.

Mental Health

When reviewing the effects of physical activity on health, it is imperative to consider the effects on mental health as well. The benefits of physical activity are not limited to physical improvements, but have a positive effect on the overall wellbeing of an individual. Stevens (1988) examined physical activity levels and psychological status in the United States and Canada. Four population surveys were conducted over a ten-year time frame and results showed a positive association between physical activity and overall wellbeing as well as elevated mood and lower depression and anxiety levels (Stevens, 1988). Physical activity, particularly in the form of aerobics or strength training, is a proven treatment for depression and is associated with reducing anxiety and panic attacks (Fox, 1999; Paluska & Schwenk, 2000). Physical activity is also helpful in preventing and treating stress and increasing ability to cope with stressful situations (Shephard, 1997). In psychological tests, athletes scored better for tension, depression, anger, fatigue, and confusion than individuals who were sedentary (Shephard, 1997). DiPietro, Seeman, Merrill & Berkman (1996) compared physical activity to improved cognitive function in 1,189 American adults as part of the MacArthur Study of Successful Ageing. The authors found that total cognitive function was improved by physical activity but may also be influenced by education level (DiPietro et al., 1996). More research is needed on the effects of physical activity on the improved mental health of Hong Kong Chinese.

Physical Activity / Sports Participation and Health in Children

Disease risk factors are becoming more prevalent in children and adolescents (Gupta et al., 1998; Hager, 1996; Katzmarzyk, Malina & Bouchard, 1999). In the US, the Secretary of Health and Human Services and the Secretary of Education jointly announced that physical inactivity has contributed to an unprecedented epidemic of childhood obesity that is currently plaguing the US (National Center for Chronic Disease Prevention and Health Promotion, 2000). The percentage of young people who are overweight has doubled since 1980. Of children aged 5 to 15 who are overweight, 61% have one or more cardiovascular disease risk factors, and 27% have two or more. Type 2 diabetes, which was rarely seen in children, has become a major health concern in children. It is also suggested that physical inactivity is a major cause for these health problems in children. A national survey (Centers for Disease Control and Prevention, 2000) indicated that more than 35% of high school students in the US do not participate regularly in vigorous physical activity. Regular participation in vigorous physical activity drops from 73% of 9th grade students to 61% of 12th grade students. Nearly half (45%) do not play on any sports teams during the year. Nearly half (44%) are not even enrolled in a physical education class; enrollment in physical education drops from 79% in 9th grade to 37% in 12th grade. Only 29% attend daily physical education classes, a dramatic decline from 1991, when 42% of high school students did so.

Twisk, Kemper, vanMechelen & Post (1997) conducted the Amsterdam Growth and Health Study in order to determine which lifestyle factors had the closest correlation to a high risk for disease. This 15-year study observed 181 subjects who were 13 years old at the beginning of the study. It was determined that physical inactivity has the highest correlation to a high risk of CHD for that age group (Twisk et al., 1997). Therefore, there is a need to begin implementing healthy lifestyle intervention programs, which stress the importance of physical activity, in the youth. It is also necessary to start educating children about the benefits of physical activity because it is easier to alter behaviour in children and they would be more likely to make regular physical activity a part of their normal lives (Taubert, Moller & Washington, 1996).

