Modeling Physical Activity in Working Adults: How Suitable Is the Expanded Parallel Process Model?

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MODELING PHYSICAL ACTIVITY IN WORKING ADULTS: HOW SUITABLE IS THE EXPANDED PARALLEL PROCESS MODEL?

By

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ABSTRACT

MODELING PHYSICAL ACTIVITY IN WORKING ADULTS: HOW SUITABLE IS THE EXPANDED PARALLEL PROCESS MODEL?

Adwoa B-H-Sam
Old Dominion University, 2008
Chairman: Dr. Martha Walker

This study is an assessment of the usefulness of the Expanded Parallel Process Model in predicting health enhancing physical activity as an outcome variable. The theory is tested in the context of risk for coronary heart disease and involves secondary analyses of a dataset from a group of working adults. These individuals had elected first to participate in a health plan ‘Quality Improvement Study’ and were then randomly selected to receive an intervention program designed to get people to be more active.

Data on self-reported demographics, physical activity levels, health status characteristics and perceptions measured on a Likert-type scale known as the Risk Behavior Diagnosis Scale are analyzed. The perceptions measured cover the threat to one’s health that a heart attack poses in terms of severity and one’s susceptibility as well as perceptions about the effectiveness of physical activity to reduce or avert this threat and one’s ability to engage in the required amount of physical activity to obtain this health benefit. These Risk Behavior Diagnosis Scale measures represent the Expanded Parallel Process Model hypothesized mediating variables which are perceived severity, perceived susceptibility, perceived response efficacy and perceived self-efficacy.
Testing of the model consists of the examination of variable relationships to assess whether the Expanded Parallel Process Model related perceptions are related to meeting health enhancing physical activity requirements. Overall, the results of data analyses offer limited and weak support for the use of the Expanded Parallel Process Model to explain differences in health enhancing physical activity behavior of working adults. Although the magnitude of the hypothesized Expanded Parallel Process Model related mediator variables observed in this dissertation study are small, this evidence may suffice in calling for further research using study designs, other than cross-sectional surveys that provide opportunity for mediator analysis. This study also concludes that the determinants of health behavior change are complex and this warrants the development and exploration of theoretical models that encompass different approaches to the study of physical activity behavior.
This dissertation is dedicated to

the memory of my parents,

John Kwame Bosque-Hamilton and Clarice Aba Yenyiwa Bosque-Hamilton;

to the memory of Auntie Mercy Badoe and to Professor E.A. Badoe, whom I

affectionately call ‘Uncle Doctor’;

to the memory of Major (Rtd) M. Sanni-Thomas and to Auntie Dorothy Sanni-Thomas

and to

Uncle Kwame Agyei-Gyamfi and Auntie Alice Agyei-Gyamfi.

For

your endless love,

for nurturing a love of learning, inspiring me to always put forth my best effort,

instilling in me a determination to complete any task at hand, and assuming the roles of

cheerleaders in my life,

I say “Thank You!!!”
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CHAPTER I: INTRODUCTION

We need . . . a wide-range of vigor in our lives-not only in the sense of high heart rate and rapid respiration during physical activity, but also in the sense of a balanced, persistent, non-sedentary pace. We see that we are going nowhere in our transportation policy, which effectively engineers an important physical activity out of our lives. We see the same in many areas of mechanization at home and work. In the interest of convenience and efficiency, we deny ourselves the opportunity to use our bodies for the motions for which they were designed. Among our rewards for these policies is . . . coronary heart disease (Jacobs, 2000, p.45).

Physical inactivity, in relation to cardiovascular disease and coronary heart disease in particular, has substantial consequences both for the United States (U.S.) health care system and also for the individuals who must bear a portion of these health and medical costs [United States Department of Health and Human Services (USDHHS), 2002]. The overall goal of this study is to support the ‘Healthy People 2010’ national disease prevention and health promotion objectives that relate to increased risk for cardiovascular disease and increasing physical activity in the U.S. population. In particular, this study seeks to better understand what influences the decision to engage in physical activity behavior. The specific objective of this study is to assess the utility of the Expanded Parallel Process Model (EPPM) in predicting physical activity by examining relationships between physical activity and model theoretical variables with risk for cardiovascular disease, specifically coronary heart disease, as the focus.

The study supports three Healthy People 2010 objectives for improving health related to physical activity which are to (1) reduce prevalence of no leisure-time physical activity in adults from 40 to 20 percent, (2) increase the proportion of adults who engage in regular moderate physical activity from 15 to 30 percent, and (3) increase the proportion of adults who engage in vigorous physical activity that promotes development
and maintenance of cardio-respiratory fitness three or more days per week for 20 or more
minutes per occasion from 23 to 30 percent (USDHHS, 2000).

Statement of the Problem

Physical activity is important because it is one of the primary health behaviors
that can minimize the risk of cardiovascular disease. Cardiovascular diseases are a
leading cause of death in the U.S. with about 871,500 people dying each year. 452,327 of
these deaths are from coronary heart disease as a specific cardiovascular disease
(American Heart Association, 2007). Mortality data for 2004 shows that while
cardiovascular diseases accounted for 36 percent of the 2,398,000 deaths that year (one in
every 2.8 deaths), coronary heart disease was responsible for 20 percent (one in every
five deaths) [American Heart Association, 2007].

There is ample evidence pointing to the effectiveness of healthy lifestyles such as
physical activity in decreasing cardiovascular risk and in preventing coronary heart
disease (Young, Haskell, Jatulis & Fortman, 1993; Elley, Kerse, & Arroll, 2003; Franco,
de Lact, Peeters, Jonker, Mackenbach, & Nusselder, 2005; Yusuf et al., 2004; Warburton,
Nicol & Bredin, 2006). Research demonstrates a consistent association and a well-
established dose response relationship, between physical inactivity and increased risk of
coronary heart disease which is a leading cause of death in the United States (Morris,
Heady, Raffle, Roberts, & Parks as cited in Paffenbarger, Blair, & Lee, 2001; Morris,
Kagan, Pattison, & Gardner as cited in Paffenbarger et al., 2001; Powell, Thompson,
Caspersen, & Kendrick as cited in Kohl, 2001; Berlin & Colditz, 1990; Young et al.,
1993; Hu et al., 2001; Kohl, 2001; Rennie, McCarthy, Yazdgerdi, Marmot, & Brunner,
2003; Carnethon, Gulati & Greenland, 2005; Franco et al., 2005). Middle-aged
individuals with sedentary occupations, in particular, constitute an important group in terms of coronary heart disease risk (Rennie et al., 2003).

Physical inactivity, as population surveys suggest, is however increasingly prevalent in the U.S. [Centers for Disease Control and Prevention (CDC), 2001, 2003, 2005; Carnethon et al., 2005] and progress made in improving overall physical activity in the U.S. population has only been modest (CDC, 2003; Pratt, Macera, Sallis, O’Donnell, & Frank, 2004). Though physical activity levels, in general, are reported to be the highest in young adults aged 18-24 years of age, they generally decrease steadily with age through adulthood (Stang, 2002). In particular, late adolescence and early adult life marks a critical transition from adequate physical activity to inactivity or activity insufficient for a health benefit (Haase, Steptoe, Sallis, & Wardle, 2004). In view of the health and economic implications, there is reason for concern.

In order to promote physical activity behavior change among adults, there is a need to recast issues of public health importance such as risk for cardiovascular disease and the benefits of physical activity into a framework that is persuasive and more meaningful to target populations or audiences of interest (Weininger, 2003). One potential framework is the Expanded Parallel Process Model (EPPM). If this model is valid with respect to physical activity behavior, then it may be useful in guiding the creation of precisely targeted information that facilitates the process of physical activity behavior change among adults. Such information, theoretically based on the EPPM, will incorporate the message values of severity of cardiovascular disease, susceptibility to cardiovascular disease, efficacy of a response in reducing risk for cardiovascular disease, and self-efficacy towards physical activity that reduces risk for cardiovascular disease.
Purpose of the Study

This dissertation study proposes, within the context of cardiovascular disease risk, to test the usefulness of the EPPM in predicting health enhancing physical activity behavior. The study will involve secondary analysis of a dataset from a group of working adults who elected to participate in a Health Plan Quality Improvement Program and were then randomly selected to receive an intervention lifestyle program designed to get people to be more active. Model testing will entail an examination of the relationships among participation in regular health enhancing physical activity and (1) perceptions of severity of coronary heart disease, (2) perceptions about one’s susceptibility to coronary heart disease, (3) perceptions about ability of regular physical activity to reduce risk for coronary artery disease and (4) perceptions of one’s ability to engage in regular health enhancing physical activity.

Epidemiology of Physical Inactivity

Physical activity levels are low and steadily declining (Tudor-Locke, 2002; Chan, Spangler, Valcour & Tudor-Locke, 2003; CDC, 2003, 2005; Brownson, Boehmer & Luke, 2005; Carnethon et al., 2005). Data describing current patterns and long-term trends in the United States that go back up to 50 years, in some cases, indicate relatively stable or slightly increasing levels of leisure-time physical activity. The data, however, also shows declining work-related activity, declining transportation activity, declining activity in the home, and increasing sedentary activity; all results which reflect an overall trend of declining total physical activity (Brownson et al., 2005). A strong linear increase in vehicle miles traveled per person over the past half century, along with a corresponding strong and consistent trend of living in suburbs has also been taken as an
indication that changes to the built environment and increases in the proportion of individuals engaging in sedentary activities have put majority of the American population at high risk of physical inactivity (Brownson et al., 2005).

The noticeable shift in work-related physical activity demands from physical labor to sedentary occupations (US Department of Transportation, 1999) has rendered work-sites as ‘areas of preponderance of physical inactivity’ (Fisher, Ritchie, Abernathy, Hut Ford & Miller, 1998). Chan et al. (2003) conclude that the resultant negative impact on physical activity could be expected given that total daily activity is a sum of all occupational, household and leisure-time activities. In addition to the fact that occupational physical activity has declined due to increased automation and use of technology, the time spent at more sedentary occupations or involving work-related activities such as passive commuting has also been observed to be increasing (Chan et al., 2003). Mean ambulatory activity levels defined by ‘pedometer-determined steps per day’ were found to be positively related to self reports of occupational activity across workplaces that were mainly sedentary worksites (Chan et al., 2003). This led to a conclusion that though occupational activity does have an impact on total daily activity, sedentary workers do not tend to compensate for occupational inactivity by increasing their leisure-time activity (Chan et al., 2003).

An assessment of appropriate levels of physical activity in 2001, using a Behavioral Risk Factor Surveillance System (BRFSS) measure of physical activity that was more complete in comparison to what was used previously, revealed that the majority of U.S. adults are not physically active at levels that can promote health (CDC, 2003). Though the data from the BRFSS yields the largest estimates of physical activity
(Brownson et al., 2005), the BRFSS questions used to measure the previous level of appropriate physical activity had been developed about a decade before CDC and the American College of Sports Medicine conducted a review and came to the conclusion that health-related benefits could accrue from a minimum of 30 minutes of moderate-intensity activity on most days of the week (CDC, 2003). During the period spanning 1986-2000, the BRFSS measured leisure-time physical activity in the form of questions focused primarily on exercise or sports-related activities. Previous guidelines for appropriate physical activity had included participating in vigorous-intensity activity for 20 or more minutes per day at least three days per week but now, it was apparent that various household and transportation-related physical activities as well as some other leisure-time activities could be important to measure (CDC, 2003).

In response to these expanded activity recommendations that accommodated health-related lifestyle activities, newly developed BRFSS physical activity questions were used in the 2001 BRFSS after the necessary cognitive, validity, and reliability testing. To bridge the gap, a separate question that allowed tracking of physical inactivity during leisure time across years was used in both the 2000 and 2001 BRFSS questionnaires. Data from the responses to the 2000 BRFSS leisure-time activity questions and the updated lifestyle activity questions of the 2001 BRFSS evaluating combined leisure-time, household, and transportation activities were then used to compare the overall U.S. as well as state-specific prevalence estimates for adults who engaged in physical activities deemed consistent with recommendations from both survey years (CDC, 2003).
An analysis of 1988-2002 data from the Behavioral Risk Factor Surveillance System (BRFSS) for 35 States and the District of Columbia indicated that leisure-time physical inactivity decreased during that period, especially after 1996 (CDC, 2004). This initiative to examine trends in no leisure-time physical activity and further characterize them by sex, age group, and racial/ethnic population was prompted by the U.S. national health objective for 2010 of reducing the prevalence of no leisure-time physical activity to 20%. Declining trends were found among men and women, in the majority of age groups, and in the majority of racial/ethnic populations. To promote further declines in leisure-time physical inactivity, it was recommended by the CDC that state and local health departments and other organizations should adopt effective, evidence-based strategies to encourage more adults to be physically active in their leisure time (CDC, 2004).

Data were again analyzed from the Behavioral Risk Factor Surveillance System (BRFSS) surveys for 2001 and 2003 in order to examine differences from 2001 to 2003 in overall U.S. as well as state- and territory-specific prevalence estimates of adult participation with respect to the minimum recommended level of physical activity and physical inactivity among adults during lifestyle activities (CDC, 2005). The CDC reported this time that study findings indicated that more than half of U.S. adults continue not to participate in physical activity at a level recommended as being beneficial to health and that concerted public health efforts at federal, state, and local levels, therefore, were needed to improve participation in physical activity. The study was based on CDC and the American College of Sports Medicine recommendations that adults engage in at least 30 minutes of moderate-intensity physical activity on most days, preferably all days, to
have a beneficial effect on their health. Two ‘Healthy People 2010’ objectives of increasing the proportion of adults who engage in regular moderate or vigorous activity to at least 50 % and decreasing the proportion of adults who engage in no leisure-time physical activity to 20 % were also taken into consideration.

Physical activity levels overall, are highest in young adults aged 18-24 years of age and then decrease steadily with age through adulthood (Stang, 2002). Disparities in levels of physical activity do exist among other population groups in the area of leisure-time or recreational physical activity as well. Generally speaking, report of no leisure-time physical activity is higher among the less affluent than the more affluent and also as grade in school increases. Persons with lower levels of education and income tend to be least active in their leisure time. In terms of gender, men are slightly more likely to meet recommended levels of physical activity compared to women. Based on ethnic grouping, African Americans and Hispanics seem least likely to meet recommended levels of physical activity while Non-Hispanic whites are most likely to meet the levels of physical activity recommended (CDC, 2003; Brownson et al., 2005).

Costs

Cost in Lives due to Physical Inactivity

Physical inactivity has a large effect on mortality [New York State Department of Health, (NYSDH), 1999]. The annual cost in lives due to physical inactivity in the U.S. has ranged from 200,000-300,000 (Brownson et al., 2005). A landmark study on physical fitness and mortality involving 13,344 men and women demonstrates that the risks posed by physical inactivity to the individual are substantial (Blair, Kohl, Paffenbarger, Clark, Cooper, & Gibbons, 1989). Age-adjusted death rates from all causes were found to be to
be 3.4 times higher for the least-fit men in the study compared to the most-fit men. For women, age-adjusted death rates from all causes were 4.6 times higher for the least-fit than for the most-fit (Blair et al., 1989).

In 1996, seven out of ten deaths (1.6 million out of 2.3 million) in the US were reported as being due to four chronic conditions namely, total cardiovascular diseases, all cancers, chronic obstructive disease, and diabetes and the total number of years lost in relation to these deaths due to chronic disease was estimated to be 24.3 million (Hoffman, Rice & Sung, 1996). Of these 1.6 million chronic health condition deaths, 15 percent (240,000) were due to sedentary lifestyle alone leading to a conclusion that a major cause of death in the U.S. is sedentary living (Hoffman et al., 1996). Another landmark study in 1993 on actual causes of death in the U.S. revealed that 14 percent of all deaths in the U.S. were considered attributable to inactivity patterns and diet (McGinnis & Foege, 1993). A later study known as ‘Actual Causes of Death in the U.S., 2000’ updated the 1993 landmark study by McGinnis and Foege (1993) and showed that about 17 percent of deaths (400,000) were now related to poor diet and physical inactivity (Mokdad, Marks, Stroup & Gerberding, 2004). The 2000 update study also revealed that while most of the major preventable causes of death showed declines or little change since 1990, deaths due to poor diet and physical inactivity had increased by 33 %.

Economic Costs of Physical Inactivity

The economic impact of physical inactivity is reflected in the report that the federal government, through the Medicaid and Medicare programs, spends 84 billion dollars annually on five chronic conditions that could be significantly improved by increased physical activity namely heart disease, diabetes, depression, cancer and arthritis.
Health care costs for physical inactivity takes up approximately 15% of the U.S. health care budget (Booth & Chakravarthy, 2002). Direct (medical) costs involve preventive, diagnostic and treatment expenditures for services such as physician visits, pharmaceuticals, ambulance services, rehabilitation services, hospital and nursing home care. Indirect (financial) costs take into account lost wages of people who cannot work due to illness and disability (morbidity indirect costs) as well as estimates of the value of future earnings lost by premature death (mortality indirect costs) [USDHHS, 2002]). The estimate for medical costs due to physical inactivity is 76 billion in terms of the year 2000 dollars (Brownson et al., 2005) and overall, the direct and indirect cost of sedentary living related to chronic health conditions has been reported to be more than 150 billion dollars in terms of the year 2000 dollars (Booth & Chakravarthy, 2002).

