INTEGRATING HEALTH, HUMAN PERFORMANCE AND RECREATION

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Technology and Lifestyles

The Industrial Revolution transformed workers from manual laborers to machine operators. The development of machine tools made possible the machines that increasingly reduced the amount of physical effort required in manufacturing and other industries. The development of the steam engine to power machines decreased the dependence of manufacturing on access to waterways, and facilitated the transportation of goods and services. The application of machines to agriculture began with the cotton gin and expanded to a wide range of agricultural equipment to transform farmers from manual laborers to machine operators while greatly increasing individual productivity in agriculture.

The application of machines to transportation moved people off their feet and horses to far less physically demanding travel on steamships, trains, automobiles and urban mass transit. Machines allowed electricity to be produced, controlled, distributed and used productively to power machines, create abundant light, and facilitate communications, first with the telegraph and later with the telephone. Considering the transformation in lifestyles brought about by machines and technology, it is worth noting that the first message transmitted to demonstrate the telegraph was “What hath God wrought?” Mass production methods developed to meet consumer demands for bicycles were combined with the development of the internal combustion engine to sweep Americans off their feet and into automobiles. The introduction of machines to the home transformed housework to reduce the time and effort required to complete household chores.

The technological revolution during the second half of the twentieth century saw computers evolve from primitive electronic digital computers, through the semiconductor revolution, to large mainframe computers, to computer-assisted manufacturing, to industrial robots, to computer-aided design, to mini-computers, through the

microprocessor revolution, to personal computers, to the Internet, to increasingly smaller personal computers, to increasingly more powerful super computers, and to cellular telephone technology. Most of this technological revolution has occurred within the lifetimes of the current faculty at the University of Wisconsin – Whitewater, and most of the current students at the University of Wisconsin – Whitewater cannot imagine life before personal computers, the Internet and cellular telephones.

The Industrial Revolution, improvements in agriculture, transportation and communications, mass production methods, the internal combustion engine, and recent developments in computer technology have combined to make us more productive and more efficient at the worksite and in the home. But we have also become less physically active and increasingly sedentary. The machines of the Industrial Revolution removed much of the physical activity from work, while assembly line methods made workers more efficient and more productive at work. Now computer technology removes workers from the assembly line by replacing them with computerized machines and robotic devices. Machines, labor saving devices and technology increasingly spare us from physical activity at work and increasingly provide us with inactive opportunities for leisure.

Through increased productivity and efficiency at the worksite and in the home, machines, labor saving devices and technology have promised us shorter work weeks with more opportunities for leisure. Unfortunately, the reality has fallen short of the promise and the work week has become longer rather than shorter. Furthermore, technology has facilitated various inactive forms of leisure to further remove leisure from our lifestyles. We entered the new millennium as a busy, stressed and sedentary society; working more hours, performing little or no physical activity, and with fewer opportunities for leisure. Our increasingly sedentary lifestyles have created an epidemic of chronic disease outcomes associated with physical inactivity, especially coronary heart disease, and including cerebrovascular disease, hypertension, dyslipidemia, impaired fasting glucose and obesity. (Albrechtsen, 1999, 2000a, 2000b, 2001a, 2001b, 2002a, 2002b, 2003).

Sedentary Lifestyles and Diseases of the Heart

The American College of Sports Medicine (ACSM, 2006) identified sedentary lifestyle as one of the positive risk factors associated with coronary heart disease. Sedentary lifestyle became a positive risk factor for coronary artery disease in “Persons not participating in a regular exercise program or not meeting the minimal physical activity recommendations from the U.S. Surgeon General’s Report” which recommended “Accumulating 30 minutes or more of moderate intensity physical activity on most days of the week.” Other positive risk factors which increased the risk of developing coronary heart disease were family history, cigarette smoking, hypertension, dyslipidemia, impaired fasting glucose, and obesity. The one negative risk factor which decreased the risk of developing coronary heart disease was high-serum HDL cholesterol.

While sedentary lifestyle was one of the eight risk factors associated with coronary heart disease, sedentary lifestyle contributed to five of the other risk factors and may also be associated with the remaining two risk factors. Sedentary lifestyle may be a consequence of family history, may be more common in cigarette smokers, and cigarette smoking may make it less likely physical activity will be increased and sustained. Hypertension or high blood pressure, dyslipidemia or high LDL cholesterol or high total cholesterol, impaired fasting glucose associated with pre-diabetes and diabetes mellitus, and obesity all occurred more commonly in persons with a sedentary lifestyle. Furthermore, blood pressure was often lowered, LDL cholesterol and total cholesterol were often lowered, glucose tolerance was often improved, and weight was often lost to resolve obesity in persons who led active lifestyles and/or participated regularly in exercise programs. Low-serum HDL cholesterol levels occurred more commonly in persons with a sedentary lifestyle, while HDL cholesterol was raised and high-serum HDL cholesterol levels occurred more commonly in persons who led active lifestyles and/or participated regularly in exercise programs.

At the beginning of the twentieth century, the leading cause of death in the United States was pneumonia and influenza (11.8% of the total of 343,217 reported deaths), followed by tuberculosis as the second leading cause of death (11.3% of total deaths), diarrhea, enteritis and ulceration of the intestines as the third leading cause of death (8.3% of total deaths), and diseases of the heart as the fourth leading cause of death (8.0% of total deaths) (Linder & Grove, 1947). Table 1 presents data on deaths and death rates from all causes and from the ten leading causes of death for 1900.

Table 1: Deaths and death rates from all causes and from the ten leading causes of death for 1900.