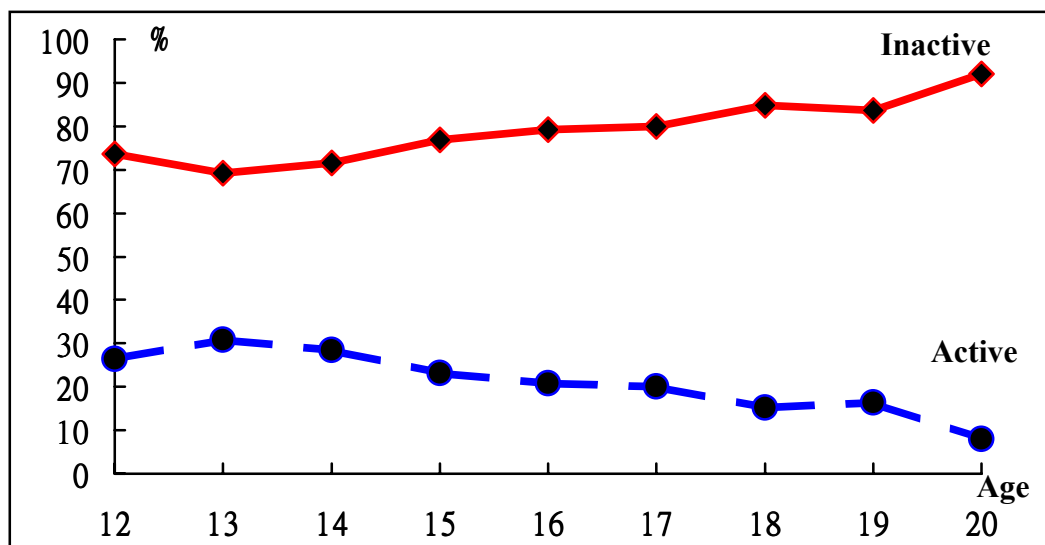
In order to determine what stage of life physical activity programs designed to prevent sedentary lifestyles in adulthood should be initiated, a 5-year, population-based study was implemented using 126 children in Muscatine, Iowa (Janz, Dawson & Mahoney, 2000). It was concluded that increasing regular physical activity in children will prove to have

positive health benefits in their adult lives and thus, improve the overall health of the population (Janz et al., 2000).

The need for physical activity intervention in the youth is of extreme importance in Hong Kong. Most Hong Kong schools offer only two physical education classes a week, compared with the United States minimum of five. It is estimated that the children in Hong Kong schools are exercising at a level in which they receive health benefits for only four minutes a day (Adab & Macfarlane, 1998). This suggests that Hong Kong primary children may be the most inactive in the world. Another citywide physical activity survey of secondary school students (Hui et al., in press) conducted in 2000 found that 18.3% of youth in Hong Kong were sedentary, 50.2% were somewhat active, and 31.5% were active enough to achieve health benefits according to the criterion given by previous literature. Moreover, the portion of active youth decreases steadily from age 13 to 20 years (from 31% to 8%), while the inactive portion increases with age (Figure 3). A study by Hong, Chan and Li (1998) compared health-related physical fitness of children in Hong Kong and Mainland China. It was determined that in school children between the ages of 9 and 18, Hong Kong school boys were heavier than those of Mainland China with similar height. It was also observed that Hong Kong children did not have as much cardiorespiratory endurance as those in Mainland China. In addition, Mainland China school children had better muscular fitness than did the Hong Kong students (Hong et al., 1998). This study observed that Mainland China students were better in every facet of the experiment than Hong Kong students. These studies suggest that children in Hong Kong are not getting the recommended amount of physical activity.

Some parents and teachers in Hong Kong believe that sports participation is detrimental to the academic development of students. Lindner (1999) compiled a sports participation and self-reported academic performance questionnaire for Hong Kong school children between the ages of 9 and 18. Contrary to popular opinion, the study found that Hong Kong students who said they were high academic achievers also had a higher tendency to participate in sport and physical activity (Lindner, 1999). More recent research (Lindner, 2000) has looked at the relationship between sport and physical activity and actual academic achievement and shows that parents' and teachers' concerns are unfounded, as sport and physical activity are not detrimental to academic achievement.

Figure 3. Physical Activity Participation of Hong Kong Youth – The Hong Kong Youth Fitness Study (Hui et al., in press)



Sources: 1. Hui, S. C., Chan, C. M., Wong, S. H. S., Ha, A. S. C., & Hong, Y. (In press). Physical activity levels of Chinese youths and its association with physical fitness and demographic variables: The Hong Kong Youth Fitness Study. Research Quarterly for Exercise and Sport, 71(supplement).