Physical inactivity, together with overweight, and obesity, is associated with 23% of health plan health care charges and 27% of national health care charges (Anderson et al., 2005). In an attempt to estimate the proportion of total health care charges associated with physical inactivity, overweight, and obesity among U.S. populations, Anderson et al. developed a predictive model of health care charges using data from a cohort of 8000 health plan members aged 40 years and older. Study results showed that charges were the highest for individuals aged 65 years and older as well as for individuals with chronic conditions. It was also determined, however, that nearly half of the aggregate charges were generated from plan members aged 40 to 64 years without chronic disease. It was therefore concluded that, along with overweight and obesity, the charges associated with physical inactivity constituted a significant portion of total medical expenditures (Anderson et al., 2005).
Cost in Lives of Cardiovascular Disease associated with Physical Inactivity

Physical inactivity is closely linked to cardiovascular disease. Low cardiorespiratory fitness in adolescents and adults, as a result of physical inactivity, is common in the U.S. population and has a tendency to be associated with increased prevalence of cardiovascular disease risk factors (Carnethon et al., 2005). Carnethon et al. set out to describe the prevalence of low fitness in the U.S. population and explore the relationship of low fitness to cardiovascular disease risk factors by studying a cohort group of 3110 adolescents aged 12-19 years and 2205 adults aged 20-49 years who were free from previously diagnosed cardiovascular disease. Data from the cross-sectional nationally representative National Health and Nutrition Examination Survey 1999-2002 was used and by estimation, low fitness was identified in 7.5 million (33.6 %) of adolescents and 8.5 million (13.9 %) of adults (Carnethon, et al., 2005).

In 1996, findings from a sample of 25,341 men and 7080 women in a follow-up study to that of Blair et al. (1989) that focused on death from cardiovascular disease showed that males categorized as ‘low-fit’ were 2.7 times more likely to die from cardiovascular disease than their physically fit counterparts. In the case of women, the ‘low-fit’ were 2.8 times more likely to die from cardiovascular diseases than those meeting the criteria of being physically fit. (Blair et al., 1996). Overall, low physical fitness as a predictor of early death was shown to be as important a factor as cigarette smoking, high blood pressure and high blood cholesterol. Moderate levels of physical fitness were associated with a lower risk of early death and this appeared to be so even among individuals with other risk factors such as high cholesterol, high blood pressure or cigarette smoking. It was concluded that there was a benefit to being moderately or
highly fit in comparison to being low-fit regardless of whether one was healthy or unhealthy, had combinations of other risk factors or not, or was obese or of normal weight (Blair et al., 1996).

In 1986, the effect of physical inactivity on the chronic diseases of coronary heart disease, stroke and colon cancer was determined to be 256,686 deaths. Of these 256,686 deaths in the U.S. attributable to sedentary and irregularly active lifestyle, 205,254 (80%) of them were deaths from coronary heart disease (Hahn, Teutsch, Rothenberg & Marks, 1990). In the U.S., it is estimated that about 35% of the deaths from coronary heart disease occur as a result of physical inactivity (NYSDH, 1999). In 2002, it was estimated that there are approximately 459,841 deaths from coronary heart disease occurring each year (Booth & Chakravarthy, 2002). The American Heart Association (2007) reported that 452,327 deaths occurred from coronary heart disease in 2004. By estimation, therefore about 158,305 and 160,930 deaths from coronary heart disease in 2002 and 2004 respectively occurred as a result of physical inactivity. Coronary heart disease thus appears to be a sedentary lifestyle-mediated condition that contributes to a high number of deaths.

Economic Costs of Cardiovascular Disease associated with Physical Inactivity

The total medical expenditure of persons with cardiovascular disease in 1996 was 41.3 billion dollars of which 5.4 billion dollars (13.1%) was expended on cardiovascular disease associated with inactivity. For 2001, the economic impact of cardiovascular disease associated with physical inactivity by way of direct medical expenditures was estimated to be 23.7 billion dollars (Wang, Pratt, Macera, Zheng, & Heath, 2004). In order to attract more resources for preventing cardiovascular disease and promoting
physical activity, Wang et al. had conducted a study using data that linked a 1996 Medical Expenditure Panel Survey to the 1995 National Health Interview Survey from 2,472 participants in the non-institutionalized, civilian population aged 19 years or older. The estimates of direct medical expenditures of cardiovascular disease associated with physical inactivity led Wang et al. to conclude that the economic burden of physical inactivity associated with cardiovascular disease was high and that this demonstrated the need to promote physical activity among U.S. adults.

Being physically inactive puts one at risk not only for the medical consequences but also the financial consequences that come with the development of chronic diseases such as heart disease, stroke, colon cancer, diabetes, obesity, and osteoporosis (USDHHS, 2002). In a study estimating the total medical expenditures attributable to physical inactivity patterns among members of a large health plan, total health plan expenditures attributable to physical inactivity for 2000 amounted to 83.6 million dollars (Garrett, Brasure, Schmitz, Schultz, & Huber, 2004). This cost-of-illness approach attributing medical and pharmacy costs for specific diseases to physical inactivity used the 2000 Behavioral Risk Factor Surveillance System and medical claims incurred in 2000 among 1.5 million health plan members aged 18 years or more as data sources. These data were coupled with relative risks based on the scientific literature to demonstrate that heart disease, stroke, hypertension, type 2 diabetes, colon cancer, breast cancer, osteoporosis, depression, and anxiety were directly related to individual physical activity patterns in adults.

Heart disease turned out to be the most expensive outcome of physical inactivity within the health plan population, costing 35.3 million dollars in 2000. The researchers
concluded that the study confirmed 'the growing body of research quantifying physical inactivity as a serious and expensive public health problem. They also noted that as a public health problem, the burden of the health and economic costs of coronary heart disease associated with physical inactivity is borne by taxpayers, employers or individuals, either in the form of higher taxes to subsidize public insurance programs or increased health insurance premiums (Garrett et al., 2004).

Cost of Cardiovascular Disease in Lives

Cardiovascular disease in general and coronary heart disease, specifically, has been the leading cause of death in the United States within the 20th century with the exception of 1918 (American Heart Association, 1998, 2006). In 2002, cardiovascular disease was determined to be the primary or contributing cause of about 1.4 million deaths amounting to about 58% of all deaths that year. Cardiovascular disease is currently reported to result in more deaths each year than the next four leading causes of death combined which are cancer, chronic lower respiratory diseases, accidents and diabetes mellitus (American Heart Association, 2006). Coronary heart disease, in particular, is known as the single largest killer of American males and females and is said to comprise more than half of all cardiovascular events in men and women under age 75 (American Heart Association, 2007). In 1998, for instance, cardiovascular disease was the primary cause of 949,619 deaths amounting to 41% of all deaths (American Heart Association, 2000). In 1998, also, there were approximately 459,841 deaths in the United States resulting from coronary heart disease (American Heart Association, 2006).

With an incidence of 1,200,000 new and recurrent coronary attacks per year, it is estimated that about 38% of the people who experience a coronary attack in a given year
will die from it (American Heart Association, 2007). Recent statistics for the United States for 2004 shows the mortality from coronary heart disease to be 452,327 (American Heart Association, 2007). This figure translates to one out of every five deaths and it was noted that even though the death rate from coronary heart disease from 1994 to 2004 declined 33%, the actual number of deaths declined only 18% (American Heart Association, 2007). It has been noted, furthermore, that the decline in death rates from coronary heart disease that had began during the 1960s slowed down during the 1990s (Cooper et al., 2000).

It is significant that coronary heart disease is still the leading cause of death and disability despite heightened public awareness, improvements in early detection, widespread use of innovative treatments and improved clinical care resulting in improved survival of patients, all of which may have contributed to the apparent declines (Cooper et al., 2000; Tyroler, 2000). The fact that the rate of decline in deaths from coronary heart disease has been observed to be slowing may be a reflection of the pattern of coronary heart disease risk factors reported during the 1990s (Cooper et al., 2000). This pattern, in particular, showed that minimal improvement, if any, had occurred in preventive behaviors such as adequate physical activity, cessation of smoking and the control of high blood pressure (Cooper et al., 2000). Tyroler (2000) also indicates that the overall decline in heart disease mortality tends to mask some important differences in rates of declines according to ethnicity, gender, socio-economic status and even geographical region.

**Economic Costs of Cardiovascular Disease**

The total national cost of illness for heart diseases in the year 2000 was estimated at 183 billion dollars by the National Institute of Health (USDHHS, 2002). Of this
amount spent in 2000 on cardiovascular disease, Medicare spending on heart disease treatment and services constituted $34.9 billion. This figure reflects a trend of increased costs because heart disease treatment and services had been estimated at $21.1 billion in 1992, $29.7 billion in 1996, and furthermore, was projected to increase to $42.8 billion in 2004. The estimates, moreover, reflected only Medicare program payments for direct (medical) costs and therefore did not include any indirect (morbidity and mortality related financial costs) nor did they reflect co-payments or deductible payments made by beneficiaries of the services (USDHHS, 2002).

Cardiovascular diseases stand as a leading cause of disability in working adults and in 2001, the cost of health care expenditures as well as lost productivity that was attributed to cardiovascular disease was estimated at $298 billion (NYSDH, 2006). For 2006, the estimated direct and indirect cost of cardiovascular disease was estimated at $403.1 billion (American Heart Association, 2006). The 2007 cost of cardiovascular diseases and stroke in the United States is estimated at $431.8 billion. This amount includes health expenditures (direct costs), such as the cost of physicians and other professionals, hospital and nursing home services, cost of medications, home health care and other medical durables as well as lost productivity resulting from morbidity and mortality (indirect costs) [American Heart Association, 2007]. In terms of coronary heart disease, the estimated direct and indirect cost for 2006 stood at $142.5 billion, an amount that was approximately 35 % of the overall 2006 estimated cardiovascular disease direct and indirect cost of $403.1 billion (American Heart Association, 2006). The estimated direct and indirect cost of coronary heart disease in the United States for 2007 of $151.6
billion (American Heart Association, 2007) also is about 35% of the overall 2007 estimated direct and indirect cost of $431.8 billion for cardiovascular diseases and stroke.

Coronary heart disease does not only comprise more than half of all cardiovascular events. It has a relatively greater economic impact as well. Estimates by the American Heart Association (2000) gave the projected costs of cardiovascular disease for the year 2001 as $298.2 billion compared to an amount of $98 billion for 'type 2' diabetes and it is noted even that a minimum of 65% of people with diabetes mellitus die of some form of heart disease or stroke (CDC, 1999). In 2001, also, program payments made to Medicare beneficiaries with a principal diagnosis of cardiovascular disease who were discharged either dead or alive from short-stay hospitals averaged $8,354 for a total of $29.3 billion. In contrast, the total of $11.1 billion paid to Medicare beneficiaries for coronary heart disease discharges in the same year, averaged $11,201 per discharge for acute myocardial infarction/heart attack and $11,308 per discharge for coronary atherosclerosis (American Heart Association, 2006).

Summary of Costs

There is evidence that the highest risk of death and disability is found among those who do no regular physical activity and that those who are physically inactive are almost twice as likely to develop coronary heart disease as those who engage in regular physical activity. The relative risk of coronary heart disease associated with physical inactivity is also comparable to that observed for high blood cholesterol, high blood pressure or cigarette smoking, which are all established coronary heart disease risk factors. Heart disease associated with physical inactivity also has a major economic impact.
Benefits of Physical Activity

Physical inactivity is a modifiable risk factor for a large number of chronic health conditions including cardiovascular disease (Franco et al., 2005). Research demonstrates that most individuals benefit from regular physical activity whether they are participating in vigorous exercise or a more moderate health enhancing type of physical activity (USDHHS, 2002). A study of Harvard College alumni, for example, showed that death rates declined with increased levels of physical activity (estimated in kcal), and declined also with increased intensity of effort as measured from none, to light, to moderately-vigorous or vigorous sports play. Study findings also showed that at any given quantity of physical exercise, death rates were lower for men playing moderately intense sports than for men categorized as less vigorous (Lee, Sesso, Oguma & Paffenberger, 2004).

Emergency room visits and overnight hospital stays also decreased as walking increased even though the average number of primary care visits did not decrease (Perkins & Clark, 2001). Perkins and Clark had looked at the association between health services cost and walking in a low economic and largely chronically ill urban sample. Physically active people were also found to have lower annual direct medical costs on average compared to inactive people (Pratt, Macera & Wang, 2000). Pratt et al, in addition, found that physically active people had fewer hospital stays and physician visits and used less medication than inactive people. The costs savings realized were consistent for men and women, for those with and without physical limitations, and also for smokers and non-smokers (Pratt et al, 2000).

Credit for the first formal epidemiological study linking physical activity to better health is given to researcher Jeremy Morris and his colleagues who, in 1953, compared
double-decker bus drivers in London to the bus conductors to test their notion that deaths from coronary heart disease might be less common among men engaged in physically active work than among those in sedentary jobs (Morris et al. as cited in Paffenbarger et al., 2001). According to Paffenbarger et al. (2001), the study was viewed with considerable skepticism both by medical scientists and practitioners ostensibly because conventional thinking at the time was that coronary heart disease resulted from hypertension, high blood cholesterol and obesity. Physical activity, or the lack of it, therefore, had nothing to do with the incidence of heart disease.

Despite the positive findings by Morris et al. (as cited in Paffenbarger et al., 2001), Paffenbarger et al. comment that much skepticism about the links between physical activity and health persisted among the medical community, and they continued to turn their interest to such factors as weight-for-height, hypertension, and lipoprotein profile, while ignoring physical activity. Morris, Kagan, et al. (as cited in Paffenbarger et al., 2001), regardless, pursued the matter further and conducted two more civil service surveys. In both of these studies, Morris, Kagan, et al. (as cited in Paffenbarger et al., 2001) were able to demonstrate strong negative associations between moderately vigorous or vigorous exercise and coronary heart disease occurrence, independent of other associations, in age classes 35–64 years. Recent studies examining the evidence for a dose-response with respect to physical activity and cardiovascular disease still find that amount of physical activity performed is inversely related to the risk of coronary heart disease (Hu et al., 2001; Kohl, 2001; Elley et al., 2003; Franco et al., 2005).

Studies consistently find cause-and-effect evidence that exercise protects against heart disease and averts premature mortality (Paffenbarger et al., 2001), and that avoiding
a sedentary lifestyle during the adult years prevents cardiovascular disease independently of other risk factors (Franco et al., 2005). Studies have been conducted in both sexes (Blair et al., 1996; Yusuf et al., 2004), in different ethnic groups, in broad age classes (Young et al., 1993; Yusuf et al., 2004), in a variety of social groups (Paffenbarger & Hale, 1975; Sesso, Paffenbarger, & Lee, 2000; Lee et al., 2004; Yusuf et al., 2004) and on most continents of the world (Yusuf et al., 2004), all with similar results. An extensive literature review on the role of physical activity in the development of chronic disease and premature death also confirms that regular physical activity is effective in both primary and secondary prevention of chronic diseases including cardiovascular disease (Warburton et al., 2006).

**Summary**

Increasing daily activity can have significant individual and public health benefit not only for coronary heart disease prevention but also for deaths from all causes and especially for those who are sedentary. The role of physical activity in preventing coronary heart disease, according to the USDHHS, is of particular importance, given that coronary heart disease is the leading cause of death and disability in the U.S..

Furthermore, in terms of the risk posed by several well-known coronary heart disease risk factors, physical inactivity is more prevalent (USDDH, 2000). Finally, the effects of promoting physical activity can be far-reaching in that individuals with other risk factors for coronary heart disease, in particular obesity, high blood pressure (USDHHS, 2000) and diabetes, also benefit from increases in physical activity in relation to those risk factors and thereby decrease their risk for coronary heart disease.
Physical Inactivity as a Risk Behavior

A study on 'primary prevention of coronary heart disease in women through diet and lifestyle' showed that about 82% of coronary heart disease was caused by high-risk lifestyles. Low risk behavior as defined included engagement in moderate-to-vigorous physical activity for at least half an hour per day (Stampfer, Hu, Manson, Rimm, & Willett as cited in Booth & Chakravarthy, 2002). The logical inference made was that engaging in low-risk lifestyles could prevent a large majority of the cases of coronary heart disease.

Using sexual precautionary or sexual risk behavior and perceptions of vulnerability to HIV as an example, individuals engaging in more risk behaviors were shown to be inclined to have higher estimates of likelihood of contracting HIV compared to those who were engaging in fewer risk behaviors (Gerrard, Gibbons, & Bushman, 1996). Gerrard et al. point out that in high-risk groups, however, perceptions of vulnerability to HIV infection were not sufficient in motivating adoption of precautionary behaviors. An explanation given for this is that high-risk groups, compared to low-risk groups, are less likely to base their risk estimates on their behavior especially if they do not fully acknowledge the relation between their behavior and their risk either through ignorance or through denial.

Studies have also revealed that when a disease is considered extremely threatening, or when precautionary methods are either perceived to be difficult to implement or sustain or else unavailable, the tendency is to ignore or distort the threat rather than make effort to change behavior (Beck & Frankel as cited in Gerrard et al., 1996; Rogers & Mewborn as cited in Gerrard et al., 1996). Thus, people in high-risk
groups are classified as such because they may have become convinced that they cannot change their behavior and it may appear that the segment of a population that over time shows no behavior change is composed of increasingly larger proportions of individuals who may think that they cannot implement precautions or who are unwilling to make an attempt (Gerrard et al., 1996).