Rank	Cause	Total Deaths	Rate per 100,000 Population
	All Causes	343,217	1,719.1
1	Pneumonia (all forms) and influenza	40,362	202.2
2	Tuberculosis (all forms)	38,820	194.4
3	Diarrhea, enteritis, and ulceration of the intestines	28,491	142.7
4	Diseases of the heart	27,427	137.4
5	Intracranial lesions of vascular origin	21,353	106.9
6	Nephritis (all forms)	17,699	88.6
7	All accidents	14,429	72.3
8	Cancer and other malignant tumors	12,769	64.0
9	Senility	10,015	50.2
10	Diphtheria	8,056	40.3

Source: Linder & Grove, 1947

The population of the United States increased substantially throughout the twentieth century with corresponding increases in the annual totals of reported deaths. At the same time the death rate per 100,000 people in the United States declined as infant mortality decreased, medical care expanded and improved, and infectious diseases such as tuberculosis, pneumonia, influenza and diphtheria were brought under control. Diseases of the heart became the third leading cause of death in 1901 and became the second leading cause of death in 1908. For one year in 1909 tuberculosis replaced pneumonia and influenza as the leading cause of death followed by diseases of the heart, and in 1910 diseases of the heart became the leading cause of death in the United States. Since 1910 diseases of the heart have remained the leading cause of death in the United States with the exception of 1918 through 1920 when the world-wide influenza pandemic made pneumonia and influenza the leading cause of death in the United States and around the world (Linder & Grove, 1947; Grove & Hetzel, 1968; National Center for Health Statistics [NCHS], 1974, 1985, 1994; Minino, Arias, Kochanek, Murphy, & Smith, 2002; Kung, Hoyert, Xu, & Murphy, 2008; Heron, Hoyert, Xu, Scott, & Tejada-Vera, 2008). The total number of deaths from diseases of the heart peaked in 1985 at 771,169 of a total of 2,086,440 deaths and the death rate from diseases of the heart per 100,000 population peaked in 1963 at 375.5 of a total of 962.2 deaths per 100,000 population. Table 2 presents data on deaths and death rates from all causes and from diseases of the heart every ten years throughout the twentieth century. 2005 was the last year for which final data was available (Kung, et al., 2008) and the data for 2006 were preliminary data (Heron, et al., 2008).

Diseases of the Heart in the New Millennium

Table 3 presents data on deaths and death rates from all causes and from the ten leading causes of death for 2005, the last year for which final data was available (Kung, et al., 2008). Table 4 presents preliminary data on deaths and death rates from all causes and the ten leading causes of death for 2006 (Heron, et al., 2008).

The latest data from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee (Rosamond, et al., 2008) estimated that 80,700,000 American adults (one in three) had one or more types of cardiovascular disease, including 38,200,000 who were sixty years of age or older. These numbers included 73,000,000 Americans with hypertension, 16,000,000 Americans with coronary heart disease (including 8,100,000 who had suffered a myocardial infarction or heart attack and 9,100,000 who experienced angina pectoris or chest pain), 5,300,000 with heart failure, 5,800,000 who had suffered a stroke, and 650,000 to 1,300,000 who had congenital cardiovascular defects. Nearly 2,400 American died of cardiovascular disease every day, averaging one death every 37 seconds. In 2004, 32% of deaths from cardiovascular disease occurred before the age of 75 years, which was well before the average life expectancy of 77.9 years.

The most recent report from the American Heart Association (Rosamond, et al., 2008) explained in its summary that while death rates from cardiovascular disease had declined, the burden of disease due to cardiovascular disease remained high. The

estimated direct and indirect costs of cardiovascular disease for 2008 were $448.5 billion. These direct costs included hospital, nursing home, physicians and other professionals, drugs and other medical durables, and home health care. The indirect costs included lost productivity due to morbidity (disease) and lost productivity due to mortality (death). Of the 15 most costly medical conditions and the estimated percentage increase in total healthcare spending for each condition from 1987 to 2000, heart disease ranked number one in total costs with an 8.06% increase, hypertension ranked fifth in total costs with a 4.24% increase, cerebrovascular disease ranked seventh with a 3.52% increase, and diabetes mellitus ranked ninth with a 2.37% increase (Thorpe, Florence, Howard, & Joski, 2004).

Table 2: Deaths and death rates from all causes and from diseases of the heart for selected years from 1900 through 2000.

	All Causes		Diseases of the Heart		
Year	Total Deaths	Rate per 100,000 Population	Total Deaths	Rate per 100,000 Population	Rank
1900	343,217	1,719.1	27,427	137.4	4
1910	696,856	1,468.0	75,429	158.9	1
1920	1,118,070	1,298.9	137,374	159.6	2
1930	1,327,240	1,132.1	251,153	214.2	1
1940	1,417,269	1,076.4	385,191	292.5	1
1950	1,452,454	963.8	535,705	355.5	1
1960	1,711,982	954.7	661,712	369.0	1
1970	1,921,031	945.3	735,542	362.0	1
1980	1,989,841	878.3	761,085	336.0	1
1990	2,148,463	863.8	720,058	289.5	1
2000	2,403,351	873.1	710,760	258.2	1
2005	2,448,017	825.9	652,091	220.0	1
2006	2,425,901	810.3	629,191	210.2	1

Sources: Linder & Grove, 1947; Grove & Hetzel, 1968; NCHS, 1974, 1985, 1994; Minino, et al., 2002; Kung, et al., 2008; Heron, et al., 2008.

Coronary heart disease is vascular disease of the heart, may result in a myocardial infarction or heart attack, and is the single most important cardiovascular disease and the single most important disease of the heart. Data from the 2005 survey of the Centers for Disease Control and Prevention (CDC, 2007) showed that 6.5% of respondents reported a history of coronary heart disease. Significantly more men than women reported having had a myocardial infarction (5.5% versus 2.9%) or reported having experienced angina pectoris (5.5% versus 3.4%). Reports of these conditions increased with age and decreased with higher education.

Table 3: Deaths and death rates from all causes and from the ten leading causes of death for 2005.