Physical Activity / Sports Participation and Health in Adults

The results of this literature review demonstrate that the various health benefits of regular physical activity have been proven worldwide. However, most people are still not getting enough physical activity in their daily lives in order to achieve these benefits (U.S. Department of Health and Human Services, 1996). The 1996 Surgeon General's Report found that only 22% of American adults are participating at a level in which they achieve health benefits. Therefore, 78% of Americans are not physically active enough to receive health benefits. It was also found that 54% of American adults are somewhat active, while 24% are not active at all. In Hong Kong around one half of the adult population take part in some form of physical activity or sport (Hong Kong Sports Development Board, 2000; Lam, Chan, Ho & Chan, 1999).

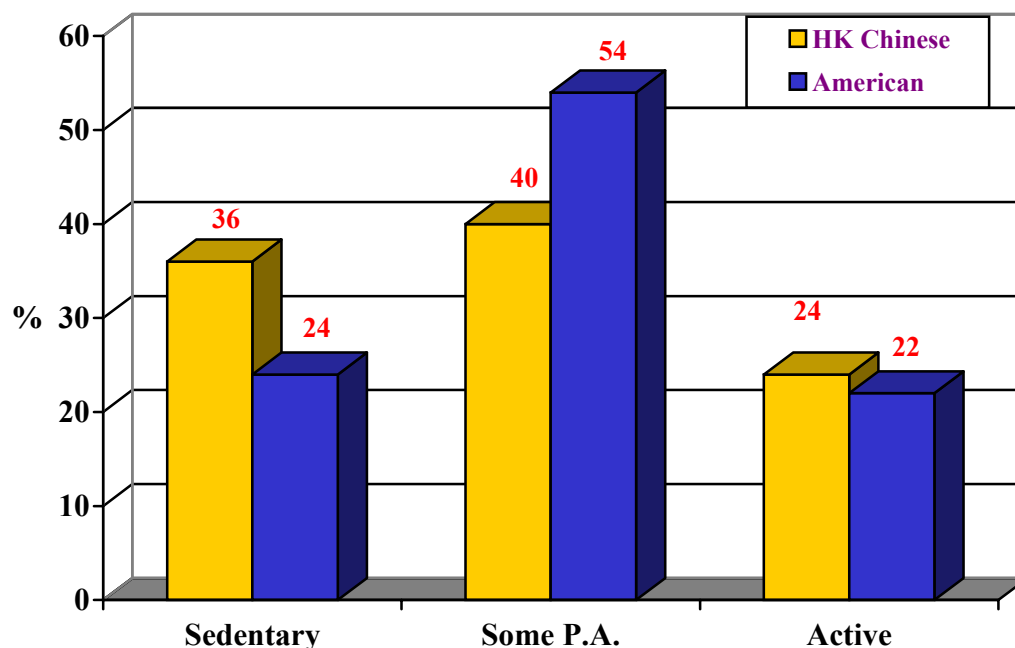
However, research by Hui and Morrow (in press), who conducted a random telephone survey to determine participation and knowledge of physical activity in a sample of 812 Hong Kong Chinese, shows that the majority of people are not sufficiently active to obtain health benefits.

Similar to results found in the United States, only 23.7% of Hong Kong Chinese were considered active enough to obtain health benefits. In other words, three out of four Hong Kong people (76%) are not participating at a level in which they can achieve health benefits (Hui & Morrow). In the Hong Kong population, 40.2% were somewhat active, while 36.1% were not active at all (Figure 4).

In contrast to the United States which reported decreasing physical activity levels with age (Pate et al., 1995), physical activity levels of the Hong Kong population were found to increase in older individuals, resulting in the elderly individuals being the most active group (Hui & Morrow, in press). The tendency of older individuals to become more active was also observed in similar studies from Japan and Canada (Ohta, Tabata & Mochizuki, 1999; Curtis, White & McPherson, 2000). Furthermore, the group demonstrating the least amount of physical activity in Hong Kong Chinese was the middle-aged group (Hui & Morrow). Therefore, intervention is necessary to improve physical activity levels of Hong Kong Chinese, placing particular emphasis on the middle-aged group.