The behavior of high-risk individuals suggests that the association between vulnerability and behavior is moderated by or linked to an additional variable such as self-efficacy or other variables (Aspinwall, Kemeny, Taylor, Schneider, & Dudley as cited in Gerrard et al., 1996; Blalock as cited in Gerrard et al., 1996). In their review of 26 cross-sectional studies, Gerrard et al. (1996) state that the possibility that such an association would remain undetected because the moderating variable or variables were not measured and entered into a model would mean that ‘perceived vulnerability is a necessary, but not a sufficient, prerequisite for precautionary behavior.’ (p.403)

It has been observed that 90% of patients diagnosed with coronary heart disease had at least one if not more of what is referred to as behaviorally based cardiovascular risk factors (Johnston, Johnston, Pollard, Kinmonth, & Mant, 2004). Examples of some of these risk factors were sedentary lifestyles, cigarette smoking or poor diet and Johnston et al. noted from the literature that such behaviors, though modifiable, are often difficult to change. Considering that behavior change was modest even in the case of patients who had willingly enrolled in psycho-educational programs as demonstrated through a meta-analysis by Dusseldorp, van Elderen, Maes, Meulman & Kraaij (as cited in Johnston et al., 2004) concluded that an increased knowledge of the determinants of
theses cardiovascular risk behaviors might help in the development of more effective interventions.

In order to make decisions about personal risks or importance of avoiding a health risk or hazard, individuals need to understand the risks they face (Weinstein, 1999). Weinstein (1999) maintains that to ascertain understanding of a health risk or in evaluating how effective a risk communication message has been, an examination of a constellation of beliefs that are relevant to decisions and behaviors can prove helpful. Based on the assumption that no one had tried to specify the minimum information needed by an individual to understand his or her own risk, Weinstein (1999) draws on the decision-making and health behavior literature to put forward a set of risk attributes he considers essential for informed personal decision-making.

The first piece of information needed according to Weinstein (1999) is information about the nature and likelihood of potential ill effects because people tend to be influenced by how serious they think it would be if a hazardous outcome occurred. Information about the risk factors that modify one’s susceptibility is also important because the chances that harm would occur if no preventive steps were taken is rarely the same for all individuals. An understanding of personal vulnerability therefore requires knowledge of the main factors used to estimate chances that harm would occur such as personal behaviors, family history and environmental exposures. Weinstein (1999) adds that an understanding of what the chances of harm are must also take into account a health behavioral concept that is sometimes referred to as controllability. This concept denotes reductions in the likelihood of harm that a particular health risk preventive behavior achieves. Weinstein (1999) also adds that the amount of difficulty associated
with carrying out preventive actions has been demonstrated to be a factor that is frequently underestimated during decision-making. Knowledge about either the ease or difficulty associated with performance of preventive actions is therefore essential to informed decision-making regarding personal risk.

In conclusion, Weinstein (1999) indicates that most studies of hazard perception or knowledge fail to examine even this limited range of risk attributes or dimensions discussed that are necessary for risk comprehension. These attributes namely, nature and severity of the potential harm or undesirable consequences of an activity, likelihood of potential ill effects or the probability of harm under various circumstances, possibility of reducing the harm in order to modify susceptibility, and ease or difficulty of avoiding the harmful consequences represent the kinds of information people may need to make appropriate risk decisions (Weinstein, 1999).

**The Expanded Parallel Process Model (EPPM) as a Model to Explain Risk Behavior**

The EPPM (Witte, 1992; 1999; Witte, Meyer & Martell, 2001) is one of many theoretical approaches explaining how variables work together to influence health behaviors. The theory posits that perceptions of threat and perceptions of efficacy combine to produce danger control or fear control processes that influence behavior. The EPPM is built on the work of Levanthal’s (1970) Parallel Process Model as a basis. Levanthal’s work suggested general states that distinguished between ‘fear control’ and ‘danger control’ processes as the two distinct processes that occur in response to health risk messages. There was, however, a failure to specify when one of the processes would dominate (Witte et al. 2001). The EPPM is also built on Rogers’ (1975, 1983) Protection Motivation Theory in the explanation of what leads to danger control.
The EPPM incorporates four dimensions of risk as underlying mechanisms to behavior change that are synonymous with those identified by Weinstein (1999). These dimensions referred to as the model’s health risk communication variables are ‘perceived severity, defined as the perceived seriousness of a threat in terms of magnitude of harm that might be experienced; perceived susceptibility, defined as perceived likelihood of experiencing a threat; perceived response efficacy, defined as beliefs about whether or not recommended responses work in averting a threat; and perceived self-efficacy, defined as beliefs about one’s ability to perform the recommended response’ (Witte, Girma & Girge, 2003. p.164-165).

The EPPM has been tested across a wide range of topics and populations yielding good empirical support (Witte et al., 2001) and with a variety of research methods that have included experiments, focus groups and surveys (Gore & Bracken, 2005). Topic areas have included skin cancer (Stephenson & Witte as cited in Gore & Bracken, 2005), breast cancer (Dassow, 2005), HIV/AIDS prevention (Witte & Morrison as cited in Witte et al., 2001; Witte, Cameron, Lapinski, & Nzyuko, 1998; Cameron, Witte, Lapinski, & Nzyuko, 1999; Witte et al., 2002-2003), teen pregnancy (Witte as cited in Gore & Bracken, 2005), tractor safety (Witte et al. as cited in Gore & Bracken, 2005), radon awareness (Witte, Berkowitz, Lillie, Cameron, Lapinski, & Liu, 1998), genital warts (Witte, Cameron, Mckeon & Berkowitz, 1996; Witte, Berkowitz, Cameron & Mckeon, 1998), and meningitis (Gore & Bracken, 2005). The EPPM, however, has so far not been used in studies in the area of physical activity.
Significance of the Study

This study addresses a gap in the literature regarding empirical support for the application of the EPPM to physical activity behavior. The findings of this study may contribute to efforts in the field of public health to gain a better understanding of physical activity behavior as it relates especially to risk for coronary heart disease. This could impact the way physical activity interventions are designed. The study findings could also spearhead further research on the EPPM variables as hypothesized mediators of physical activity behavior change. This, in turn, could hopefully yield more evidence-based and effective interventions that promote physical activity.

The fact that the EPPM as a risk behavior model has so far been tested across a wide range of topics and populations yielding good empirical support (Witte et al., 2001; Gore & Bracken, 2005) but to date, has not been used in studies in the area of physical activity is evidence of a gap in the literature in this area. The EPPM is a theoretical model of health risk behavior change that has potential in health intervention and health communication research to address the range of attributes that Weinstein (1999) identifies as contributing to a persons decision-making about risk. As a theoretical basis for intervention programs, the EPPM is appropriate for motivational campaigns rather than awareness or knowledge campaigns (Witte et al., 2002-2003) and may prove useful in motivating individuals to be more physically active. This is important considering the evidence of the high prevalence of inactivity and the fact that physical activity emerged in the US as one of the ten leading indicators in ‘Healthy People 2010’. ‘Healthy People 2010’ identifies the most significant preventable threats and also sets national goals to
reduce these threats with the aim of improving the health of all people in the US during the 21st Century (USDHHS, 2000).

Phillips (2002) observes that although examples of successful public health programs that encouraged healthier lifestyles and reduced the burden of disease exist, there is still a need to be more effective in putting theory into practice. Using a theory to guide intervention and evaluation cuts out guesswork so as to increase efficiency and allow isolation of the ‘how and why of an intervention’s success’ or lack thereof (Witte, 1999). It is only by understanding causes of intervention successes and failures, that systematic improvements can be applied to interventions in order to improve public health (Bauman, Sallis, Dzewaltowski, & Owen, 2002). According to Bauman et al., interventions work by means of mediating variables. This premise implies that the extent to which an intervention affects mediating variables will determine the extent to which the intervention will impact behavior. If so, research on the mechanisms by which physical activity interventions exert their effects, such as those involving the EPPM variables, could lead to a better use of theory and explanatory variables in designing interventions that effectively promote physical activity (Bauman et al., 2002).

**Research Questions**

Research questions guiding the study are as follows:

1. To what extent do working adults participate in health enhancing physical activity?

2. To what extent does the Expanded Parallel Process Model (EPPM) explain participation in health enhancing physical activity by working adults who elect to participate in the Health Plan Quality Improvement Program?
3. To what extent is the EPPM explanation of participation in health enhancing physical activity moderated by demographic and health status characteristics?

4. Does the EPPM perform differently with people who are at different levels of coronary artery disease risk as objectively defined by the American College of Sports Medicine (ACSM)?

Limitations

This dissertation study will be a retrospective analysis of a sample of participants in a larger intervention study on physical activity. The dataset uses an intact group, and initial participation in the larger study prior to randomization to the intervention group is voluntary. Continued participation is also voluntary. This may limit applicability to other working adult population settings and also create a self-selection bias. The source of data is self-report which is assumed to be accurate. Finally, the dissertation study has a cross-sectional observational design which, makes it unclear as to whether level of participation in health enhancing physical activity is contingent upon the perception variables being measured or vice versa.

Delimitations

The database is delimited to records of working adults between the ages of 18 and 69 in an urban area health care organization during the period 2006-2007. As employees of a Health Care Organization or by virtue of initial voluntary consent, the study data may reflect a sample that respectively has a different preventive health motivation or a higher level of readiness towards changes in lifestyle.
CHAPTER II: REVIEW OF THE LITERATURE

This chapter presents a review of the literature regarding the working adult population represented by the sample of data records being used in this dissertation study as well as a review of the theory being tested in the context of this sample population. It initially concentrates on a review of research on the health behavior patterns of adults working in healthcare environments. This is followed by a review of literature that pertains to promotion of healthy behaviors and reducing risk in connection with the proposed study variables of interest. These variables as discussed earlier are perceptions of severity, perceptions about susceptibility, response efficacy perceptions regarding ability of a specified behavior to reduce a particular risk and self-efficacy perceptions with regard to executing the specified behavior.

The Expanded Parallel process Model (EPPM) as a model of health behavior change is described in the next section - theoretical framework for the study. There will be an attempt to analyze why it can be suitable for and applicable to physical activity as a coronary heart disease risk reducing behavior. The focus then shifts to studies that have employed the EPPM as a useful theoretical framework.

Review of Literature on the Working Adult in the Healthcare Environment

Having a sample population that is delimited to working adults in an urban area healthcare organization brings up concerns that secondary data records examined in this dissertation study may reflect a population with a preventive health motivation that is very different from that of other working adult populations. Healthcare workers may be expected to have greater knowledge of risk factors for diseases (Wynd, Cihlar, Graor, Imani, & McDougal, 2007). Working in a healthcare environment may also motivate
healthier practices not only because of factors such as knowledge about health and illness, but also because of exposure to ill clients and a need to be an example of a health behavior that is relevant to patient education (Angard, Chez & Young as cited in Wynd et al., 2007). In a review of the literature, however, Wynd et al. note a study by Webb (as cited in Wynd et al., 2007) showing that there were no significant differences between health professionals and non-health professionals regarding knowledge about coronary disease risk factors, self-perception in terms of risk factors and the practice of health-promoting behaviors. They also note a study by Hope, Kelleher & O'Connor (as cited in Wynd et al., 2007) that seemed to indicate that nurses often lag behind lay people in the area of adopting healthy behaviors as a result of ‘high stress related to workplace relationships and job demands.’

Angard et al. (as cited in Wynd et al., 2007) questioned the ‘knowledge and commitment’ of healthcare employees towards health promotion in their study which found that 82% (49) of a sample of 60 female employees had ‘unhealthy practices and symptoms.’ A similar percentage (83%) of a sample of healthcare employees studied by Wynd et al. (2007) were interested in attending programs addressing health promoting behaviors such as lack of physical activity and weight control. When asked to identify a health habit of theirs that needed to be improved, 51% of this sample, in particular, specified a need to increase amount of exercise. This sample was made up of respondents completing questionnaires at three health fairs held in 2003, 2004, and 2005 and it was almost evenly split in terms of respondent designations as clinical employee (58%) or non-clinical in 2003; and direct-care provider (54% in 2004 and 53% in 2005) or other (Wynd et al.; 2007).
The situation appears to be no better when it comes to physicians as a specific group of healthcare workers who are expected to be good exercise role models. It has been demonstrated that physicians are less active than the general population (Rogers, Bailey & Guitin as cited in Rogers et al., 2006) and it has also been found that most resident physicians do not feel they engage in sufficient exercise (Rosen, Christie, Bellini & Asch as cited in Rogers et al., 2006). For example, only 33% of internal medicine resident physicians being evaluated as ‘role models for promoting exercise’ reported high self-efficacy in using ‘behavior modification techniques’ and even fewer (25%) perceived themselves as successful in their ability to engage in regular physical activity (Rogers et al., 2006). Rogers et al. found that the majority of those studied not only failed to meet current physical activity recommendations, but also, they exhibited below average cardiovascular fitness.

Though it can be argued that the poor exercise habits of physicians are due to the long and demanding work hours of the profession (Rogers et al., 2006), it may be that personal exercise related habits of physicians are for the most part established before they start medical school (Frank, Galuska, Elon, & Wright, 2004). Descriptive data from a survey of 1906 entering freshmen medical students during orientation compared favorably with national self-reported data for 20-29 year olds such as the percentage complying with exercise recommendations or the percentage that engaged in no leisure time physical activity. Frank et al. cite other literature to support their view that without intervention to support healthier practices, the personal health habits of medical students such as those related to exercise, may worsen through medical school and professional practice.
Review of Related Literature on Study Variables

An understanding of how the public thinks about risk is important for two reasons. First of all, risk assessments and risk communication are increasingly being performed by health professionals to emphasize primary and secondary prevention of coronary heart disease and secondly, perception of risk can affect risk-reducing behavior (Van der Pligt, 1998). It is more likely for individuals who perceive themselves to be at increased risk of coronary heart disease to adopt behaviors that reduce risk such as smoking cessation, adopting a low-fat diet, engaging in more exercise and taking medication as prescribed (British Heart Foundation, 2002). Risk perception has two judgment components which are the perceived severity of a coronary event and one’s perceived likelihood of experiencing such an event (susceptibility). Risks can be perceived as verbal categories such as “likely”, “probable”, “possible”; as absolute probabilities such as “I have a 10% chance of developing coronary heart disease” and/or can be perceived in comparison to other people (Edward, Elwyn, & Mulley, 2002).

Though perceptions of absolute risk have been shown to have moderate associations with the adoption of risk reducing behavior and willingness to consent to medical and surgical procedures, the perception of being at increased risk of coronary heart disease by itself is an unlikely motivation for people to adopt risk-reducing behaviors (Van der Pligt, 1998). A perception that one has control over coronary heart disease is also necessary (Van der Pligt, 1998) and this perception of control also has two judgment components referred to as response efficacy and self-efficacy (British Heart Foundation, 2002). Response efficacy is ‘the perception that a risk-reducing behavior will be effective in preventing coronary heart disease’ and self-efficacy is ‘feeling confident
in one’s ability to adopt the risk-reducing behavior’ (British Heart Foundation, 2002).

The determination of how much the public understands about a risk or the evaluation of the effectiveness of communication about risk perception and risk-reducing behaviors should then require an appropriate ‘measure of understanding’ (Weinstein, 1999) that lines up with the notion of risk communication as imparting information about risk, information on risk reduction and information that fosters confidence in the ability to change behavior (British Heart Foundation, 2002). Such information, when personalized, is more likely to influence behavior change than when presented as more general information about risk (McClure, 2002). An example of such personalized information is a calculation of an individual’s risk of future coronary heart disease from a chart based on personal information about risk factors such as age, smoking status and conditions like hypertension, high blood cholesterol and diabetes (Edwards et al., 2002).

Perceptions of Severity

The relationship between preventive health orientation and perceptions of the seriousness (severity) of heart disease has been demonstrated to be statistically significant. A study by Aho, conducted as far back as 1977, investigated relationships among attitudes, opinions and beliefs and behavior related to heart disease from an interesting perspective- that of the role wives could play in preventing heart disease in their spouses. Based on their responses regarding the role they could play, participants were classified into groups of low, medium and high levels of preventive health orientation. Fewer of the participants ranking low on preventive health orientation had ever suggested any health related behavior to their husbands though most of this group
perceived heart disease to be a serious condition that reduced a person’s chances of living a normal life (Aho, 1977).

Having a greater awareness of the health risks of physical inactivity improved the odds ratio of being sufficiently physically active for a health benefit by 40% (Martin, Morrow, Jackson, & Dunn, 2000). A telephone survey assessment of physical activity levels of 2002 households in the continental U.S. by Martin et al. (2000) investigated the relation between perceived importance of physical activity and demographic variables and current physical activity level. This was done with specific reference to the guidelines for the Centers for Disease Control and Prevention and American College of Sports Medicine guidelines for sufficient physical activity for a health benefit (Pate et al., 1995). Two variables, namely, perceived importance of physical inactivity as a health risk and gender emerged as having significant relationships with meeting the Centers for Disease Control and Prevention/American College of Sports Medicine physical activity guidelines (Martin et al., 2000).