Rank	Cause	Total Deaths	Rate per 100,000 Population
	All Causes	2,448,017	825.9
1	Diseases of heart	652,091	220.0
2	Malignant neoplasms	559,312	188.7
3	Cerebrovascular diseases	143,579	48.4
4	Chronic lower respiratory diseases	130,933	44.2
5	Accidents (unintentional injuries)	117,809	39.7
6	Diabetes mellitus	75,119	25.3
7	Alzheimer's disease	71,599	24.2
8	Influenza and pneumonia	63,001	21.3
9	Nephritis, nephrotic syndrome and nephrosis	43,901	14.8
10	Septicemia	34,136	11.5

Source: Kung, et al., 2008

Table 4: Deaths and death rates from all causes and from the ten leading causes of death for 2006 (preliminary data).

Rank	Cause	Total Deaths	Rate per 100,000 Population
	All Causes	2,425,901	810.3
1	Diseases of heart	629,191	210.2
2	Malignant neoplasms	560,102	187.1
3	Cerebrovascular diseases	137,265	45.8
4	Chronic lower respiratory diseases	124,614	41.6
5	Accidents (unintentional injuries)	117,748	39.3
6	Alzheimer's disease	72,914	24.4
7	Diabetes mellitus	72,507	24.2
8	Influenza and pneumonia	56,247	18.8
9	Nephritis, nephrotic syndrome and nephrosis	44,791	15.0
10	Septicemia	34,031	11.4

Source: Heron, et al., 2008

Unpublished data from the National Heart, Lung, and Blood Institute of the National Institutes of Health estimated that in 2008, 770,000 Americans would have a new coronary attack, approximately 430,000 would have a recurrent attack, and there would

be an additional 190,000 silent first myocardial infarctions. The average age at first myocardial infarction was 64.5 years for men and 70.4 years for women. Coronary heart disease made up one-half of all cardiovascular events in men and women less than 75 years of age. The lifetime risk of developing coronary heart disease after 40 years of age was 49% for men and 32% for women. Women developed coronary heart disease about 10 years after men, and women experienced serious events such as myocardial infarction and sudden death about 20 years after men. (Rosamond, et al., 2008; Thom, Kannel, Silbershatz, & D'Agostino, 2001; Lloyd-Jones, Larson, Beiser, & Levy, 1999).

The estimated direct and indirect costs of coronary heart disease for 2008 were $156.4 billion (Rosamond, et al., 2008). These direct and indirect costs of coronary heart disease accounted for 34.9% of the total direct and indirect costs of all cardiovascular diseases. In terms of operations and procedures to treat coronary heart disease, in 2005, an estimated 1,271,000 inpatient angioplasty procedures, 469,000 inpatient bypass procedures, 1,322,000 inpatient diagnostic cardiac catheterizations, 91,000 inpatient implantable defibrillators, and 180,000 pacemaker procedures were performed for inpatients in the United States (Rosamond, et al., 2008).

Cerebrovascular Diseases and Diabetes Mellitus

Cerebrovascular diseases are vascular diseases of the brain and may result in a stroke. In 1900 the fifth leading cause of death in the United States was intracranial lesions of vascular origin. Intracranial lesions of vascular origin was briefly the fourth leading cause of death in 1903, but was otherwise the fifth leading cause of death until 1919 when it again became the fourth leading cause of death, rising to the third leading cause of death in 1923, dropping back to the fifth leading cause of death in 1925, and again becoming the fourth leading cause of death in 1932. Intracranial lesions of vascular origin continued as the fourth leading cause of death in the United States until 1938 when it again became the third leading cause of death (Linder & Grove, 1947).

The term "Intracranial lesions of vascular origin" was changed to "Vascular lesions affecting central nervous system" in 1949, which was changed to "Cerebrovascular diseases" in 1968 which is the term currently in use as a cause of death. Intracranial diseases of vascular origin, vascular lesions affecting the central nervous system, and cerebrovascular diseases have remained the third leading cause of death in the United States beginning in 1938, continuing through the end of the twentieth century, and continuing on into the twenty-first century (Linder & Grove, 1947; Grove & Hetzel, 1968; NCHS, 1974, 1985, 1994; Minino, et al., 2002; Kung, et al., 2008; Heron, et al., 2008). In 2005, the last year for which final data was available, cerebrovascular diseases continued to be the third leading cause of death in the United States causing 5.9% or 143,579 of the total of 2,448,017 reported deaths and 48.4 of the total of 825.9 deaths per 100,000 population (Kung, et al., 2008). Preliminary data for 2006 showed cerebrovascular diseases continuing as the third leading cause of death in the United States causing 5.7% or 137,265 of the total of 2,425,901 reported deaths and 45.8 of the total of 810.3 deaths per 100,000 population (Heron, et al., 2008).

The most recent report of the American Heart Association (Rosamond, et al., 2008) explained that every year approximately 780,000 people experienced a new or recurrent stroke, including approximately 600,000 first strokes and 180,000 recurrent strokes. On average, every 40 seconds, someone in the United States had a stroke and every three to four minutes someone died of a stroke. The estimated direct and indirect costs of stroke for 2008 were $65.6 billion. These direct and indirect costs of stroke accounted for 14.6% of the total direct and indirect costs of all cardiovascular diseases. (Rosamond, et al., 2008; National Heart, Lung, and Blood Institute, 2006). Taylor and colleagues (1996) estimated the lifetime cost of ischemic stroke in the United States at $140,048, including inpatient care, rehabilitation, and follow-up care necessary for lasting deficits.