Even though there is an increase in physical activity in older individuals in Hong Kong, current knowledge of the importance of regular physical activity is still low. Hui and Morrow (in press) found that for the Hong Kong Chinese population, physical activity was perceived as the least important influence on health in both the young and middle-age groups and was ranked only slightly higher in the old-age group (Hui, Yuen, & Morrow, 1999; Hui & Morrow, in press). In both the United States and Hong Kong, higher education levels may be associated with greater degrees of physical activity, while sedentary lifestyles are likely to be found in poorly educated individuals (Lewis, Raczynski, Heath, Levinson & Cutter, 1993; Woo et al., 1999). Hui & Leung (1999) revealed that knowledge of physical activity would influence the practice of physical activity in Hong Kong Chinese adults and is a function of education level and age. This suggests that there is a need for public education in Hong Kong on the positive health benefits of physical activity.

Figure 4. A Comparison of Physical Activity Levels Between Hong Kong Chinese Adults¹ and American Adults²



- Sources: 1. Hui, S. C., & Morrow, J. R. Jr. (in press). Level of participation and knowledge of physical activity in Hong Kong Chinese adults and their association with age. *Journal of Aging and Physical Activity*.
2. U.S. Department of Health and Human Services. (1996). *Physical Activity and Health: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.

As well as a lack of knowledge about physical activity, the busy lifestyles of many people in Hong Kong act as a barrier to participation in sport and physical activity. Lack of time is the main reason consistently given for not playing sport or being active (Hong Kong Sports Development Board, 2000). Strategies to promote active lifestyles in Hong Kong, therefore, will have to demonstrate how physical activity can be fitted into people's busy lives.

Health Care Costs

The positive effects of physical activity go beyond that of improving health. Individuals that are physically active enough to achieve health benefits also experience lower health care costs than their sedentary peers (Pratt, Macera, & Wang, 2000; Pronk, Tan, & O'Connor, 1999). Pronk et al. (1999) found that a high BMI and low physical fitness level are directly and significantly related to high health care costs. Colditz (1999) calculated the health care expenses in the United States that were a result of physical inactivity and obesity, which included CHD, hypertension, NIDDM, colon cancer, depression and anxiety, hip fractures resulting from osteoporosis, and obesity. Colditz (1999) concluded that 9.4% or 94 billion dollars of the yearly health care expenses in America are accredited to obesity and physical inactivity. Another cross-sectional stratified analysis of the 1987 National Medical Expenditure Survey found that in Americans age 15 and older without physical limitations, the average annual direct medical costs were US\$1,019 for those who were regularly physical active, and US\$1,349 for those who reported being inactive (Pratt, Macera, & Wang, 2000). The cost were lower for active persons among smokers (US\$1,079 vs US\$1,448) and nonsmokers (US\$953 vs US\$1,234) and were consistent across age-groups and sex. Pratt, Macera, and Wang (2000) further commented that the mean net annual benefit (reduction of medical cost) of physical activity was US\$330 per person, and would be triple in the year of 2000.

However, Nicholl, Coleman, and Brazier (1994) collected data from the United Kingdom and concluded that economic benefits derived from participation of exercise were found only in adults aged 45 and above but not in younger adults. With participation in exercise and sports, the estimated health care costs avoided in adults aged 45 and above (> £30) greatly outweigh the costs that would be incurred (< £10).

Recently, researchers in Australia used the concept of “population attributable risk” (PAR) to estimate the proportion of disease outcomes attributable to being physically inactive (Stephenson et al., 2000). National prevalence data of inactivity among adults were derived from the Active Australia 1997 National Physical Activity Survey, and estimates of relative risk (of disease outcomes for those who were inactive) were derived from multiple studies of physical activity and each specific disease.

The 1997 adult Australian prevalence rate of 44 per cent of adults who were ‘insufficiently active’ was used as the estimate of inactivity. Conservative estimates suggested that the PARs for each disease were 18 percent for CHD, 16 percent for stroke, 13

percent for NIDDM, 19 percent for colon cancer, 9 per cent for breast cancer and 10 per cent for depression symptoms. In addition, hypothetical estimates were derived for all cause mortality, and 18 percent was estimated to be due to inactivity.