Baseline perceived severity of the consequences of uncontrolled diabetes was shown to be positively related to a positive change in HbA1c concentration (an index of glycemic control) over an 18-month follow-up period (Daniel & Messer, 2002). This was demonstrated in a longitudinal study on perceptions about having diabetes and glycemic outcomes using a sample of Aboriginal Canadians from a population at high risk for diabetes and its complications. Even though baseline perceptions of the severity of diabetes predicted a reduced HbA1c at the time of the follow-up survey, the follow-up survey also indicated that high perceived severity of diabetes (as well as low perceived barriers to therapeutic behaviors to control diabetes) were related to both healthful
concentrations and reductions in HbA1c. The consistent relationship between perceived severity and glycemic control in this longitudinal study was an important finding because most of the earlier reports linking perceived severity and healthful HbA1c from cross-sectional studies had indicated that a high level of perceived severity was related to poor glycemic control. The study results supported a therapeutic emphasis placed by health professionals on severity of diabetes and its complications (alongside the belief that barriers to therapeutic behaviors could be surmounted) in order to influence the ability of individuals with diabetes to achieve control of blood glucose (Daniel & Messer, 2002).

Severity or seriousness of coronary heart disease is one of the predictor variables of coronary heart disease preventive behaviors (Ali, 2002). Together with susceptibility to coronary heart disease, knowledge of risk factors of coronary heart disease, and general health motivation, severity of coronary heart disease explained 76% of the variance of coronary heart disease behaviors (Ali, 2002). Perception of severity is also thought to account for some of the variation in 'heart-care seeking behavior' and treatment decisions between men and women (Nau, Ellis, Kline-Rogers, Mallya, Eagle, & Erickson, 2005). For example, it has been demonstrated that compared with men, women delay seeking medical care when they experience symptoms of acute coronary syndrome or other cardiac-related symptoms (Kudenchuck, Maynard, Martin, Wirkus, & Weaver, 1996). Women, however, also perceive their severity of cardiac-related illness to be no greater than men do, even when the clinical evidence suggests they have more severe disease in view of reported 'lower functional capacity, more symptoms, more comorbidity, and lower health status' (Nau et al., 2005). The issue of perception of severity accounting for some of the variation in care-seeking behavior and treatment decisions
between men and women is important because if women do not perceive that their cardiac disease is severe, they may not pursue medical evaluation, treatment, or rehabilitation (Nau et al., 2005).

**Perceptions of Susceptibility**

Susceptibility to coronary heart disease has some support in the literature as a predictor of coronary heart disease preventive behaviors (Aho, 1977; Ali, 2002). Aho (1977), for instance, cross-tabulated study participants’ preventive health orientation (a term used to describe how much of a role wives believe they can play in helping to prevent heart disease in their husbands) with the variable of perception of husband’s susceptibility to heart disease. Compared with medium-ranking and high-ranking participants, fewer of the participants who ranked low on the preventive health orientation continuum held the perception that their husbands were very susceptible to heart disease and this relationship between preventive health orientation and perception of husband’s susceptibility to heart disease was determined to be statistically significant (Aho, 1977).

As far as susceptibility to health problems are concerned, there is a tendency to down play risk and claim that one is at less risk compared to one’s peers (Weinstein, 1987; Van der Pligt, 1998). This tendency to be overly optimistic is referred to as optimistic bias and is not limited to any particular age, sex, educational or occupational group (Weinstein, 1987). Optimistic bias about susceptibility to harm is often observed to be present when individuals estimate future vulnerability based on past experience. The hazards that are likely to create unrealistic optimism are the ones associated with the belief or perception that a problem that has not yet appeared is unlikely to occur in the
future (Weinstein, 1987). Optimistic biases have been shown to increase with the perceived preventability of a hazard and decrease with perceived frequency of occurrence of the hazard and personal experience (Weinstein, 1987). Thus, even though believing one’s own risk to be less than that of others may reduce motivation to engage in health-protective behaviors on one hand, perception of personal risk on the other hand is also influenced by factors such as perceived preventability of a hazard and/or perceived frequency of its occurrence (Weinstein, 1987).

**Perceptions of Response Efficacy**

Response efficacy, defined as the degree to which a preventive behavior can avert the occurrence of a health risk (Witte, 1992), is associated with behavior. The belief that treatment for heart disease was effective, for example, was reported by fewer of the participants who ranked low on preventive health orientation in comparison with participants who were ranked as medium and high in a study on the relationship of wives’ preventive health orientation and beliefs about heart disease in husbands (Aho, 1977). This relationship between level of preventive health orientation in terms of wives’ roles in helping to prevent heart disease in husbands and perception about the effectiveness of treatment for heart disease was found to be statistically significant (Aho, 1977). An examination of changes in lifestyle six months after a myocardial infarction also indicated that a conception held by patients about myocardial infarction as something impossible to prevent negatively affected lifestyle changes (Petrie & Weinman, 1997). Patients who believed that an unhealthy lifestyle caused the myocardial infarction, however, had significantly more often improved their diet and the frequency of strenuous exercise (Petrie & Weinman, 1997).
Strength of beliefs in the health benefits of activity is positively associated with the likelihood of leisure-time physical activity in a dose-dependent fashion (Haase et al., 2004). A cross-sectional study on prevalence of inactivity, health beliefs, and knowledge of the risks of inactivity surveyed and labeled 19,298 university students from 23 countries as ‘inactive’, ‘low frequency activity’ and ‘recommended frequency activity’ based on their responses (Haase et al., 2004). It was found that the proportion of respondents reporting strong beliefs was significantly lowest among participants categorized as inactive and greatest in the group that was active at the recommended levels of physical activity that produce health benefits (Haase et al., 2004).

**Perceptions of Self-Efficacy**

A review of the literature reveals a substantial amount of research on the relationship between self-efficacy and behavior (Hovell, Sallis, Hofstetter, Spry, Faucher, & Caspersen, 1989; Conn, 1998; Grassi, Gonzalez, Tello, & He, 1999; Rimal, 2000; Walcott-McQuigg, 2000; Stutts, 2002). Knowledge-behavior correlations were greater among those with high self-efficacy versus those with low self-efficacy in a study that sought to determine whether diet self-efficacy mediated the relation between diet knowledge and behavior (Rimal, 2000). The study’s longitudinal data analysis furthermore demonstrated that knowledge-behavior correlations increased among those who increased their self-efficacy and decreased among those who decreased their self-efficacy (Rimal, 2000). Self-efficacy towards exercise and diet also positively correlated with cardiovascular risk reduction behavior such as diet control, exercise and weight management in low and middle-income African-American women (Walcott-McQuigg,
This is note-worthy given that cardiovascular disease is a leading cause of death in women and African-American women especially (Walcott-McQuigg, 2000).

Self-efficacy was one of the variables predictive of walking in the most sedentary subgroups of a sample of 2,053 respondents over-representing middle/upper middle class residents and under-representing minority residents in San Diego, California (Hovell et al., 1989). Hovell et al. had carried out an investigation of the correlates for walking for exercise derived from Social Learning Theory. Self-efficacy was also the only variable overall to significantly predict physical activity in adults in a study that had required inactive participants to identify barriers to physical activity and active participants to cite cues prompting their physically active lifestyle (Stutts, 2002). Though the primary reason for inactivity was lack of time and the most frequently cited cue to activity was dissatisfaction with weight or appearance, higher self-efficacy was linked to greater physical activity (Stutts, 2002).

Self-efficacy as a concept, along with perceived barriers to exercise as another concept, was a strong predictor of exercise in a predictive model of older adults’ exercise behavior that was driven by Social Cognitive Theory and tested across ‘rural, regional and city locales’ (Conn, 1998). Among adults, time constraints are said to be the most frequent barriers to exercise reported by both sedentary and active individuals (Dishman, Sallis & Oreinstein as cited by Sherwood, 2002; King, Taylor, Haskell & DeBusk as cited by Sherwood, 2002). Ducharme and Brawley (1995) note that even among regular exercisers, an important and significant predictor of adherence is self-efficacy for scheduling and regular exercisers do have to become adept at dealing with time as a barrier to maintaining exercise adherence. Such planning and overcoming of barriers are
obstacles to exercise participation that, along with the ability of individuals to incorporate regular exercise into their lifestyle, remains challenging despite the considerable amount of research directed towards understanding exercise participation patterns (Shrigley & Dawson, 2004).

Shrigley & Dawson (2004) described three measures of self-efficacy—namely, perceptions of ability to complete exercise components, perceptions of ability to organize, plan and schedule regular exercise sessions and perceptions of ability to overcome specific barriers in order to exercise regularly—regardless of actual exercise frequency. It was predicted that there would be a difference between three behavioral frequency groups in terms of these self-efficacy measures but the study data analysis indicated there were no significant differences in the measures of self-efficacy (Shrigley & Dawson, 2004). The three exercise frequency groups had involved regular attenders who attended three or more times per week for nine out of the program’s ten-weeks, sporadic attenders who differed from regular attenders in that they missed more than one full week of exercise classes and dropouts who attended 1-3 classes during the first two weeks of a program but did not continue to attend (Shrigley & Dawson, 2004).

Grassi et al. (1999) unexpectedly found that while perceived barriers to physical activity decreased over time, participation in physical activity did not increase over time. A cohort of 202 individuals aged 18 to 55 years from a geographically isolated and low socio-economic rural Latino community when surveyed at baseline, six months and one year perceived significantly fewer barriers to walking yet walked less as the program progressed reflecting a difference between attitude and behavior (Grassi, et al., 1999). It was concluded that important mechanisms could have been in operation during the first
six months of this program but this could not be determined due to the six-month gap between the study testing periods (Grassi, et al., 1999).

Summary

This review of the literature uncovers information that indicates that the current study variables of interest do play a role in influencing health risk reducing behaviors. In some instances, a joint effect of these variables on the health risk reducing behavior was observed (Aho, 1977; Ali, 2002). In other situations, these variables did not seem to independently explain study outcomes (Grassi, et al., 1999; Shrigley & Dawson, 2004) or differentiate between study outcomes (Stutts, 2002; Shrigley & Dawson, 2004). For example, if both sedentary and active individuals cite time constraints as a barrier and if both frequent and less frequent participants in an exercise/fitness class perceive themselves as highly efficacious with regard to planning/scheduling and barrier self-efficacy, it may be reasonable to conclude that though exercise self-efficacy is one of the strongest and consistent predictors of exercise behavior, some other factor or factors in addition serve as predictor variables. This conclusion reinforces the idea that there is no single factor that explains and predicts health behavior change and that one has to think, instead, in terms of process models with various constructs that are related to each other (Lippke & Schwarzer, 2002).

In place of one variable to predict health behavior, the EPPM guides us to use a combination of the four variables of perceptions of severity, susceptibility, response-efficacy and self-efficacy. It is possible that these variables, jointly, can distinguish between frequent and less frequent participants in an exercise/fitness class or explain
why among people facing barriers to exercise, some find a way around them to become or remain active while others just stay sedentary.

More research is needed to assess the effectiveness of risk communication, in all its possible formats, on the understanding of coronary heart disease and adopting risk-reducing behavior (British Heart Foundation, 2002). If the study variables of interest do work together, as the EPPM hypothesizes, then it would be worth the research effort to examine whether relationships among these perceptions variables can be useful in modeling behavior patterns as they apply to coronary heart disease risk and physical activity as a risk reducing behavior.

Theoretical Framework

*The Extended Parallel Process Model (EPPM)*

The EPPM (Witte, 1992, 1999; Witte et al., 2001) is a process model that considers what happens when an individual is faced with a health risk message that depicts components of threat (severity and susceptibility) and components of efficacy (response efficacy and self-efficacy). First, the perceived threat of the risk factor is appraised and if this appraisal of threat results in a moderate to high level of perceived threat, then fear is elicited triggering motivation to begin a second appraisal- that of evaluating the recommended response. These two appraisals bring about an interaction between threat and efficacy that could result in one of three outcomes: no response, or danger control response, or fear control response.

Danger control responses are considered to be primarily cognitive or thought processes that elicit protection motivation leading to message acceptance. This acceptance is reflected in adaptive actions or responses such as attitude, intention and
behavior changes that have the intent of controlling the danger. Fear control processes are primarily emotional processes leading people to respond to and cope with their fear but this time, a defensive motivation is elicited by heightened fear arousal from the interaction of threat and efficacy. The responses produced to control fear include defensive avoidance, reactance and denial. The EPPM asserts that if perceptions of threat (severity and susceptibility) and efficacy (response efficacy and self-efficacy) towards a health threat and recommended response can be determined, it can also be predicted which of the responses will be engaged in. In addition, determination of perceptions of threat and efficacy provide knowledge of which perceptions need to be increased, decreased, or maintained to promote desired danger control responses (Witte, 1992; 1999; Witte et al., 2001).

The EPPM, as briefly mentioned in chapter one, is built on the work of Leventhal’s (1970) Parallel Process Model as the basis and also on Rogers’ (1975, 1983) Protection Motivation Theory in the explanation of what leads to danger control. Leventhal’s work suggested general states that distinguished between ‘fear control’ and ‘danger control’ processes as the two distinct processes that occur in response to health risk messages. There was, however, a failure to specify when one of the processes would dominate (Witte et al. 2001). Rogers’ (1975) theory stated that most health risk messages had message components that could be described as the probability of a threat occurring, the magnitude of harm or noxiousness if the threat did occur and the effectiveness of a recommended response to avert the threat. These components led to corresponding perceptions (Witte et al. 2001).
Rogers (1983) revised his theory and included a new variable—self-efficacy, which worked with response-efficacy to influence outcomes. Despite the ability to identify components of the health risk message and explain the cognitive ‘danger control’ side of Levanthal’s model (1970), Rogers’ theory (1975, 1983) could not account for the when and why of people rejecting the health risk message recommendations (Witte et al. 2001). The EPPM was therefore developed in an attempt to explain in an integrated manner, when and why health risk messages work, in addition to when and why they fail to motivate behavior change. As such, it helped to both expand and differentiate between ‘danger control’ and ‘fear control’ processes of Levanthal’s model (1970), and also furthered the Protection Motivation Theory (Rogers, 1975, 1983) by expanding on it (Witte et al. 2001).

The EPPM, as shown in Figure 1, addresses beliefs and motivations for behavior using the concept of risk appraisal that involves the constructs of threat perceptions (severity and susceptibility), and efficacy perceptions (response efficacy and self-efficacy). The model posits that people’s cognitions or thoughts about threat and efficacy cause attitude, intention, or behavior-change as an adaptive response if danger-control processes are manifested. Maladaptive responses such as defensive avoidance, perceived manipulation and reactance are due to fear-control processes and they interfere with adaptive responses. This can occur at a critical point in message processing when perceived threat exceeds perceived efficacy. The EPPM argues further that high fear, caused first by high level of perceived threat and then intensified by low perceived efficacy later, elicits defensive motivation, which in turn induces these maladaptive outcomes (Witte, 1992, 1999; Witte et al., 2001).
## Figure 1

The Expanded Parallel Process Model

<table>
<thead>
<tr>
<th>External Stimuli</th>
<th>Existing Perceptions [Message Processing (1\textsuperscript{st} &amp; 2\textsuperscript{nd} Appraisals)]</th>
<th>Outcomes</th>
<th>Process</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>MESSAGE COMPONENTS</td>
<td>PERCEIVED EFFICACY (Self-Efficacy, Response Efficacy)</td>
<td>Protection Motivation</td>
<td>Danger Control Process</td>
<td>HEPA</td>
</tr>
<tr>
<td></td>
<td>PERCEIVED THREAT (Susceptibility Severity)</td>
<td>FEAR</td>
<td>Fear Control Process</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Feedback loop</td>
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<td>Defensive Motivation</td>
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<td></td>
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<td>Message Acceptance</td>
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<td></td>
<td></td>
<td>Message Rejection</td>
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<td></td>
<td></td>
<td>No Threat Perceived (No response)</td>
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<tr>
<td></td>
<td></td>
<td>Individual Differences</td>
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</tbody>
</table>

Adapted from Witte, Meyer & Martell, 2001
Table 2.1 shows the EPPM hypothesized relationships of threat perceptions (severity and susceptibility) and efficacy perceptions (response efficacy and self-efficacy). The table also includes recommended health communication message strategies that can be used to promote 'danger-control' actions.

**Table 2.1**  
**Chart of the Extended Parallel Process Model’s Variables, Expected Responses, and Message Strategies.**

<table>
<thead>
<tr>
<th>PERCEPTIONS</th>
<th><strong>High Efficacy</strong></th>
<th><strong>Low Efficacy</strong></th>
</tr>
</thead>
</table>
| **High Threat**  
Beliefs that one is at-risk for a significantly harmful threat | Beliefs that one is able to avert a threat and that recommended response work in averting a threat | Beliefs that one cannot avert a threat, and even if s/he could, it wouldn’t work anyway. |
| **Response:** Danger Control (take protective action)  
**Message Strategy:** Emphasize severity and susceptibility to the threat; reinforce response and self-efficacy beliefs. | **Response:** Fear Control (in denial, defensive avoidance, reactance)  
**Message Strategy:** Emphasize response and self-efficacy only (already motivated to act given high threat perceptions). |
| **Low Threat**  
Beliefs that a threat is irrelevant and/or trivial | **Response:** Lesser Amount of Danger Control (some protective action taken but little motivation to act)  
**Message Strategy:** Emphasize severity and susceptibility to the threat to motivate action; reinforce response and self-efficacy beliefs. | **Response:** No response (no threat perceived; no motivation to act)  
**Message Strategy:** Emphasize response and self-efficacy first, then emphasize severity and susceptibility to the threat to motivate action. |

Witte, Girma & Girgre, 2002-2003

The EPPM is considered a suitable theoretical framework in the context of this proposed study because it addresses the key variables of interest in this study. The study variables deal with appraisal of the severity of a hazardous outcome if it occurred, factors that modify one’s susceptibility, response efficacy or reductions in the likelihood of harm.
that a particular health risk preventive behavior such as health enhancing physical activity achieves, and self-efficacy or factors affecting ease or difficulty in ability to carry out this health risk preventive behavior. According to the EPPM, these are the underlying mechanisms or mediators influencing a health behavior of interest.