Diabetes mellitus appeared briefly on the list of the top ten leading causes of death in 1922 when it was the tenth leading cause of death in the United States, and returned as the tenth leading cause of death from 1932 through 1938. Diabetes mellitus was the ninth leading cause of disease in 1941 and 1942, from 1946 through 1948, and in 1951. Diabetes mellitus was the eighth leading cause of death in 1939 and 1940, from 1943 through 1945, and from 1952 through 1967. Diabetes mellitus was the seventh leading cause of death from 1968 and through 1979, from 1981 through 1995, and in 1998 and 1999. Diabetes mellitus was the sixth leading cause of disease from 1972 and through 1978, in 1980 and 1996, and from 1999 through 2005 (Linder & Grove, 1947; Grove & Hetzel, 1968; NCHS, 1974, 1985, 1994; Minino, et al., 2002; Kung, et al., 2008; Heron, et al., 2008).

In 2005, the last year for which final data was available, diabetes mellitus caused 3.1% or 75,119 of the total of 2,448,017 reported deaths and 25.3 of the total of 825.9 deaths per 100,000 population (Kung, et al., 2008). Preliminary data for 2006 show diabetes mellitus as the seventh leading cause of death in the United States causing 3.0% or 72,507 of the total of 2,425,901 reported deaths and 24.2 of the total of 810.3 deaths per 100,000 population. Moving ahead of diabetes mellitus to become the sixth leading cause of death in the United States was Alzheimer's disease which caused 3.0% or 72,914 of the total of 2,425,901 reported deaths and 24.4 of the total of 810.3 deaths per 100,000 population (Heron, et al., 2008).

The SEARCH for Diabetes in Youth Study Group (Liese, et al., 2006) reported that in 2001 there were 154,369 youth less than 20 years of age with physician-diagnosed diabetes mellitus in the United States. While type 1 diabetes mellitus accounted for 80% or more of diabetes mellitus among younger children, among older youth the proportion of type 2 diabetes mellitus ranged from 6% for non-Hispanic white youth to 76% for American-Indian youth. Among adult Americans 20 years of age and older, 9.6% have diabetes mellitus, and among adult Americans 60 years of age and older, 21% have diabetes mellitus (National Institute of Diabetes and Digestive and Kidney Diseases, 2006). Mokdad and colleagues (2001) reported that the prevalence of diabetes mellitus increased by 8.2% from 2000 to 2001 and that the prevalence of those diagnosed with diabetes mellitus had increased 61% from 1990. Type 2 diabetes mellitus accounted for from 90% to 95% up to 99% of all diagnosed cases of diabetes

mellitus in adults (Rosamond, et al., 2008; Meigs, Cupples, & Wilson, 2000). The estimated direct and indirect costs of diabetes mellitus for 2002 were $132 billion (CDC, 2004). Selby, Ray, Zhang and Colby (1997) reported that 25% of the excess cost of diabetes mellitus was due to complications of cardiovascular disease. In the United States, the prevalence of diabetes mellitus is expected to more than double from 5.6% in 2005 to 12.0% in 2050 (Narayan, Boyle, Geiss, Saaddine, & Thompson, 2006). The worldwide prevalence of diabetes was estimated to be 2.8% in 2000 and is projected to increase to 4.4% in 2030. The total number of people with diabetes mellitus worldwide is expected to increase from an estimated 171 million in 2000 to a projected 366 million in 2030 (Wild, Roglic, Green, Sicree, & King, 2004).

Hypertension and Cholesterol

The National High Blood Pressure Education Program (2004) defined hypertension or high blood pressure as systolic blood pressure equal to or greater than 140 mm Hg or diastolic blood pressure equal to or greater than 90 mm Hg, confirmed by measurements on at least two separate occasions, or on antihypertensive medication. Prehypertension was defined as untreated systolic blood pressure of 120 to 139 mm Hg or untreated diastolic blood pressure of 80 to 89 mm Hg and not having been told on two occasions by a doctor or other health professional that one has hypertension. Hypertension is the most prevalent cardiovascular disease. Between 90% and 95% of hypertension is considered essential hypertension which is defined as high blood pressure for which there is no known cause and, therefore, no known cure, but which requires continuing treatment, usually with medications. In 2005, an estimated 73,000,000 Americans – one in three American adults – had hypertension and almost as many Americans, 69,700,000, had prehypertension (Rosamond, et al., 2008; Field, et al., 2004; Qureshi, Suri, Kirmani, & Divani, 2005).

From 1963 to 1988 the trends in blood pressure, prehypertension and hypertension went down in children and adolescents from eight to 17 years of age, but pre-hypertension increased 2.3% and hypertension increased 1% in children and adolescents between 1988 and 1999. The downward trends in the prevalence of prehypertension and hypertension in children and adolescents reversed approximately ten years after the increase in the prevalence of obesity (Din-Dzietham, Liu, Bielo, & Shamsa, 2007). While hypertension has never been among the top ten leading causes of death in the United States, in 2005, the last year for which final data was available, essential (primary) hypertension and hypertensive renal disease ranked thirteenth as the leading cause of death in the United States causing 1.0% or 24,902 of the total of 2,448,017 reported deaths and 8.4 of the total of 825.9 deaths per 100,000 population (Kung, et al., 2008). Preliminary data for 2006 showed essential (primary) hypertension and hypertensive renal disease continuing as the thirteenth leading cause of death in the United States causing 1.0% or 23,985 of the total of 2,425,901 reported deaths and 8.0 of the total of 810.3 deaths per 100,000 population (Heron, et al., 2008). Hypertension contributes significantly to deaths attributed to other causes, especially other cardiovascular diseases, and most especially coronary heart disease. The

estimated direct and indirect costs of hypertension for 2008 were $69.4 billion (Rosamond, et al., 2008).

Cholesterol is a combination of fat (lipid) and protein, and classified according to density as very low density lipoprotein (VLDL) cholesterol, low density lipoprotein (LDL) cholesterol, and high density lipoprotein (HDL) cholesterol. LDL cholesterol is considered undesirable or bad cholesterol while HDL cholesterol is considered desirable or good cholesterol. The American College of Sports Medicine (2006) identified total cholesterol greater than 200 mg/dL as a positive risk factor threshold that increased the risk of coronary heart disease. Among children from four to 11 years of age, the mean total cholesterol level was 164.5 mg/dL; among adolescents from 12 to 19 years of age, the mean total cholesterol level was 161.7 mg/dL; among male adults 20 years of age and older, the mean total cholesterol level was 201 mg/dL; and among female adults 20 years of age and older the mean total cholesterol level was 202 mg/dL (Rosamond, et al., 2008; NCHS, 2006).