Physical inactivity contributes to the risk of 6,400 deaths annually in Australia from CHD, NIDDM and colon cancer, and up to 2200 more due to other conditions, including breast cancer and stroke. Of these deaths 1531 occur in people under the age of 70 years and contribute to an estimated 77,603 potential years of life lost because of inactivity.

Stephenson et al. further commented that these deaths are potentially avoidable if the sedentary and low active population became at least moderately active.

The annual direct health care cost attributable to physical inactivity is around A\$377 million per year. For each disease, costs were estimated to be A\$161 million for CHD, A\$28 million for NIDDM, A\$16 million for colon cancer, A\$101 million for stroke, A\$16 million for breast cancer, and up to A\$56 million for depressive disorders. These data reinforces the evidence that there is a substantial burden of disease as well as substantial costs attributable to inactivity.

The role of physical activity on reducing health care costs can also be seen at the corporate level in companies that offer fitness programs. Most of the health costs of corporations are due to a lack of physical activity, stamina, and endurance, CHD, and back pain in their employees (Zechetmayr, 1995). Corporate fitness programs have been proven to be cost-effective to companies because they reduce the occurrence of these problems as well as the costs associated with them (Zechetmayr, 1995). Corporate fitness programs also decrease the incidence of absences and attract more productive employees (Kaman, 1987; Zechetmayr, 1995). There is a need to determine and quantify the effect physical activity has on reducing health care costs in Hong Kong and to analyse the cost-effectiveness of fitness programs based in Hong Kong corporations.

Recommendations for Physical Activity, Exercise and Sports

The Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM) have established a set of recommendations in order to achieve the health benefits of physical activity. In order to improve health, it is necessary to burn approximately 200 calories a day. This can usually be accomplished by participating in 30 minutes of daily moderate-intensity activity on most days of the week. Therefore, the CDC and ACSM state that, "every American adult should accumulate 30 minutes or more of

moderate-intensity physical activity on most, preferably all, days of the week." (Pate et al., 1995). The most recent addition to these recommendations is that the 30 minutes of daily activity can be spread out during the day, rather than accumulated all at one time. Before beginning an exercise programme, it is important to check with a doctor if a chronic disease is present for men over 40 and women over 50 years of age (Pate et al., 1995). These recommendations are also found to be in accordance with the American Heart Association (Fletcher et al., 1996).

The largest health benefits of physical activity can be seen in sedentary individuals. However, more active individuals will see additional benefits and improved fitness levels from 20 minutes of vigorous, high-intensity activity at least three times a week (Pate et al., 1995). Dunn et al. (1999) compared the effects of a 24-month lifestyle intervention and a 24-month structured exercise programme on previously sedentary individuals. This study provided evidence that a lifestyle intervention programme is as effective at improving the health of sedentary individuals as an exercise programme. A lifestyle intervention programme includes such things as taking the stairs, parking further away from a destination and walking, working in the yard, exercising while watching television, and so forth. Therefore, there is no need to join a gym or health club in order to obtain the benefits of physical activity.

Due to the alarming figures of inactive adolescents and children, the International Consensus Conference on Physical Activity Guidelines for Adolescents (Sallis & Patrick, 1994) issued the following recommendations:

- i. All adolescents should be physically active daily, or nearly every day, as part of play, games, sports, work, transportation, recreation, physical education, or planned exercise, in the context of family, school, and community activities.
- ii. Adolescents should engage in three or more sessions per week of activities that last 20 minutes or more at a time and that require moderate to vigorous levels of exertion.