The EPPM has the potential to embrace a wide range of indicators or factors identified in the literature as applicable to evidence-based promotion of physical activity. With respect to knowledge as an indicator, Witte (1992) referring to Lazarus, states that knowledge and appraisal are both forms of cognition. Knowledge is defined as consisting of attributions and a person’s beliefs about the way the world works not only in general but also in a specific context while appraisal is an individual’s evaluation of what is happening in terms of personal significance (Lazarus as cited in Witte, 1992). Knowledge and beliefs, therefore, are taken into account by the model in terms of a person’s appraisal of threat and efficacy.

Barriers to performing a health behavior, as an indicator, is looked at as a separate construct variable in some studies (Conn, 1998; Grassi, et al., 1999; Daniel & Messer, 2002; Stutts, 2002) and as part of an all-encompassing self-efficacy variable (Shrigley & Dawson, 2004) in other studies. Perceived barriers to health behavior change constitute a concept believed to influence motivation in cardiovascular risk reduction. These perceived barriers have been described as perceptions or beliefs about the relative cost of taking health action. Specifically, perceived barriers have been conceptualized as the ways that action might be expensive, unpleasant, difficult, inconvenient, or time-consuming (Cummings, Becker, & Maile, 1980). Individual perception of barriers has been associated with cardiovascular health behaviors, including participation in regular
physical activity (Slenker, Price, Roberts, & Jurs, 1984) and attitudes toward exercise (Bonheur & Young, 1991). The indicator of barriers to participation in a health behavior is addressed in the EPPM by the construct of efficacy and in particular, self-efficacy towards participation in a health behavior (Witte et al., 2001).

Efficacy is an overall concept looked at by the EPPM in terms of the response-effectiveness of the recommended behavior and self-effectiveness towards the recommended behavior. Regardless of whether an efficacy construct is explicitly addressed, every risk communication message does have an inherent level of efficacy, which as an EPPM determinant of behavior, may inadvertently influence outcomes (Witte 1992). This makes it necessary to pay attention to the construct of efficacy because if no information regarding the efficacy of the recommended response is given in a message, the tendency is for individuals to rely on past experiences and prior beliefs to determine perceived efficacy (Witte et al., 2001).

Self-effectiveness is synonymous with the self-efficacy dimension of the EPPM construct of efficacy (Witte et al., 2001). Witte et al. (2001) acknowledge that some disagreement exists as to whether barriers constitute the ‘flip-side’ of efficacy, thereby being inclusive in the overall concept of self-efficacy, or whether they are completely separate variables as the Health Belief Model, for instance, suggests. In the judgment of Witte et al., self-efficacy is inclusive of barriers and they maintain that because self-efficacy in the EPPM is broadly defined as one’s perceived ability to perform a given action, then anything affecting this ability is part of the overall concept of self-efficacy. Since barriers are typically considered to be all factors interfering with performance of a certain action (be it psychological, interpersonal such as lack of social support or
structural and so forth), then barriers can be seen as potentially influencing perceived ability to perform an action. By definition therefore, if people have ‘high’ perceived barriers, then they have low perceived self-efficacy and vice-versa and it is this perspective that rationalizes barriers to behavior changes as an integral part of the EPPM overall concept of self-efficacy (Witte et al., 2001).

In terms of demographic variables, individual differences, according to the EPPM, influence the appraisal of threat (severity and susceptibility) and efficacy (response efficacy and self-efficacy) processes and each person evaluates the components of a message in relation to his or her prior experience, culture and personality characteristics. No matter how these variables interact or combine their influences, they induce perceptions of threat and efficacy which then work together to produce danger-control, fear-control or no response message processing. Because individual differences do not appear to influence outcomes directly but rather indirectly by mediating perceptions of threat and efficacy, it is possible for the same fear appeal message to produce different perceptions that influence subsequent outcomes in different people (Witte, 1992; Witte et al., 2001).

The EPPM incorporates an additional theoretical approach dealing with language expectancy theory. Witte (1992) cites Burgeon and Miller as having outlined research that showed that strong fear appeals when used by low credibility speakers may inhibit persuasiveness and cause audience expectations to be negatively violated. In contrast, the review of research by Burgeon and Miller (as cited by Witte, 1992) noted that strong fear appeals when given by high credibility speakers turned out to be successful in that the speakers did not negatively violate expectations because they were allowed greater
latitude in their language choices. These review findings tie in with findings from a study by Yankelovich (2005) on the issue of how companies should respond to consumers’ expectations regarding preventative healthcare and wellness and how to effectively reach out with messages, products, and services that help consumers improve overall health. Based on the study data, consumers reportedly indicated that in addition to having access to professionals in healthcare and resources to assist in the implementation of specific strategies to improve overall well being, they needed information that was personally relevant and delivered consistently from credible sources (Yankelovich, 2005).

**Summary**

The EPPM, according to Witte et al. (2001), is an integration of earlier perspectives of fear appeal theorizing and represents current theorizing on how health risk messages are processed. The knowledge that threat (severity and susceptibility) and efficacy (response efficacy and self-efficacy) are causal variables in a study outcome did not in itself explain why they were causal variables, making it necessary for their theoretical functions, according to Witte (1992), to be made explicit. The EPPM as a theory therefore was developed as an explanation of when and why persuasive messages may succeed or not. Andranovich and Riposa (1993) state that theory, by means of the scientific method helps to turn data into information that can be useful. When applied to a set of events that occur, theory makes it possible to look for a common pattern among the events, provide for generalization with regard to relationships between concepts and between variables while allowing for repeated investigation of the same phenomenon (Andranovich & Riposa, 1993). The next question then is what kinds of useful
information have emerged from the application of the EPPM in the repeated investigation of the same phenomenon - that of threat and efficacy?

Research / Empirical Evidence supporting the EPPM

The EPPM as reported by Witte et al. (2001) has been tested with a variety of research methods. These methods include experiments, surveys, focus groups, (Witte et al., 2001; Gore & Bracken, 2005) and content analyses (Witte et al., 2001). Topic areas of EPPM studies, as mentioned in chapter one, have included skin cancer (Stephenson & Witte as cited in Gore & Bracken, 2005), breast cancer (Dassow, 2005), HIV/AIDS prevention (Witte, 1992, 1994; Witte & Morrison as cited in Witte et al., 2001; Witte, Cameron et al., 1998; Witte et al., 2002-2003), teen pregnancy (Witte as cited in Gore & Bracken, 2005), tractor safety (Witte et al. as cited in Gore & Bracken, 2005), radon awareness (Witte, Berkowitz, Lillie et al., 1998), genital warts (Witte, Cameron, McKeon, & Berkowitz, 1996; Witte, Berkowitz, Cameron & McKeon, 1998), and meningitis (Gore & Bracken, 2005).

The populations focused on also have included juvenile delinquents, high school and college students, Kenyan prostitutes, farmers, gun owners, African-American homeowners and the general public (Witte et al., 2001; Gore & Bracken, 2005). Despite this broad and diverse terrain of research interest in terms of topics and populations, Witte et al. (2001) indicate that relatively consistent results indicating good empirical support have emerged though some exceptions to the general patterns have also occurred. Witte et al. conclude therefore, that much more research is required before it can be categorically stated that the EPPM is an accurate health risk message model.
Examples of earlier EPPM studies include a study on existing perceptions, knowledge and use of preventive measures in individuals with the highest HIV infection rates that found high levels of threat coupled with low levels of efficacy among commercial sex workers, truck drivers and other young men living and working at truck stops along a ‘Trans-Africa highway’ in Kenya (Cameron et al., 1999). African-Americans at an increased risk of harmful effects from radon gas were also more often found to view the threat posed by radon gas as serious while perceiving recommended responses for averting the harm from the gas as inadequate (Witte, Berkowitz, Lillie et al., 1998). A concurrent evaluation of a radon reduction campaign in this population demonstrated that while the campaign materials did promote threat perceptions, efficacy perceptions in terms of recommended responses had not been promoted (Witte Berkowitz, Lillie et al., 1998). Five hypotheses from an EPPM guided field study predicting the conditions under which a campaign to prevent the spread of genital warts would be successful or not were also tested and supported by results (Witte, Berkowitz, Cameron & McKeon, 1998).

In terms of more recent studies, a study on HIV/AIDS preventive behaviors found the ‘best fitting model’ of significant variables that discriminated between condom users and non-users to be perceived susceptibility, perceived response efficacy and perceived self-efficacy (Witte et al., 2002-2003). Perceived self-efficacy turned out to be the strongest predictor of group membership. Perceived severity did not appear to influence condom use since almost all respondents thought HIV/AIDS was serious. Because all the other variables typically used to explain condom use such as demographics, knowledge, awareness, cultural norms, barriers, prior experience and so forth ‘dropped out of the
equation’ (in terms of significantly predicting which condom-related behavior group the study participants would fall into) when the risk communication variables of susceptibility, severity, response efficacy and self-efficacy were inserted, the data generated by the study overall was considered to be consistent with the EPPM theory (Witte et al., 2002-2003). The researchers concluded that the EPPM risk communication variables appeared to explain the gap between knowledge/attitude and behavior in Ethiopian urban youth and suggested that these variables should be critical targets in HIV/AIDS prevention communication in that target population (Witte et al., 2002-2003).

A pattern of results consistent with the main predictions of the EPPM was also found in a study that examined fear control and danger control responses using extreme parameters of threat and efficacy conditions in college students as a high risk target group for contracting meningitis (Gore & Bracken, 2005). The intervention consisted of either a high threatening message that had no recommendation as to how to avoid the disease or minimize the dangers of exposure or, a ‘high efficacy’ message containing relatively very little threat about the dangers of exposure. Pretest and posttest scores were used to ascertain if the respondents’ discriminating values had changed and also to assess attitude change towards vaccination (the recommended response) as a measure of effectiveness and validity of the model (Gore & Bracken, 2005).

The fact that fear control and danger control responses could be predicted in situations polarizing threat and efficacy perceptions, in the estimation of the researchers, gave further credence to a relatively new theory (Gore & Bracken, 2005). The study results showed for example, that in terms of mean scores, respondents with negative discriminating values on a pretest questionnaire (indicating fear control responses
regarding vaccination) scored positive discriminating values on posttest (reflecting danger control responses) after they had received a high-efficacy/no-threat health risk message. A high-threat/no-efficacy health risk message shifted respondents with pretest fear control responses into further fear control with respect to vaccination. This high-threat/no-efficacy message also moved participants with pretest danger control responses toward fear control responses where vaccination was concerned as reflected by a shift in the pretest mean of 6.10 to a posttest negative value mean of -7.13. For respondents who held danger control responses (mean pretest scores of 6.59), the high-efficacy/no-threat message almost had no effect on attitude toward vaccination as measured by mean posttest scores of 6.47, which, was a positive discriminating value (Gore & Bracken, 2005).

A third study found that the EPPM may improve the efficiency of preventive medicine counseling through use of the Risk Behavior Diagnosis Scale (RBDS) [Dassow, 2005]. The study was prompted by the fact that numerous scales developed for ascertainment of patient’s beliefs about disease screening that had been rigorously tested for reliability and validity also had the tendency to be disease specific. This resulted in a difficult and almost impossible situation of comparing similar beliefs across different disease-states and hampered the ability to prioritize preventive health counseling especially since healthcare providers are pressed for time and resources. Dassow (2005) measured women’s beliefs about disease screening with the RBDS developed by Witte et al. (1996) with the EPPM as its basis across three disease states to gain an understanding of the differences in beliefs to do with colon cancer screening, breast cancer screening,
and osteoporosis screening and identify beliefs that were most highly associated with up-to-date screening behaviors.

Up-to date screening participation was the dependent variable and the four beliefs about disease severity, disease susceptibility, self-efficacy and response efficacy measured by the Risk Behavior Diagnosis Scale were the independent variables. In the case of colon cancer screening, bivariate analysis revealed significant associations with all four of the measured beliefs. When these four beliefs were included in a model though, the threat beliefs of disease severity and disease susceptibility emerged as independently driving behavior. The data for breast cancer screening also showed beliefs about threat and response efficacy that were quite high and this was attributed in part to the two decades of prominent media campaigns and health provider education on the topic. However, taking all four beliefs into consideration in the model, belief in self-efficacy was the only predictor variable of past breast cancer screening behavior. In the case of osteoporosis, self-efficacy was most predictive of participation in screening though there were misconceptions on the part of respondents about the role of bone density screening in leading to treatments to prevent osteoporosis. It was concluded that providers should ensure when counseling women about preventive care that these beliefs are addressed and that attention is paid to possible misconceptions about the ability of screening tests to prevent disease (Dassow, 2005).

Summary

This review of the literature on the theoretical model, while uncovering nothing substantial on the EPPM and physical activity, suggests that in terms of theoretical constructs, relationships and propositions, the model has the potential of being tested
empirically in this area. Development and application of multi-strategies, according to Mummery (2003), strengthens the capacity of health professionals in their promotion of physical activity and that of individuals in their efforts to become more active. The EPPM is an appropriate model to generate evidenced-based data on the threat of physical inactivity and efficacy of physical activity as it applies to coronary heart disease. Understanding the relationships between threat and efficacy responses in sedentary and active adults may help health professionals tailor their health behavior messages to be more effective.
Chapter III: METHODOLOGY

Overview

The main objective of this dissertation study is to test the ability of the Expanded Parallel Process Model (EPPM) to predict participation in health enhancing physical activity (HEPA) among working adults age 18-69. The dissertation study involves secondary data analysis of data collected during an on-going Health Plan Quality Improvement study aimed at encouraging healthy lifestyles. The secondary data are obtained from working adults who elected to participate in this Quality Improvement program and were collected during the pretest phase of the study’s intervention arm. The outcome measure for this dissertation study is health enhancing physical activity (HEPA) that meets at least the moderate intensity public health recommendations for a health benefit. The main independent variables are the constructs of the EPPM and include perceptions of severity of and susceptibility to a heart attack, and response efficacy of HEPA in reducing risk for a heart attack and self-efficacy for engaging in HEPA.

An examination of the associations that exist among ‘theoretically derived variables’ and a behavior of interest to see if they help in understanding and predicting the behavior is one of two ways of testing a theory. The other way to approach theory testing deals with evaluation of interventions to assess whether they modified the mechanisms or influences believed to result in behavior change (Bauman et al., 2002). This dissertation study will use the former approach in order to assess the potential of the EPPM as a model that aids in understanding and predicting HEPA. The assessment also forms a basis for determining if the EPPM merits further assessment in the future as a mediating variable model framework using the latter approach.
Research Questions and Hypotheses for Testing

These are the study research questions and associated hypotheses:

1. To what extent do working adults participate in health enhancing physical activity (HEPA)?

2. To what extent does the Expanded Parallel Process Model (EPPM) explain participation in HEPA by working adults who elect to participate in the Health Plan Quality Improvement Program?

Bivariate Hypotheses:

a) Those with higher response efficacy perceptions will be significantly more likely to engage in HEPA.

b) Those with higher self-efficacy perceptions will be significantly more likely to engage in HEPA.

c) Those with higher severity perceptions will be significantly more likely to engage in HEPA.

d) Those with higher susceptibility perceptions will be significantly more likely to engage in HEPA.

e) There will be an overall effect of efficacy (response efficacy and self-efficacy perceptions) on HEPA.

f) There will be an overall effect of threat (severity and susceptibility perceptions) on HEPA.

g) There will be a positive correlation between HEPA and overall ‘Discriminating Value Formula’ (Σ efficacy - Σ threat) scores on the RBDS.
h) Those in danger control as objectively defined and measured by the RBDS 'Discriminating Value Formula' (\(\sum\) efficacy - \(\sum\) threat) score will be significantly more likely to have sufficient levels of HEPA compared to those with 'no perceived or irrelevant threat' or those in fear control.

*Multivariate Hypotheses:*

i) The EPPM variables considered together in the same model will be better predictors of HEPA than when considered and tested as individual predictors.

j) The EPPM will explain a substantial amount of variance in HEPA greater than or equal to a standard of a coefficient of determination of .3 as documented in the physical activity literature.

k) The odds of sufficient HEPA as objectively measured by the IPAQ can be reliably predicted from knowledge of perceptions of severity, susceptibility, response efficacy self-efficacy and the interaction effects of response efficacy and self-efficacy, and severity and susceptibility.

3. To what extent is the EPPM explanation of participation in health enhancing physical activity moderated by demographic and health status variables?

*Bivariate Hypotheses:*

a) Level of risk for coronary heart disease will be significantly associated with HEPA with high and low levels of risk being significantly associated with lower levels of HEPA compared to medium levels of risk.

b) Younger adults will be significantly more likely to have higher levels of HEPA compared to older adults.
c) Males will be significantly more likely to have sufficient HEPA levels compared to females.

d) Zip code-to-city areas of residence with higher levels of mean ‘average household income’ as defined by zip code as proxy for average household income will be significantly more likely to have sufficient HEPA levels.

e) Those who report smoking will have significantly lower levels of HEPA compared to self-reported non-smokers.

f) Those with a family history of coronary heart disease will have significantly higher levels of HEPA compared to those without a family history.

g) There will be a negative association between Body Mass Index (BMI) and HEPA.

h) Those who report diabetes will have significantly lower levels of HEPA compared to those who do not.

i) There will be a significant association between having hypertension and HEPA.

j) Those who report high blood cholesterol will have significantly lower levels of HEPA compared to those who do not.

k) Those who report asthma will be significantly less likely to have sufficient levels of HEPA compared to those who do not.

l) General satisfaction with life will be positively associated with HEPA.

m) Evaluation of personal health will be positively associated with HEPA.