Data from the 2005 survey of the Centers for Disease Control and Prevention (2006) showed that 73% of adults had been screened for high blood cholesterol in the preceding five years and that 35.6% of adults 18 years of age and older had been told that they had high blood cholesterol. The Centers for Disease Control and Prevention (2000) estimated that a 10% population-wide decrease in total cholesterol levels could result in a 30% reduction in the incidence of coronary heart disease. The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults reported in 2002 that fewer than one-half of the persons who qualified were receiving any kind of lipid-modifying treatment to reduce the risk of coronary heart disease, fewer than one-half of even the highest-risk persons were receiving lipid-modifying treatment, only about one-third of treated patients were achieving their LDL cholesterol goal, and less than 20% of coronary heart disease patients were at their LDL cholesterol goal.

The American College of Sports Medicine (2006) identified LDL cholesterol greater than 130 mg/dL as a positive risk factor threshold that increased the risk of coronary heart disease. Levels of 130 to 159 mg/dL were consider borderline high, levels of 160 to 189 mg/dL were consider high, and levels of 190 mg/dL and higher were considered very high. Among adolescents from 12 to 19 years of age, the mean LDL cholesterol level was 90.5 mg/dL; and among adults 20 years of age and older, the mean LDL cholesterol level was 123 mg/dL (Carroll, et al., 2005; Rosamond, et al., 2008). The age adjusted prevalence of high LDL cholesterol in American adults was 26.6% in 1988-1994 and 25.3% in 1999-2004. Between 1988-1994 and 1999-2004, awareness levels increased from 39.2% to 63.0%, the use of lipid-lowering medications increased from 11.7% to 40.8%, and control of LDL cholesterol among those with high levels of LDL cholesterol increased from 4.0% to 25.1% (Hyre, Muntner, Menke, Raggi, & He, 2007).

The American College of Sports Medicine (2006) identified HDL cholesterol less than 40 mg/dL as a positive risk factor threshold that increased the risk of coronary artery disease and identified HDL cholesterol greater than 60 mg/dL as a negative risk factor

threshold that decreased the risk of coronary heart disease. Among children from four to 11 years of age, the mean HDL cholesterol level was 55.2 mg/dL; and among adolescents from 12 to 19 years of age, the mean HDL cholesterol level was 52.6 mg/dL (Rosamond, et al., 2008). Among adults 20 years of age and older, the mean total cholesterol level was 51.3 mg/dL (Carroll, et al., 2005).

Overweight, Obesity and Sedentary Lifestyles

The American College of Sports Medicine (2006) identified a body mass index (BMI) greater than 30 kg/m^2; or a waist girth greater than 102 cm for men and greater than 88 cm for women; or a waist/hip ratio greater than or equal to 0.95 for men and greater than or equal to 0.86 for women as a positive risk factor threshold that increased the risk of coronary heart disease. Data from the National Center for Health Statistics (2007) indicated that the prevalence of overweight in infants and children from six to 23 months of age increased from 7.2% in 1976-1980 to 11.5% in 2003-2004. Ogden and colleagues (2006) reported that the prevalence of overweight in preschool children from two to five years or age increased from 10.3% in 1999-2000 to nearly 14% in 2003-2004.

Data from the National Center for Health Statistics (2006) indicated that the prevalence of overweight in children from six to 11 years of age increased from 4.0% in 1971-1974 to 17.5% in 2001-2004. In 2005, 4,200,000 children from six to 11 years of age (17.5%) were overweight, with 2,300,000 males overweight (18.7%) and 1,900,000 females overweight (16.3%). The prevalence of overweight in adolescents from 12 to 19 years of age increased from 6.1% in 1971-1974 to 17.0% in 2001-2004. In 2005, 5,700,000 children from 12 to 19 years of age were overweight (17.0%), with 3,100,000 males overweight (17.9%) and 2,600,000 females overweight (16.0%). The U.S. Department of Health and Human Services (2007) reported that overweight adolescents had a 70% chance of becoming overweight adults and that this increased to 80% if one or more parents were overweight or obese.

Ogden and colleagues (2006) reported that the prevalence of overweight and obesity as defined by a BMI equal to or greater than 25 kg/m^2 increased from 64.5% in 1999-2000 to 66.3% in 2003-2004. The prevalence of obesity defined by a BMI equal to or greater than 30 kg/m^2 increased from 30.5% in 1999-2000 to 32.2% in 2003-2004 and the prevalence of extreme obesity defined by a BMI equal to or greater than 40 kg/m^2 increased from 4.7% in 1999-2000 to 4.8% in 2003-2004. The World Health Organization (2006) estimated that by 2015, the number of overweight people in the world will increase to 2.3 billion and more than 700 million of these people will be obese. At least 20 million children less than five years of age were overweight globally in 2005. Furthermore, the problem of overweight and obese was once confined to economically developed countries, but is dramatically increasing in many developing countries, particularly in urban areas. The Centers for Disease Control and Prevention (2005a) determined that the annual hospital costs related to obesity among children and adolescents were $127 million between 1997 and 1999. Finkelstein, Fiebelkorn and Wang (2003) reported that annual medical spending due to overweight and obesity

could have been as high as $92.6 billion dollars and represented 9.1% of total health care expenditures in the United States.