Since the developmental needs and abilities of younger children differ from those of adolescents and adults, The National Association for Sport and Physical Education (NASPE) has issued physical activity guidelines for elementary school-aged children (Corbin & Pangrazi, 1998) that recommend the following:

- i. Elementary school-aged children should accumulate at least 30 to 60 minutes of age-appropriate and developmentally appropriate physical activity from a variety of activities on all, or most, days of the week.
- ii. An accumulation of more than 60 minutes, and up to several hours per day, of age-appropriate and developmentally appropriate activity is encouraged.
- iii. Some of the child's activity each day should be in periods lasting 10 to 15 minutes or more and include moderate to vigorous activity. This activity will typically be intermittent in nature, involving alternating moderate to vigorous activity with brief periods of rest and recovery.
- iv. Children should not have extended periods of inactivity.

Recommendations for heart disease prevention in Hong Kong are listed in the Hong Kong Cardiovascular Risk Factor Prevalence Study, in which Janus (1997b) gave the following recommendations for the entire population of Hong Kong: consume less fat, avoid becoming overweight or obese, partake in regular moderate exercise, and avoid smoking. These recommendations also apply to the prevention of diabetes, high cholesterol, and high blood pressure (Janus, 1997b). There is a further need to compare the reliability and validity of the dose-response relationships of the physical activity recommendations in America to Hong Kong populations. It is also necessary to establish specific physical activity recommendations for Hong Kong Chinese in order to improve health and educate the people of Hong Kong on the importance of regular physical activity. Governmental programs and interventions are a necessity in order to improve education on this topic.

Conclusions

Physical activity has been defined as "any bodily movement produced by skeletal muscles and resulting in energy expenditure" (Caspersen, Powell & Christenson, 1985). Therefore, there are a number of ways in which people can incorporate physical activity into their daily lives. Activity done on the job or in leisure-time results in health benefits, demonstrating that physical activity does not need to be strenuous or structured in order to improve health. Exercise, which is a form of physical activity, is "planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness" (Caspersen et al., 1985). An example of exercise is aerobic dance, which is a very popular form of structured exercise. Sport participation is also a form of physical activity.

Sport includes a wide range of activities that can be played as a team, such as in basketball and soccer, or as in individual, as in long distance running and golf. Therefore, there are many ways in which one can achieve the benefits of physical activity, including a lifestyle intervention program, occupational physical activity, leisure-time physical activity, exercise, and sports participation.

In reviewing the existing data on the health benefits of physical activity, it can be concluded that physical activity can be an effective method for the prevention and treatment of obesity, CHD, diabetes, colon cancer, stroke, hypertension, osteoporosis, and mental distress in Caucasian and Hong Kong Chinese populations. Unfortunately, most Hong Kong Chinese are not active enough to achieve these health benefits. Close to 70% of Hong Kong youths are not active enough to achieve a health benefit, and the exercise/sports participation level declines gradually and significantly from age 13 to 20. Three out of four Hong Kong adults do not exercise enough to achieve a health benefit. Education levels on the positive health benefits of physical activity are currently low and need to be improved. In order to educate and improve the health and wellbeing of Hong Kong Chinese, government involvement and intervention is necessary. In addition, specific recommendations for improved health through physical activity are needed for Hong Kong. It is also suggested that providing choices and opportunities for all types of activities in a variety of settings, such as at home, workplaces, schools, public places, community, and sports facilities, should be the goal for both public and private sectors.

Starting from last year, there are two large-scale physical activity and health promotion campaigns being implemented in Hong Kong. They are the “Better Health for Better Hong Kong” initiated by the Hospital Authority, and the “Healthy Exercise for All Campaign” which is jointly organised by the Leisure and Cultural Services Department and the Department of Health. The motto of the “Better Health for Better Hong Kong” campaign is “Happy all the times, exercise everyday, and balance diet every meals” (時時開心, 日日運動, 餐餐均衡), whereas the motto of the “Healthy Exercise for All Campaign” is “Daily exercise keeps us fit, people of all ages can do it” (日日運動身體好, 男女老幼做得到). Although these activities indicate a good start for promoting physical activity and health in Hong Kong, long-term commitment, particularly ensuring adequate resources and appropriate policies, is necessary to ensure that substantial numbers of people in Hong Kong enjoy the benefits of a healthy, active lifestyle.

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