Multivariate Hypotheses:

n) When considered in one model the EPPM variables will be most influential as
predictor variables and the demographic and health status variables will not contribute significantly to the prediction of HEPA.

4. Does the EPPM perform differently with people who are at different levels of coronary artery disease risk as objectively defined by the American College of Sports Medicine (ACSM)?

*Multivariate Hypotheses:*

a) The prediction of HEPA by the EPPM variables will be similar for people who are at different levels of coronary artery disease risk as objectively defined by the ACSM.

**Research Design**

This dissertation study employs a cross-sectional design that utilizes a subset of secondary data collected during a Health Plan Quality Improvement study that was seeking to evaluate an intervention to increase HEPA. The study evaluating the intervention to increase HEPA was contained within a larger control group study aimed at encouraging healthy lifestyles. The larger control group study was described as a Quality Improvement research project developed to find out if coaching by phone can control medical costs, improve health behaviors and help keep healthy employees healthy (See Appendix 1a. for details of this intervention).

With the cross-sectional nature of this dissertation study design, causality cannot be directly inferred. However, though the correlates of physical activity are not viewed as causal factors, research involving these physical activity correlates as indicated by Bauman et al. (2002) can be used in examining the utility of behavioral theories as applied to physical activity. The cross-sectional assessment data will thus permit a
limited test of the predictive ability of the EPPM in modeling the extent to which the four constructs of perceived severity, perceived susceptibility, perceived response efficacy and perceived self-efficacy relate to participation in health enhancing physical activity (HEPA). It will also allow an examination of the extent to which socio-demographic and health status factors mediate the effect of the EPPM constructs on HEPA.

**Research Methods used by the Health Care Organization to collect Data**

Study participants first enter the study by completing a Health Risk Assessment as part of their consent to participate in the aforementioned Quality Improvement study sponsored by the health plan (See Appendix 1b.). A health appraisal summary report based on analysis of the Health Risk Assessment is then generated for each participant (See Appendix 1c. for report sample). The study participants next complete an assessment of their engagement in HEPA and their beliefs about physical activity and heart attacks by either a telephone interview administered questionnaire or by a mailed-out self-administered questionnaire. Responses are entered into a database and stripped of direct identifiers to create a dataset with an accompanying dataset use agreement (See Appendix 6b.).

Measures employed by the questionnaire include ones of physical activity (the dependent variable), and the Risk Behavior Diagnosis Scale (RBDS) measures of perceptions of severity, susceptibility, response efficacy and self-efficacy (the EPPM constructs). Measures of the American College of Sports Medicine (ACSM) coronary heart disease risk stratification tool variables are also inclusive in the questionnaire. The dissertation study Researcher was not involved in implementing or in supervising the data collection process, however, she had input into the questionnaire’s design as a working
member (intern in non-pay status) of the Health Plan's Quality Improvement Research Steering Committee. In this capacity, the dissertation study Researcher was responsible for researching the literature and deriving the questionnaire with well-tested component measures based on the constructs the health plan organization wanted to examine.

**Description of the Population, Setting and Sampling Strategy**

*Description of the Population*

The total population of eligible participants consisted of 10,203 employees holding current health insurance through the organization's health plan. Out of this number, 8290 with valid postal mail addresses on file with the Health Plan were presumed to be the contactable population of eligible participants. For the purposes of this dissertation study, therefore, the total population of eligible participants is 8290. A description of the setting in which this Health Plan Quality Improvement Program was conducted is provided in Appendix 4.

*Eligibility to Participate in the Health Plan Quality Improvement Study*

This group of contactable employees was invited to participate in a larger Quality Improvement study sponsored by the health plan (see Appendix 1a.). In order to be eligible to participate in the study, the individuals had to be able to speak, read and write in English, not be pregnant, currently hold health insurance through the organization's health plan, and agree to work by telephone with a health coach at least once monthly for one year. Participants were required to obtain medical clearance from their primary healthcare provider. Additionally, participants had to consent to be in the study and return a signed informed consent form.
The data for this dissertation study comes from those participants who met the criteria and were subsequently randomized into the intervention arm of the health plan larger study. The Health Plan Quality Improvement control group study design was to have participants randomly assigned to both the intervention and control group complete the Health Risk Assessment as part of the pre and post test measures. The Health Risk Assessment was thus completed by those who ended up being randomized into the control group as part of their consent to participate as well. There was, however, no contact occurring between the health coaches administering the intervention and participants once they were randomly placed in the control group. In effect, only those randomized into the intervention group had the opportunity to complete the survey with questions regarding the EPPM and HEPA.

**Sampling Strategy/Recruitment**

Participants in the Quality Improvement Program study were recruited from a U.S. Mid-Atlantic State medium-sized healthcare organization employee health improvement program. Personal letters of invitation were sent out by United States Postal Service mail inviting them to join the Quality Improvement Program. This letter outlined basic requirements for participation which included reading a consent form and signing it once any questions they had were answered. An enclosed Health Risk Assessment was to be filled out as well with instructions to return both forms in an enclosed postage paid envelope within two weeks. The ‘Quality Improvement study participant’ recruiters included an additional two week cut off period before closing the study to participants and beginning the process of randomization to either the intervention or control group.
The method of participant recruitment by the Health Plan Organization took into consideration the need for a variety of sample characteristics for this study. Lewis, Marcus, Pate, and Dunn (2002), for instance, maintain that the influence of mediators across different groups of individuals may vary and should therefore be examined. The examination of the importance of mediators across gender, different age groups and ethnically diverse populations are given as examples (Lewis et al., 2002). A broad age range of eligible participants within the employee population, the location of the study site in an urban location, and the idea of healthcare as a desirable career field for both genders were factors taken into consideration in relation to ideal sample characteristics for this study.

Obtaining a sample spanning a broad age range for example, may help to control for the influence of age on behavior as a possible confounder during data analyses. As mentioned earlier in the introduction, physical activity levels, in general, are reported to be the highest in young adults aged 18-24 years of age and have a tendency to decrease steadily with age through adulthood (Stang, 2002). Other survey reports suggest that late adolescence and early adult life marks a critical transition from adequate physical activity to inactivity or activity insufficient for a health benefit (Haase et al., 2004). Meanwhile, middle-aged individuals with sedentary occupations also constitute an important group in terms of coronary heart disease risk (Rennie et al., 2003). A sample so selected is likely to be representative of a target population at risk for coronary heart disease either due to inadequate physical inactivity or a transition into inactivity by virtue of age and sedentary occupation.
Sampling Strategy/ Sample Size and Power

The larger Quality Improvement study from which data were extracted sought to recruit 1000 participants into the intervention arm of the program to accommodate issues such as program attrition, skewed distributions and the objective of comparing program participants with non participants. However, for the purposes of this dissertation study, a minimum number of participants required for valid statistical analyses had to be determined. This sample size estimation was carried out using a dual approach research strategy recommended by Kelley, Maxwell, and Rausch (2003). This approach estimates sample size with two different methods- one emphasizing statistical precision or accuracy in parameter estimation and another that emphasizes statistical power or effect size- that may require dramatically different sample sizes. When results of these two methods yield different sample sizes, the researcher decides which method is the most appropriate given the study goals and the resources available (Kelley et al., 2003).

Sample size estimation based on statistical precision determines how big a sample is needed to attain a desirable level of precision given the variability of the parameter estimate. This approach balances confidence or risk level, confidence interval and population size to determine the sample size needed. In terms of probability, if the sample size is such that the computed confidence interval is narrow, the correspondence between parameter estimates (that is, the point estimates of single variables) and their population values will be better since less uncertainty will exist for the obtained point estimates (Kelley et al., 2003).

Three different strategies for determining sample sizes under the precision approach were employed in order to decide on as well as confirm the appropriateness of
the minimum sample size. The sample size criteria taken into consideration as recommended by Israel (1992) were level of precision or sampling error which, is the range in which the true value of a population is estimated to be; the confidence level or risk taken about the chances that the sample obtained does not represent the true population value; and the degree of variability in the attributes being measured (ie., the distribution or estimated proportion of the attributes of interest present in the population).

The first strategy involved using a published table that reportedly employed a simplified formula \[ n = \frac{N}{1 + N(e)^2} \] provided by Yamane (as cited by Israel, 1992). For a selected combination of plus or minus five % ( .05 ) in precision, an assumed 95 % confidence level, a maximum assumed level of variability of .5 (50 %) and a selected population size of 8,000 (8290 rounded off), the table presented a sample size of 381 (Israel, 1992). The next strategy applied an equation \[ n_0 = \frac{Z^2pq}{e^2} \] developed by Cochran (as cited by Israel, 1992) to yield a representative sample for large unspecified population sizes. The values for desired level of precision, variability, and 'z' - score for the area under the normal curve that equals the desired confidence level as indicated above were plugged into the formula. The resulting sample size was 385.

Using 385 as the sample size and 8,000 as population size, another formula \( n = \frac{n_0}{1 + [(n_0-1)/N]} \) was calculated to obtain an adjustment called the finite population correction as the third strategy (Israel, 1992). Based on the reasoning that a given sample size provides proportionately more information for a small population versus a large one, Israel (1992) states that this correction could substantially reduce the sample size necessary for smaller populations. The sample size that would now be necessary for a population of 8,000 was 367. The sample size estimation process was repeated using the
large unspecified population size and the finite population correction formulas and changing only the precision level from ± 5 to ± 6 percent. This yielded a sample size of 267 (266.78 rounded off) and 259 (258.69 rounded off) respectively. (Israel, 1992).

The minimum sample sizes of 367 (with precision level ± 5%) and 259 (with precision level ± 6%) obtained by the finite population correction formula (given that the population size from which the sample was drawn is known), were respectively considered desirable, and adequate for the exploratory purposes of the study. However, another issue to take into consideration when determining sample size according to Israel (1992) is the number needed for the data analysis. He indicates, for example, that a 'good size' sample in the range of 200-500 is appropriate for analysis such as multiple regression analysis, analysis of covariance, or log-linear analysis performed in more rigorous impact evaluations. In the case of this study, the sample sizes of 367 and 259 fall within this range.

A power analysis for this study was also performed in keeping with the dual approach recommendation by Kelly et al. (2003) and the recommendation by Israel (1992) to especially consider a 'good size' sample in the range of 200-500 for data analysis such as regression analyses. The statistical power approach establishes some probability (usually in an acceptable range of 80-90 %) of correctly rejecting the null hypothesis. It is used to ensure that there is reasonably high ability to detect reasonable departures from the null hypothesis by balancing a specified desired probability, the alpha level or risk of wrongly rejecting the null hypothesis and the minimum effect size of the statistically significant difference under consideration in a power equation.
This issue of carrying out a power analysis in order to determine the number of individuals needed in a sample to detect if any differences do in fact exist among groups was addressed in six EPPM studies (Witte et al., 2001). In these studies, the effect sizes obtained for attitudes, intentions and behaviors reportedly ranged from medium to large and the average effect size for behaviors in particular was .80 which is large. In terms of ‘power’, Witte et al. (2001) indicate that in order to meet conventional standards of .80 with alpha= .05 for one tailed-tests, 26 persons will be needed per group when examining behaviors. In terms of correlations, an estimated 66 participants are needed in order to test the relationship between efficacy and behaviors. Approximately 150 participants are required in order to test the relationship between threat and behaviors (Witte et al., 2001).

The power analysis for this study was carried out at the multivariate analyses level specifically for binary logistic regression analyses using the Statistical Package for the Social Sciences (SPSS) software known as ‘Sample Power’ in view of the plan to eventually conduct data analyses for this study using SPSS software. The sample size for a simple logistic regression analysis model with one covariate was initially calculated during the power analysis and an adjustment formula \( N_1 / (1 - R^2) \) was then applied to obtain the sample sizes for multiple logistic regression analysis. The logic underlying the calculations is that in a simple logistic regression model, a covariate \( X_1 \) is related to a binary response or dependent variable in a model \( \log \left( \frac{P}{1-P} \right) = \beta_0 + \beta_1 X_1 \) to test the null hypothesis against the alternative which states that the covariate is related to the binary response variable where \( P \) is the probability of the dependent variable outcome \( Y \), being equal to 1 (Hsieh, Bloch & Larsen, 1998).
A goal of logistic regression, other than that of testing the null hypothesis that the probability of a dependent variable event is not associated with the independent or measurement variable, is to predict probability of an event, given the independent or measurement variable (McDonald, 2006). In the logistic regression distribution, the dependent variable is thought of as having a mean value equal to the probability of the event. This is because the mean of a distribution for dependent variables with binary coding of 1 or 0 is equal to the proportion of 1's in the distribution and the mean of the distribution is also considered as the probability of drawing an event labeled as 1 at random from the distribution. In effect, the proportion of 1's and the probability of 1 in such cases are the same (Brannick, n.d.).

P is thus referred to as the event rate \((Y = 1)\) at the mean of \(X\) and for \(P_1\) (event rate at the mean of \(X_1\)), the slope coefficient \(\beta_1\) is the change in log odds for an increase of one unit in \(X_1\), the independent variable. Given that \(\beta\) is the effect size to be tested, the null hypothesis states that \(\beta_1 = 0\) while the alternative states that \(\beta_1 \neq 0\) where \(n\) is the required total sample size (Hsieh et al., 1998). For a simple logistic regression analysis with only one continuous predictor variable, one would therefore need to know the probability of a positive outcome (i.e., the probability that the outcome is equal to 1) at the mean of the predictor variable and the probability of a positive outcome at one standard deviation (representing a unit increase) above the mean of the predictor variable (the \(P_1\) and \(P_1\) event rates at \(X = 0\) and \(X = 1\) respectively) for computation of the total sample size required (UCLA Academic Technology Services, n.d.).

The effect of an independent variable is determined by changes in the probability of the occurrence of the dependent variable event as the outcome as a result of a change in
the value of the independent variable. In terms of the dependent variable outcome, the value changes from 0 to 1 while for all other independent variables in question, the value is increased by one standard deviation from the mean, which, allows for the comparison of the relative effects of different independent variable influences or effects. The standardization also enables a consideration of effects of changes that are 'plausible and substantively meaningful' and neither 'trivial nor extreme' (Russett, 2001).

As the first step in the power analysis process, a review of the literature was carried out to determine the component values needed, as already discussed, to use in the power analysis calculations. The literature indicated that about 30% of adults engaged in sufficient physical activity for a health benefit (Morrow, Krzewinski-Malone, Jackson, Bungum, & FitzGerald, 2004) and so the probability of the event of the study $P_1$, which is the event of sufficient HEPA, at the mean value of the covariate/predictor was set at .30 under the null hypothesis that the odds of sufficient HEPA is equal to 1. Given an independent variable or predictor mean of 0, a predictor Standard Deviation of 1.0, an event rate at the mean equal to .30, a change in the predictor value of 1 Standard Deviation and statistical power equal to .80, a power analysis was carried out to estimate the sample size for various event rate changes (effect on event rate due to a change in the predictor value of 1 Standard Deviation) as shown in Table 3.1.
Table 3.1 Power Analysis Simulations

<table>
<thead>
<tr>
<th>Event Rate Change %</th>
<th>Event Rate at 1 Std Dev</th>
<th>Sample Size for .80</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>difference</td>
<td>Power</td>
</tr>
<tr>
<td>16.7%</td>
<td>.35</td>
<td>730</td>
</tr>
<tr>
<td>26.7%</td>
<td>.38</td>
<td>310</td>
</tr>
<tr>
<td>33.3%</td>
<td>.40</td>
<td>210</td>
</tr>
<tr>
<td>43.3%</td>
<td>.43</td>
<td>140</td>
</tr>
<tr>
<td>50.0%</td>
<td>.45</td>
<td>110</td>
</tr>
</tbody>
</table>

An event rate of .40 corresponding to an event rate change or effect of 33.3 percent was considered to be midway in the range of a small to medium effect of 0.25 - 0.5 as proposed by Cohen (1988) and for a simple logistic regression model, the sample size requirement selected as appropriate was therefore 210. When there is more than one covariate in the model, and a hypothesis of interest is the effect of a specific covariate in the presence of other covariates, the required sample size for this multiple logistic regression model can be approximated from that of simple logistic regression by an inflation or correction factor. This factor by which the new sample size \( N_p \) can be approximated is the squared multiple correlation coefficient, also known as \( R^2 \), which is equal to the proportion of the variance accounted for in the dependent variable or explained by the regression relationship (Hsieh et al., 1998). To arrive at the multiple logistic regression analysis sample size \( N_p \), \( N_p = N_1 / (1 - R^2) \) was computed with \( N_1 \) as the sample size computed for the simple logistic regression model.

The reported multiple coefficients of correlation \( R^2 \) found between physical activity as a dependent variable and variables representing the correlates of adult participation in activity was reported in the literature as ranging from 3 % to 49.5 % with
an average of 21.2 % (± 15 %) [Trost, Owen, Bauman, Sallis & Brown, 2002].