In identifying risk factors associated with coronary heart disease the American College of Sports Medicine (ACSM, 2006) identified sedentary lifestyle as a positive risk factor in "Persons not participating in a regular exercise program or not meeting the minimal physical activity recommendations from the U.S. Surgeon General's Report" which recommended "Accumulating 30 minutes or more of moderate intensity physical activity on most days of the week." The Centers for Control and Prevention (2003) reported that in 2002, 61.5% of children nine to 13 years of age did not participate in any organized physical activity during nonschool hours and that 22.6% did not engage in any free-time physical activity. Eaton and colleagues (2006) reported that in 2005, 43.8% of male students and 27.8% of female students in grades nine through 12 met currently recommended levels of physical activity, that 37.1% of male students and 29.0% of female students attended daily physical education classes, and that 87.2% of male students and 80.3% of female students exercised or played sports for more than 20 minutes during an average physical education class.

Eaton and colleagues (2006) further reported that in 2005, 21.1% of high school students played video games or computer games or used a computer for something that was not schoolwork for three hours or more per day. Playing video games or computer games or using computer equipment for three or more hours per day was more prevalent in male students at 27.4% than in female students at 14.8%. Furthermore, in 2005, 37.2% of students watched television for three or more hours on an average school day. Pleis and Lethbridge-Cejku (2006) reported on data from 2002-2004 that showed 62.0% of adults 18 years of age or older in the United States engaged in at least some vigorous and/or light to moderate leisure-time physical activity lasting at least ten minutes per session, with men at 64.0% more likely than women at 60.2% to engage in at least some leisure-time physical activity. Engaging in a least some physical activity declined steadily with age from 68.6% of adults from 18 to 44 years of age to 40.2% of adults 75 years of age and older.

Pate and colleagues (1995) reported that the relative risk of developing coronary heart disease as a result of physical inactivity ranged from 1.5 to 2.4 and that this increase in relative risk was comparable to that observed for cigarette smoking, hypertension and cholesterol problems. Wofford, Greenlund, Croft and Labarthe (2007) found that of 2003 CDC survey respondents with heart disease, 32.0% met recommended physical activity levels, 53.2% were told to be more physically active and 30.8% were sedentary. The Centers for Disease Control and Prevention (2005b) estimated the annual direct medical cost of physical inactivity in 2000 was $76.6 billion.

Physical Education and Sedentary Lifestyles

Physical education professionals have an important responsibility in reversing the trend toward sedentary lifestyles, responding to the challenges of sedentary lifestyles, and reversing the epidemic of sedentary lifestyle diseases. Overcoming sedentary lifestyles

to achieve more active lifestyles begins with physical education in the schools and extends to programs offered by physical education professionals who work outside the schools in commercial settings, not-for-profit organizations, worksite programs, hospitals and government agencies. Physical education programs in the schools, physical education programs outside the schools, and the training physical education professionals receive to successfully deliver those programs must evolve from the twentieth century to meet the challenges of a busy, stressed and sedentary society in the new millennium.

Physical education programs in the schools have traditionally focused on the development of sport skills. This approach is often justified by claims that we are a sports-oriented society. While we may be a sports-oriented society, our orientation to sports does not sustain participation in sports beyond physical education in the schools and throughout the lifespan. The reality is that we are a spectator society. During the games of the XXIX Olympiad in Beijing, 11,028 athletes participated in 302 events in 28 sports. However, 4.7 billion people around the world watched those 11,028 athletes on television.

Interest in health and fitness developed in the United States following the Second World War during the administration of President Dwight D. Eisenhower who established the President's Council on Youth Fitness on July 16, 1956. President John F. Kennedy changed the name to the President's Council on Physical Fitness and President Lyndon B. Johnson expanded the name to the President's Council on Physical Fitness and Sports which has continued under this name to the present time. President Johnson established the Presidential Physical Fitness Award in 1966 and President Richard M. Nixon established the Presidential Sports Award in 1972. Beginning in the late 1960's and continuing throughout the 1970's, the sports skills approach to physical education evolved from a primary emphasis on team sports to an increasing emphasis on lifetime sports that might more likely be pursued throughout the lifespan.

The early efforts to promote fitness among youth that began during the 1950's extended to efforts to promote fitness among adults during the 1960's and evolved to an emphasis on health-related fitness in the 1970's and to the goal of health through fitness in the 1980's. Important contributions to the development of fitness and health-related fitness resulted from the publication of *Jogging* by William J. "Bill" Bowerman and W. E. Harris in 1966 followed by an expanded publication in 1967, and from the publication of *Aerobics* by Kenneth H. Cooper in 1968. Adult participation in jogging, running and other forms of aerobic exercise began to increase in the 1960's, continued to increase throughout the 1970's and into the 1980's, but reached a plateau and began to decrease after the mid-1980's. Efforts to move children beyond the fitness testing of the 1950's and early 1960's toward adult interest in jogging and running in the late 1960's and 1970's were largely unsuccessful. Running was often used as a punishment in physical education classes, and mandating participation in jogging and running in the physical education curriculum predisposed children to an animosity toward jogging and running as adults.

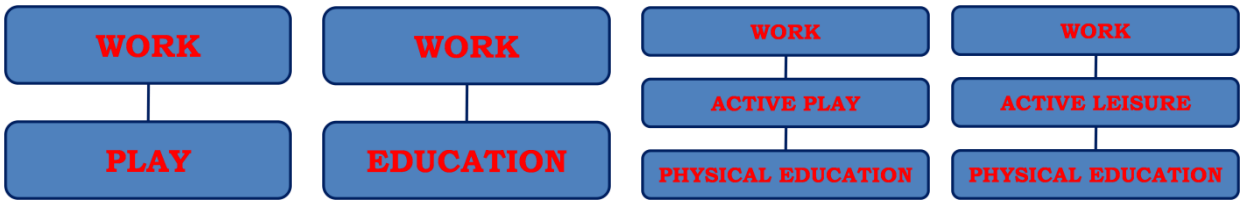
The sports skills approach to physical education in the schools has limited applications to future lifestyles when adults so often fail to participate in sports activities beyond their school experiences. The lifetime sports approach to physical education is an oxymoron when participation in these sports ends with the physical education program. The health and fitness approach to physical education has limited application to future lifestyles when adults are unable to develop and maintain health and fitness. How can physical education professionals reverse the trend toward sedentary lifestyles, respond to the challenges of sedentary lifestyles, and reverse the epidemic of sedentary lifestyle diseases? (Albrechtsen, 1995, 1996; Albrechtsen & Barak, 1997).

Toward a New Model of Physical Education

Adult participation in jogging and running reached a plateau in the mid-1980's and began a steady decline throughout the late-1980's and on through the 1990's and into the new millennium. Research in the late-1980's and early-1990's began to separately identify the health and fitness benefits of exercise, and identified substantial health benefits associated with modest volumes of exercise. In 1993, the Centers for Disease Control and Prevention and the American College of Sports Medicine, in cooperation with the President's Council on Physical Fitness and Sports, introduced the concept of Exercise Lite. The public health message of Exercise Lite stated that "Every US 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 health through fitness paradigm of the 1980's transitioned to the health before fitness paradigm of the 1990's and is moving toward an active lifestyles and leisure paradigm for the new millennium. (Albrechtsen, 1995, 1996; Albrechtsen & Barak, 1997). But how do physical education professionals provide leadership toward this new active lifestyles and leisure paradigm?

Figure 1a suggests that life is a combination of work and play. In the western world we have a saying that "All work and no play make Jack a dull boy." Figure 1b suggests that education for children is the foundation of work for adults. Figure 1c extends this concept to suggest that physical education for children is the foundation of active play. Figure 1d extends this concept to adults to suggest that physical education should be the foundation for active leisure of adults.

Figures 1a, 1b, 1c and 1d.

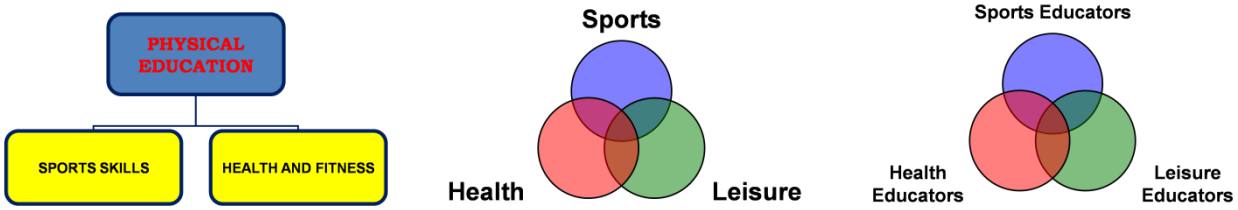


Leisure is difficult to define, but includes play, recreation, the arts and culture, sports, festivals and celebrations, health and fitness, and travel and tourism. Many of these forms of leisure involve active leisure and all of these forms of leisure might involve active leisure. The solution to sedentary lifestyles is active leisure rather than sedentary leisure. To implement this solution to sedentary lifestyles, physical education professionals must understand leisure whose dimensions include activity, experience and choice.

Leisure as activity might be measured as low intensity, moderate intensity or high intensity. Physical education professionals have the opportunity to promote moderate intensity and high intensity activity, and to offer alternatives to current awareness which too often assumes that exercise must involve high intensity activity. Leisure as experience might be measured as a state of being, as satisfaction, as a level of emotional attachment, and as a holistic measure of the individual. Physical education professionals must promote active leisure as an integral part of life, as a satisfying and enjoyable experience, as a positive emotional experience, and as holistic dimension of the individual. Leisure as choice fulfills wants, needs and desires. Physical education professionals must help people to want, need and desire active leisure. In order to successfully promote active lifestyles and leisure physical education professionals must first understand leisure.

Figure 2a shows the late twentieth century model of physical education with its emphasis on sports skills in combination with health and fitness. Figure 2b adds a third dimension of leisure to the physical education model which become an integrated combination of health, sports and leisure. Figure 2c expands the roles of physical education professionals to include roles as health educators, sports educators and leisure educators. (Albrechtsen, 2004a, 2004b, 2006, 2008; Albrechtsen & Barak, 2004; Albrechtsen, Barak, & Sivan, 2006; Albrechtsen, Sivan, & Lobo, 2008).

Figures 2a, 2b and 2c.



Physical Education at the University of Wisconsin – Whitewater

Until the mid-1970's, the University of Wisconsin – Whitewater offered a Physical Education Major for women, but only a Physical Education Minor for men. In an era of separate physical education for boys and girls, many University of Wisconsin campuses offered Physical Education majors for one gender, but not both genders. The

implementation of Title IX of the Education Amendments of 1972 resulted in Physical Education Majors for men and women on all University of Wisconsin campuses which previously offered Physical Education majors for only men or women. Prior to 1983, almost all Physical Education Majors graduating from the University of Wisconsin – Whitewater were licensed to teach physical education in the public schools of Wisconsin.

The Physical Education Licensure Program has its foundations in movement education and has sustained those foundations throughout its existence. The program follows the conceptual framework of the College of Education which promotes the role of the teacher as a reflective facilitator. In recent years the Physical Education Licensure Program has integrated the Sport Education Model into its curriculum for the preparation of physical education teachers. The students approach teaching through a series of seasons which include traditional sports such as basketball, but also include more recent innovations such as rock climbing. The Physical Education Licensure Program is a broadfield major requiring 54 units in the major and additional requirements outside the major, including a semester of full-time student teaching as a capstone experience. As a broadfield major, graduates of the Physical Education Licensure Program are licensed to teach physical education in the public schools of Wisconsin at all grade levels from Kindergarten through twelfth grade (i.e., K-12).