Baranowski, Anderson, and Carmack (1998) also suggest that a multiple coefficient of correlation greater than or equal to .3 (30 %) is the standard for an acceptable level of ‘predictiveness’ of a theoretical model predicting physical activity. In an analysis of physical activity intervention and correlation studies that represented a variety of behavioral theories as well as diverse samples, Baranowski et al. (1998) explain that with few exceptions, this multiple coefficient of correlation or percent of variance in the behavioral outcome accounted for by the theoretical variables in these studies were less than .3, which, is low. Since this value is used to specify how well a theory predicts a behavior, Baranowski et al. (1998) state that by implication, better theories have substantially higher values.

Some of the analyzed studies with values above .3 in the judgment of Baranowski et al. (1998) were easily explained in view of the fact that they used disparate groups which they maintain artificially increases the multiple coefficient of correlation; included large numbers of predictor variables which may be the result of inactivity, for example, Body Mass Index; included baseline exercise behavior or attendance, included variables not usually considered behavioral such as family cardiovascular disease risk; or showed behavior to be a function of intention. The five studies which were not so easily dismissed in terms of the possible relationship of mediating variables to behavior, in the view of Baranowski et al., had multiple coefficients of correlation greater than .3 though none of the values exceeded .4. The correction factor formula to arrive at the multiple logistic regression analysis sample size, $N_p = N_1 / (1 - R^2)$, was therefore applied using a variety of values with results summarized and presented in Table. 3.2.
Table 3.2 Estimation of Sample Sizes for Multivariate Logistic Regression ($N_p$) approximated from Simple Logistic Regression Sample Size of 210.

<table>
<thead>
<tr>
<th>Predictive model $R^2$ for physical activity correlates</th>
<th>Value</th>
<th>Correction factor formula $N_p / (1 - R^2)$</th>
<th>Ideal sample size $N_p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>.21</td>
<td>$210 / (1 -.21)$</td>
<td>265.8</td>
</tr>
<tr>
<td>Standard</td>
<td>.30</td>
<td>$210 / (1 -.30)$</td>
<td>300</td>
</tr>
<tr>
<td>Upper boundary of range of $R^2$ values</td>
<td>.50</td>
<td>$210 / (1 -.50)$</td>
<td>420</td>
</tr>
</tbody>
</table>

The different values of the average $R^2$ of .21 (Morrow et al., 2000), the standard $R^2$ of .30 for an acceptable predictive model (Baranowski et al., 1998) and the $R^2$ of .49.5 which is the upper boundary of the range of $R^2$ values for physical activity correlates (Morrow et al., 2000) were used. Thus, given that $R^2 = .21$, $N_p = 210 / (1 -.21) = 265.8$. For $R^2 = .30$, $N_p = 210 / (1 -.30) = 300$ and for $R^2 = .50$ (49.5 rounded off), $N_p = 210 / (1 -.50) = 420$. In view of the recommendation to have more observations to avoid computational difficulties caused by empty cells when categorical predictors are used, or when the outcome variable is very lopsided with very few 1s and lots of 0s, or vice versa (UCLA Academic Technology Services, n.d.), 420 was selected as the conservative or ideal sample size.

As shown in Table 3.3, the power analysis indicates though, that logistic regression data analysis could be feasibly carried out with data from 266 (265.8 rounded off) sample subjects with sufficient power to detect an effect size of $R^2 = .21$ in the area of physical activity. This number is at par with the precision approach minimum sample size of 267 required for a precision level of plus or minus 6 percent and no specified population size. In summary, the acceptable minimum sample size eventually selected
that would allow meaningful data analysis to proceed was 267. To be conservative, however, 420 is the desired minimum sample size that this dissertation study aimed for.

Table 3.3 Sample Size Determination

<table>
<thead>
<tr>
<th>Approach</th>
<th>#</th>
<th>Point estimate # (with precision level ± 5%)</th>
<th>Point estimate # (with precision level ± 6%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision approach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Table based on finite population formula $n=\frac{N}{1+N(e)^2}$</td>
<td>381</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Unspecified population</td>
<td>385</td>
<td>267</td>
<td></td>
</tr>
<tr>
<td>c. Finite population correction formula</td>
<td>367</td>
<td>259</td>
<td></td>
</tr>
<tr>
<td>Power analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Acceptable minimum (effect size $R^2=.21$)</td>
<td>266</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Conservative minimum (effect size $R^2=.5$)</td>
<td>420</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Questionnaire Development

*Overview*

The questionnaire used in this survey was developed by combining several well-tested scales into one instrument and adding additional questions about demographic characteristics (Appendix 2). As the questionnaire consists of well-tested scales, no expert panel review or pre-testing was conducted.

*Questionnaire Content*

This questionnaire contains measures of physical activity (using the short form of the International Physical Activity Questionnaire [IPAQ-short form]), measures of the Expanded Parallel Process Model (EPPM) constructs (using the Risk Behavior Diagnosis Scale [RBDS]), an assessment of risk for coronary heart disease (using the American College of Sports Medicine [ACSM] risk stratification guidelines/tool), and measures of some demographic variables. Additionally, variables collected in the initial (Quality Improvement study pretest) Health Risk Assessment [smoking, family history of
coronary heart disease, diabetes, hypertension, high blood cholesterol, asthma, general satisfaction with life, personal health evaluation, and Body Mass Index (BMI) –computed from height and weight] are included in the analysis as possible moderators of the relationship between the model constructs and physical activity. Table 3.4 shows the study variable constructs and the survey questionnaire items measuring these constructs. Components utilized from the Health Risk Assessment are also included. (See also Appendices 1 & 2).

Table 3.4
List of Variable Constructs and Survey/ Health Risk Assessment Items by Which They Are Measured

<table>
<thead>
<tr>
<th>SURVEY MEASURE</th>
<th>CONSTRUCT</th>
<th>SURVEY ITEMS</th>
<th>HEALTH RISK ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- International Physical Activity Questionnaire</td>
<td>Health Enhancing Physical Activity (HEPA)</td>
<td>Questions 1 - 7</td>
<td></td>
</tr>
<tr>
<td>2- Risk Behavior Diagnosis Scale</td>
<td>Response efficacy component of Perceived Efficacy.</td>
<td>Questions 8 - 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-efficacy component of Perceived Efficacy.</td>
<td>Questions 11 - 13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severity component of Perceived Threat.</td>
<td>Questions 14 - 16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Susceptibility component of Perceived Threat.</td>
<td>Questions 17 - 19</td>
<td></td>
</tr>
<tr>
<td>3- American College of Sports Medicine Risk Stratification Tool</td>
<td>Level of Risk for Coronary Heart Disease; Family history of coronary heart disease.</td>
<td>Questions 20 - 23</td>
<td></td>
</tr>
<tr>
<td>4- Socio-demographics measuring HEPA</td>
<td>Chronological age, gender.</td>
<td>Questions 20 - 21</td>
<td></td>
</tr>
<tr>
<td>5- Health Status variables</td>
<td>Smoking, BMI, diabetes, hypertension, high blood cholesterol, asthma, general satisfaction with life, personal health evaluation.</td>
<td>Questions 1-4, 6-9</td>
<td></td>
</tr>
</tbody>
</table>
Physical Activity Questions: The IPAQ-short form

Physical Activity is measured by the International Physical Activity Questionnaire- Short Last 7 Days - (IPAQ-short form) [Sjöström, Bull, & Craig, 2002]. This scale was designed primarily for population surveillance of young and middle-aged adults with an age range of 15-69 and consists of seven questions about the type and level of physical activity that the person engaged in during the past week. The scale items are items 1-6 in the survey (Appendix 2). An additional item on time spent sitting on a weekday (item 7) is not utilized in scoring of Physical Activity but serves as an ‘additional indicator variable of time spent in sedentary activity’ (IPAQ Committee, 2005). The IPAQ-short form is considered a reliable and valid questionnaire for assessment of physical activity in large surveys that not only ask about physical activity but a range of other issues as well (Mader, Martin, Schutz & Marti, 2006).

Overall, the IPAQ has test-retest reliability (Spearman's rho clustered around 0.8), using comparable data from short and long forms. Criterion validity assessed against an accelerometer was comparable to other self-report validation studies. Content validity is deemed high since frequency, intensity and duration of physical activity are assessed as well as sedentary behavior. The "usual week" and "last 7 days" reference periods were reported to have performed similarly. Also, the reliability of telephone administration was similar to the self-administered mode. (Matsudo, Araujo & Matsudo as cited in Viebig, Valero, Araujo, Yamada & Mansur, 2006; Sjostrom et al., 2002; Craig et al., 2003, Oja, 2003; Ekelund et al., 2006; Levy & Readdy, 2006; Macfarlane, Lee, Ho, Chan & Chan, 2006; Mader et al., 2002; 2006). The testing of IPAQ as an international measure for physical activity in developed and developing countries and the
demonstration of acceptable reliability and validity properties in both settings, especially in the urban samples, is taken as one of its strong points (Craig et al., 2003).

*Expanded Parallel Process Model Measures: Risk Behavior Diagnosis Scale*

The four constructs of the Expanded Parallel Process Model (EPPM) are measured using the Risk Behavior Diagnosis Scale (RBDS) developed by Witte et al. (1995, 1996). This is a rapid assessment tool involving a 12-item template scale that is theoretically grounded in the EPPM and can be adapted to different health concerns. The corresponding items in the questionnaire are items 8-19. Severity is measured by items 14-16. Susceptibility is measured by items 17-19. Response efficacy is measured by items 8-10 and self-efficacy is measured by items 11-13 (See Appendix 2).

The RBDS, in validation studies, is reported to exhibit content validity (94 % inter-rater agreement with an agreement of 88 % when corrected for chance), construct validity (demonstrated by confirmatory factor analysis with all factor loadings except one exceeding .55) and predictive validity (demonstrated by discriminant function analysis with correct classification rate of 62 %) [Witte, 1994; Witte et al., 1996; Dassow as cited in Dassow, 2005]. The internal consistency reliability of the RBDS as expressed by Cronbach’s alpha is considered acceptable with a range of .71-.96 (Dassow, 2005; Gore & Bracken, 2005; Witte et al., 1996; Witte et al., 2002-2003). Gore & Bracken (2005), specifically, in their study obtained a pretest Cronbach’s alpha for all four key RBDS variables ranging from .85-.95 as well as a posttest Cronbach’s alpha range of .88-.96.

The RBDS facilitates the use of the EPPM as applied theory in order to identify or survey salient beliefs about a health threat and efficacy of a recommended response (Witte et al., 2001). The template allows for using the scale according to an approach to
scale development advocated by Fishbein and Ajzen (as cited in Witte et al., 1996). In this approach, one develops items specific to a context and situation to increase accuracy and precision. The RBDS template therefore allows tailoring of the scale to a particular use by filling in a specific health threat and recommended action or response.

The threat and efficacy theoretical components affecting behavior as described by the EPPM are measured by six questions each on the 12-item scale. This breaks down into three questions each about perceptions regarding severity, susceptibility, response efficacy and self-efficacy toward a certain behavior or topic being asked. Perceptions of the severity of a specified health threat and perceptions of one’s susceptibility to that health threat constitute the threat component while perceptions of response efficacy of and one’s self-efficacy towards the recommended response make up the efficacy component. Each 12-item survey variation of the template scale measures perceptions on a 7-point Likert-type scale ranging from strongly disagree to agree. Confirmatory factor analysis results of the RBDS scale suggests that the RBDS items work together as hypothesized by the EPPM (Witte et al., 1996). “Threat and efficacy emerged as distinct factors comprising two dimensions each. Specifically, perceived severity and perceived susceptibility were found to compose the second-order factor of threat, and response efficacy and self-efficacy were found to compose the second-order factor of efficacy” (Witte et al., 1996; p.334).

The RBDS differentiates people taking self-protective action regarding a risk from those who are not taking self-protective action based on measurement of these EPPM four risk dimensions variables (Witte et al., 2001). An overall score called the ‘critical value’ is obtained by subtracting the score on the threat component (sum of
perceived severity and perceived susceptibility scores) from the score on the efficacy component (sum of perceived response efficacy and perceived self-efficacy scores).

This overall quantitative analysis permitted by the RBDS using threat and efficacy scores determines if fear-control or danger-control processes are dominating (Witte, 2004). An individual is identified as being in fear-control denoting message rejection if the critical value is a negative score. One is identified as being in danger-control denoting message acceptance if this critical value is a positive score. The EPPM posits that the effectiveness of the health risk message depends on whether targeted individuals are motivated by ‘fear control’ or ‘danger control’. Since engaging in fear control or danger control is determined by calculation of an individual’s score on the RBDS, an individual’s score on the RBDS is also referred to as a discriminating value score (Witte et al., 2001).

**Coronary Heart Disease Risk**

Risk for coronary heart disease is measured by the American College of Sports Medicine (ACSM) [2006] pre-participation health screening and risk stratification guidelines/tool for evaluation of selected risk factors associated with the development of coronary artery or heart disease. The corresponding items in the questionnaire are shown as the checklist in items 22 and 23 (See Appendix 2). Evaluation according to the guidelines uses the checklist in items 22 and 23 as well as age and gender information in items 20 and 21. This results in one of three measures of risk, namely low, moderate and high risk (ACSM, 2006). The tool is primarily used to identify both those who are not known to be at risk, and those known to be at risk for a cardiovascular event during exercise.
The questionnaire is patterned after one developed by the Wisconsin Affiliate of the American Heart Association as a practical tool for pre-participation screening that aims at identifying high-risk individuals without inhibiting their participation in exercise programs (ACSM, 2006). History, symptoms, and risk factors (including age) are typically used to make recommendations about either participating in an exercise program or contacting a physician (or appropriate healthcare provider) before participating (ACSM, 2006). Risk factors for coronary heart disease were originally validated by research that was part of the Framingham studies, which gave us the understanding that heart disease results from a combination of factors, sedentary lifestyle being one of them (Kannel, Dawber, Kagan, Revotskie, & Stokes, 1961). The writing group for this ACSM tool, Balady et al. (1998), based the recommendations and the pre-participation screening questionnaire on a review of the literature and the consensus of the group. These recommendations, according to Balady et al. (1998), are also peer reviewed by selected authorities in the field representing the American Heart Association, the American College of Sports Medicine, the American College of Cardiology, the International Health Racquet and Sports Clubs Association (IHRSA), and the Young Men's Christian Association.

The risk factors have been modified over the years, with the latest clarification being introduced by the Adult Treatment Panel (ATP III) report of the National Cholesterol Education Program (National Heart, Lung, and Blood Institute, 2002). Some of the risk factors are known to be on a continuum. That is, very high cholesterol is known to be associated with a higher risk of disease than moderately high cholesterol, and the same is true for blood pressure (ACSM, 2006). It is also known that the risk
factors are additive, which means that the more risk factors one has, the greater the risk of disease (ACSM, 2006). The ACSM risk stratification scale, with only three levels of distinction, is therefore not an exact scale to be used for prediction of disease, but is primarily used to identify a general level of risk for a cardiovascular event during exercise, and to guide high-risk individuals toward seeking medical clearance and/or treatment before starting a vigorous exercise program. It is not intended to diagnose disease, and it is not inclusive of all possible risk factors. It is, rather, a guideline recommended by an expert panel, and it is used by the clinician and/or patient in identifying probable risk for coronary artery disease for the purpose of planning what action needs to be taken.

**Demographic Variables**

Specific demographic variables known to be associated with physical activity are also included in the questionnaire. Item 20, asking for the participant’s gender and item 21 which asks for the participant’s age are also required for evaluation of coronary heart disease risk.

**Other Sources of Data Used in the Study**

Self-report data gathered from the Health Risk Assessment (HRA) that was completed at the time of consenting to participate in the study is also used in the dissertation study analyses. This HRA data collection tool is used by the Health Care Organization in question and gathers self-reported information covering a variety of issues. Items on the HRA ask questions to do with one’s general satisfaction with one’s life; one’s overall description of one’s health or perceived health status; risk factors such as blood cholesterol level, blood pressure, weight, height, smoking status, presence of
diabetes, and presence of asthma. Time of last clinical breast exam from medical
professional for females, time of last mammogram for females over 40 years of age, and
time of last rectal examination of the prostate for males over age 40 are other questions
that are asked (See Appendix 1b.).

The variables selected for inclusion in the dissertation study data analyses are
those which have to do with smoking, asthma, diabetes, hypertension, high blood
cholesterol, general satisfaction with life, personal health evaluation and height and
weight from which Body Mass Index is calculated. This design is to help reduce the
length of the time it would take to administer the survey with questions regarding HEPA
and the EPPM. Duplication of effort is also avoided since this information is already
available and can be matched to participant survey responses prior to the stripping of
identifiers in the dataset and its release for data analyses.