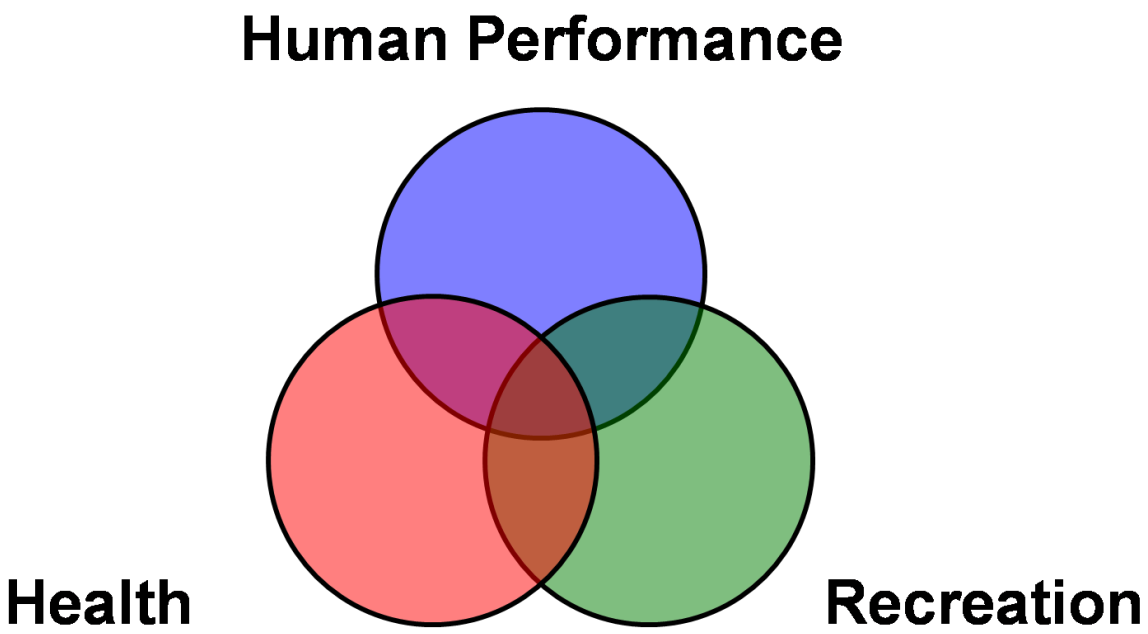
Beginning with the arrival of the author on the Whitewater campus in 1983, increasing numbers of students in the Physical Education Major expressed the desire for training as physical education professionals to work outside the schools in commercial settings, not-for-profit organizations, worksite programs, hospitals and government agencies. Initially the Physical Education Major facilitated the interests of students outside of teaching by offering the option of a personalized 54-unit major which replaced teacher education courses with newly developed courses to prepare physical education professionals to work outside the schools. During the 1996-1997 academic year, the Physical Education Major was split to continue the 54-unit licensure major as a sub-major and to create a new 35-unit non-licensure sub-major which required the completion of a minor.

During the 2002-2003 academic year, the non-licensure sub-major was revised and the name of the sub-major was changed to Health, Human Performance and Recreation which is the name that continues to the present time. The Health, Human Performance and Recreation sub-major integrates sports and exercise through Human Performance with Health Promotion, and Recreation and Leisure Studies to achieve the integrated program represented in Figure 3.

Students in Health, Human Performance and Recreation complete core courses in Human Performance that include the basic sciences of anatomy and physiology, the applied sciences of kinesiology and physiology of exercise, and the practical sciences of health appraisal, exercise testing and exercise prescription. These courses seek to integrate Human Performance with Health Promotion, and Recreation and Leisure Studies. The students select additional courses in health or safety, programming,

administration, and special populations from the disciplines of Health Promotion, Safety, Recreation and Leisure Studies, and Sports. Students complete a minor selected on the basis of their career interests with most students completing minors in Health Promotion, Recreation and Leisure Studies, and/or Athletic Coaching Education. The capstone experience for Health, Human Performance and Recreation is a semester-long internship in a physical education professional setting such as a commercial program, not-for-profit organization, worksite program, hospital program and/or government agency. Enrollments in Health, Human Performance and Recreation have more than tripled from 69 students in the Spring Semester of 2002, prior to the most recent curriculum revision, to 209 students in the Spring Semester of 2008, the most recent Spring Semester.

Figure 3: Integrated program in Health, Human Performance and Recreation at the University of Wisconsin – Whitewater.



During the 2007-2008 academic, Health, Human Performance and Recreation was extended from the undergraduate level to the graduate level with the development of an emphasis in Health, Human Performance and Recreation for the new Master of Science in Education – Professional Development (MSE-PD). This graduate level emphasis begins with two early program courses which explore Issues, Perspectives and Directions in Health, Human Performance and Recreation, and develop abilities for Reading, Analyzing and Evaluating Research in Health, Human Performance and Recreation. Students select additional courses based on their career interests from courses in Health Promotion, Human Performance, Physical Education, Recreation and Leisure Studies, Athletic Coaching Education, and/or from other departments across the

Whitewater campus. Eleven students enrolled in courses for the emphasis in Health, Human Performance and Recreation during the Fall Semester of 2008, 12 to 16 students are anticipated to enroll during the Spring Semester of 2009, 16 to 20 students are anticipated to enroll during the Fall Semester of 2009, and 20 to 24 students are anticipated by the Fall Semester of 2010.

Faculty, staff, students and graduates of the undergraduate and graduate programs in Health, Human Performance and Recreation at the University of Wisconsin – Whitewater are actively pursuing opportunities and careers for professional success in the global society of the technology millennium. These professionals and students are committed to providing leadership toward the new active lifestyles and leisure paradigm. Their success will be measured by their contributions to reversing the trend toward sedentary lifestyles, responding to the challenges of sedentary lifestyles, and reversing the epidemic of sedentary lifestyle diseases.

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