**Operational Definitions of Variables**

Table 3.5 shows the list of variables of main interest to this dissertation study and the
survey items by which they are measured. The operational definitions of these variables
as well as the variables consisting of other study participant self-report data gathered
from the Health Risk Assessment (HRA) that was completed at the time of consenting to
participate in the study are presented as follows:

**Dependent Variable**

The dependent variable construct for this study is engaging in health enhancing
physical activity (HEPA). This is measured by several different variables, all of which
are derived from the IPAQ scale items (Survey Questions #1-#7). Computation of the
IPAQ-short form for physical activity scores is conducted according to the Guidelines for
Data Processing and Analyses of the IPAQ (IPAQ Research Committee, 2005). This scoring protocol expresses physical activity as a metabolic energy expenditure value (MET minute per week), and yields both continuous and categorical measures as desired. A MET is defined as the metabolic energy expenditure equivalent to one kilocalorie per kilogram per hour. MET values are a reflection of intensity of an activity relative to resting or lying quietly and they are considered multiples of one MET (Rennie et al., 2003) or multiples of the rate of metabolic energy expenditure while resting (IPAQ Research Committee, 2005). The expression of physical activity in METs permits comparison between participants with different body sizes without the potential confounding of body weight that could occur if kilocalorie expenditure is used (Rennie et al., 2003). Once the METs are computed, a dichotomous variable (sufficient and insufficient HEPA levels) can then be computed based upon the IPAQ three category variable (Low, Moderate and High) standard cut-off value.

In the IPAQ scoring protocol (IPAQ Research Committee, 2005), MET-minutes are computed by multiplying the metabolic energy requirement (MET score) of an activity by the minutes performed per day. Since regular participation is a feature of the current public health guidelines for physical activity, the IPAQ scoring protocol also multiplies the MET minutes per day by the frequency or number of days per week to yield a continuous score in MET minutes/week (IPAQ Research Committee, 2005). The actual computation of the IPAQ-short form thus requires summation of the duration in minutes and frequency in days of walking, moderate intensity and vigorous intensity activities.
One of three selected energy requirements defined in METs is assigned to each of the three types of activity in the IPAQ scoring protocol. This assignment is based on work undertaken during the extensive IPAQ reliability study to derive averages for types of activities using a compendium of physical activities by Ainsworth et al. (as cited in Craig et al., 2003). These energy requirements are assigned as MET scores of 3.3, 4.0 and 8.0 for walking, moderate-intensity activity and vigorous-intensity activity respectively (Craig et al., 2003; IPAQ Research Committee, 2004; 2005). The METs for each activity are then multiplied by total minutes per day and frequency of activity per week in order to calculate MET minutes per week for each activity. Total physical activity MET minutes per week is the sum of walking plus moderate plus vigorous MET minutes per week scores.

IPAQ Categorical Scores

The following thresholds or criteria are used for the IPAQ categorical scores (See Guidelines for Data Processing and Analyses of the IPAQ - www.ipaq.ki.se):

a) high/health enhancing physically active: Defined as 3000 METs/week. This is physical activity that meets the criteria of vigorous-intensity activity on at least three days achieving at least a minimum total physical activity of at least 1500 MET minutes/week or seven or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total physical activity of at least 3000 MET minutes/week’ (IPAQ Research Committee, 2005, p.6).

b) moderate/minimally active: Defined as 600-1499 MET minutes/week. This is physical activity that meets the criteria of ‘three or more days of vigorous-intensity activity of at least 20 minutes per day or, five or more days of moderate-intensity and/or
walking for at least 30 minutes per day or, five or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total physical activity of at least 600 MET minutes/week’ (IPAQ Research Committee, 2005, p. 6).

c) **low/inactive:** Defined as not meeting the criteria for moderate or high levels. This would be equivalent to ‘Total physical activity’ that amounts to less than 600 MET minutes/week (IPAQ Research Committee, 2005, p. 6).

*Expanded Parallel Process Model (EPPM) Measures*

The EPPM variable construct measures are perceived severity, perceived susceptibility, perceived response efficacy and perceived self-efficacy. They are individually measured by the Risk Behavior Diagnosis Scale (RBDS). [The RBDS measures are covered by Survey Questions #8–#19 given that Survey Questions #1–#7 concern the measurement of health enhancing physical activity]. Computation of the RBDS perceptions scores as hypothesized by the EPPM, also involves separate summation of all perceived threat component (perceived severity and perceived susceptibility) and all perceived efficacy component (perceived response efficacy and perceived self-efficacy) subscale items. The threat score is then subtracted from the efficacy score to yield the critical/discriminating value (Witte, 2004; Witte et al., 2001). Discriminating value scores are used to classify respondents into two groups as hypothesized by the EPPM (Witte, 2004; Witte et al., 2001).

Under the perceived efficacy component variable, the EPPM theoretical construct variable of response efficacy is measured by the RBDS Response Efficacy subscale Likert-type items corresponding to Survey Questions #8, #9 and #10. The maximum
score for each of these three RBDS items on a 7-point scale that ranges from '1-strongly disagree' to '7-strongly agree' is 7 and therefore the maximum score on this subscale is 21. The minimum item score is 1 and the minimum subscale score is 3 (Witte et al., 2001). The EPPM theoretical construct variable, self-efficacy, is measured by the RBDS Self-Efficacy subscale Likert-type items corresponding to Survey Questions #11, #12, and #13. The maximum score for each of these three RBDS items on a 7-point scale that ranges from '1-strongly disagree' to '7-strongly agree' is 7 and therefore the maximum score on this subscale is 21. The minimum item score is 1 and the minimum subscale score is 3 (Witte et al., 2001).

Under the perceived threat component variable, the EPPM theoretical construct variable of severity is measured by the RBDS severity subscale Likert-type items corresponding to Survey Questions #14, #15 and #16. The maximum score for each of these three RBDS items on a 7-point scale that ranges from '1-strongly disagree' to '7-strongly agree' is 7 and therefore the maximum score on this subscale is 21. The minimum item score is 1 and the minimum subscale score is 3 (Witte et al., 2001). The EPPM theoretical construct variable, susceptibility, is measured by the RBDS Self-Efficacy subscale Likert-type items corresponding to Survey Questions #17, #18 and #19 on a 7-point scale that ranges from '1-strongly disagree' to '7-strongly agree'. The maximum score for each of these three RBDS items is 7 and the maximum score on this subscale is 21. The minimum item score is 1 and the minimum subscale score is 3 (Witte et al., 2001).

The EPPM theoretical construct component variable of efficacy is measured as the sum of the RBDS efficacy items made up of the response efficacy and self-efficacy
subscale items (Survey Questions #8 + #9 + #10 + #11 + #12 + #13). The maximum score is 42 and the minimum is 6. A score of 12 or less for this component variable is regarded as low (Witte et al., 2001). Low efficacy scores reflect a situation in which an individual is not convinced about the 'ease and feasibility and/or effectiveness of a recommended response to avert a health threat (Witte et al., 2001).

The EPPM theoretical construct component variable of threat is measured as the sum of the RBDS threat items made up of the severity and susceptibility subscale items (Survey Questions #14 + #15 + #16 + #17 + #18 + #19). The maximum score is 42 and the minimum is 6. A score of 12 or less for this component variable is regarded as low (Witte et al., 2001). Low threat scores reflect a situation in which an individual is not convinced about the seriousness of a health threat (Witte et al., 2001).

The EPPM discriminating value variable is operationally defined and measured as the threat score subtracted from the efficacy score (Witte, 2004; Witte et al., 2001). The range of the discriminating value is from negative 36 to positive 36 and if positive, reflects danger control as a result of higher efficacy perceptions. In danger control, there is motivation to control the danger of the health threat in order to remove or lessen the threat or risk. If the score is negative, the discriminating value reflects fear control as a result of higher threat perceptions. In fear control, the motivation is to control the fear about the threat rather than the danger the threat poses. This promotes fear control responses which lead to rejection of the recommended responses and maladaptive actions.
Coronary Heart Disease Risk

This variable is level of risk for coronary heart disease as objectively defined by and measured by the ACSM (2006) screening and risk stratification guidelines questionnaire (Survey Questions #20 - #23) to create an index of risk. These questions ask about an individual’s age, gender, presence of major signs or symptoms suggestive of cardiovascular and pulmonary disease and coronary heart disease risk factors pertaining to family history, cigarette smoking, hypertension, high blood cholesterol, impaired fasting glucose, obesity and sedentary lifestyle. If a participant has a negative risk factor of HDL cholesterol level greater than or equal to 60mg/dL, then the total number of positive risk factors present is reduced by one to arrive at the final number of risk factor thresholds met. Men aged less than 45 years or women aged less than 55 years, who are asymptomatic in terms of signs or symptoms suggestive of cardiovascular, pulmonary or metabolic disease (Question #22) and in addition meet no more than one coronary heart disease risk factor threshold provided in Question #23, are classified as ‘Low Risk’. Individuals with an age older than or equal to 45 if male and older than or equal to 55 if female or individual who meet the threshold for two or more coronary heart disease risk factors cardiovascular, pulmonary or metabolic disease (Question #23) are classified as ‘Moderate Risk’. ‘High Risk’ individuals are those with one or more or symptoms suggestive of cardiovascular, pulmonary or metabolic disease (Question #22) [ACSM, 2006].

Demographics

Age is measured as chronological age in years at time of completing survey; Gender is measured as male with an assigned value of 0 or female with a corresponding
value of 1. Zip code as proxy for Physical environment is measured using the 5-digit postal Zip codes. These zip codes are condensed into assigned zip to city regions as determined by United States Census 2000 data. The income component of the variable Zip code (average income in dollars using zip code as proxy) is measured as the average household income reported for each 5-digit postal Zip codes based on United States Census 2000 data (U.S. Census Bureau, 2003). These values are also collapsed into average income categories by increments of $10,000.

Other Independent Variables

Smoking is measured as current smoker or not. Family History of Coronary Heart Disease is measured as yes or no. Body Mass Index as an interval variable is measured as body weight adjusted for height using standardized tables [National Institutes of Health (NIH), 1998]. Diabetes is measured as yes or no. Hypertension is measured as yes or no. High Blood Cholesterol is measured as yes or no. Asthma is measured as yes or no. General Satisfaction with Life is measured as mostly satisfied, partly satisfied and not satisfied. Personal Health Evaluation is measured as excellent, good, fair, or poor. Time spent sitting on a week day is measured in minutes.

A summary list of classification as well as operational definitions of the variables examined in the study is provided in Table 3.5:
Table 3.5

Summary of Variables by Classification, Name, Scale and Operational Definition

<table>
<thead>
<tr>
<th>Variable/Classification</th>
<th>Variable Name/ Scale</th>
<th>Operational Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEPENDENT VARIABLE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Enhancing Physical Activity (HEPA) in METs</td>
<td>HEPAMETS- ratio variable</td>
<td>Total physical activity energy expenditure in METs expressed in MET minutes/week equal to the sum of walking, moderate and vigorous intensity activity MET-minute per week scores [ie. walking (3.3 METs<em>walking minutes</em># walking days/week) + moderate intensity activity (4.0 METs* moderate intensity activity minutes* # moderate intensity activity days/week) + vigorous intensity activity (8.0 METs* vigorous intensity activity minutes* # vigorous intensity activity days/week)]</td>
</tr>
<tr>
<td>HEPA dichotomous</td>
<td>HEPASUF- nominal variable</td>
<td>0: Insufficient; Ranges from 0-1499 MET minutes/week of Total physical activity. 1: Sufficient; ≥1500 MET minutes/ week of vigorous intensity activity OR ≥3000 MET minutes/ week of combination of walking, vigorous and moderate intensity activities.</td>
</tr>
</tbody>
</table>
### EPPM MEASURES

<table>
<thead>
<tr>
<th>Measure</th>
<th>Score Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perceived Severity</strong></td>
<td>Score on Severity Subscale of RBDS (Q14 + Q15 + Q16); Ranges from 3-21. Higher score means higher severity.</td>
</tr>
<tr>
<td><strong>Perceived Susceptibility</strong></td>
<td>Score on Susceptibility Subscale of RBDS (Q17 + Q18 + Q19); Ranges from 3-21. Higher score means higher susceptibility.</td>
</tr>
<tr>
<td><strong>Perceived Response Efficacy</strong></td>
<td>Score on Response Efficacy Subscale of RBDS (Q8 + Q9 + Q10); Ranges from 3-21. Higher score means higher response efficacy.</td>
</tr>
<tr>
<td><strong>Perceived Self-Efficacy</strong></td>
<td>Score on Self-Efficacy Subscale of RBDS (Q11 + Q12 + Q13); Ranges from 3-21. Higher score means higher self-efficacy.</td>
</tr>
<tr>
<td><strong>Perceived Threat</strong></td>
<td>Combined score on Severity and Susceptibility Subscales of RBDS (Q14 + Q15 + Q16 + Q17 + Q18 + Q19); Ranges from 6-42. Higher score means higher threat.</td>
</tr>
<tr>
<td><strong>Perceived Efficacy</strong></td>
<td>Combined score on Response Efficacy and Self-Efficacy Subscale of RBDS (Q8 + Q9 + Q10 + Q11 + Q12 + Q13); Ranges from 6-42. Higher score means higher efficacy.</td>
</tr>
<tr>
<td><strong>Discriminating Value</strong></td>
<td>0: no perceived threat; Value = 0. 1: fear control; Range = -36 to -1. 2: danger control; Range = 1 - 36.</td>
</tr>
<tr>
<td>Discriminating Value</td>
<td>DISCVAL- interval variable</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>continuous</td>
<td></td>
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</tbody>
</table>

Overall RBDS positive or negative score: \( \sum \) Perceived Efficacy minus \( \sum \) Perceived Threat = combined score on Response Efficacy and Self-Efficacy Subscales of RBDS \((Q8 + Q9 + Q10 + Q11 + Q12 + Q13)\) minus combined score on Severity and Susceptibility Subscales of RBDS \((Q14 + Q15 + Q16 + Q17 + Q18 + Q19)\); Ranges from -36 to 36. Negative values indicate less of and positive values indicate more of recommended response (HEPA).

**CORONARY HEART DISEASE RISK**

<table>
<thead>
<tr>
<th>Coronary Heart Disease Risk Level</th>
<th>CHDRCAT- ordinal variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>

1. Low; adult aged <45 if male or <55 if female; not symptomatic of cardiovascular, pulmonary or metabolic disease who meets \( \leq 1 \) risk factor threshold).
2. Moderate; adult aged \( \geq 45 \) if male or \( \geq 55 \) if female; not symptomatic of cardiovascular, pulmonary or metabolic disease who meets \( \geq 2 \) risk factor thresholds).
3. High; adults with \( \geq 1 \) symptom suggestive of or known cardiovascular, pulmonary or metabolic disease
## Socio-Demographic Variables

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in Years</td>
<td>AGEYRS- ratio variable</td>
<td>Chronological age in years at time of completing survey; Ranges from 18-69</td>
</tr>
<tr>
<td>Gender dichotomous</td>
<td>GENDER- nominal variable</td>
<td>0: male, 1: female</td>
</tr>
<tr>
<td>Physical Environment using zip-code as proxy</td>
<td>PEZIPCD- nominal proxy variable</td>
<td>5-digit postal Zip-code regions condensed into zip code-to-city regions: Region 1, Region 2, Region 3, Region 4, Region 5, Region 6, All Other Regions</td>
</tr>
<tr>
<td>Average Income in dollars using zip-code as proxy</td>
<td>AVEINC- ratio/ ordinal proxy variable</td>
<td>Average income per household by zip-code: Income groups: 1: $15000 - $24999, 2: $25000 - $34999, 3: $35000 - $44999, 4: $45000 - $54999, 5: $55000 - $64999, 6: $65000+</td>
</tr>
</tbody>
</table>
OTHER INDEPENDENT VARIABLES

Survey Method
SURVMETH
1: phone survey
2: mail survey

Smoking categorical
SMOCAT- nominal
variable
0: no, not a current smoker
1: yes, current smoker

Family History of Coronary Heart Disease
FHXCHD- nominal
variable
0: No
1: Yes

Body Mass Index (BMI)
BMINDX- interval
variable
Body weight adjusted for height;
ranges from 18 – 54.

BMI categorical
BMICAT- nominal
variable
0: BMI < 25 (normal)
1: BMI ≥ 25 - < 30 (overweight)
2: BMI ≥ 30 (obese)

Diabetes dichotomous
DIACAT- nominal
variable
0: No
1: Yes

Hypertension dichotomous
HTNCAT- nominal
variable
0: No
1: Yes

High Blood Cholesterol dichotomous
CHOLCAT- nominal
variable
0: No
1: Yes

Asthma dichotomous
ASTCAT- nominal
variable
0: No
1: Yes

General Satisfaction with Life
GENSAT- nominal
variable
3: mostly satisfied
2: partly satisfied
1: not satisfied

Personal Health Evaluation
PHEVAL- nominal
variable
4: excellent
3: good
2: fair
1: poor

Time spent sitting on a weekday
SITTIN- ratio variable
Time spent sitting in minutes
Data Collection

Data regarding health enhancing physical activity and the expanded parallel process model used in this dissertation study are extracted from two types of data collection from the sample group. Data from some subjects were collected by telephone interview administration of the survey questionnaire and data from other subjects were collected by self-administered survey questionnaire mailed to participants. Both methods of data collection have been shown to be valid for the surveys used. Notation is made regarding the type of data collection method used so that a comparison of results could be performed to determine whether collection method influences the dissertation study results. Data collection by phone was done by two Patient Service Coordinators working with participants in the role of a healthy lifestyle coach. Participants were contacted by phone at the best number to reach them, at the best time of the day and on the best day of the week for them. All this information was required as part of their consent to participate in the study in addition to their agreement to participate in monthly contacts with an assigned Patient Service Coordinator by phone. Questionnaires were mailed to the portion of participants not contacted by telephone. The data were collected using the same questionnaire items as the telephone survey, but participants were requested to complete the survey on their own and return it to the health care organization.

The Patient Service Coordinators have a combination of about 20 years experience in the medical field with duties that include responsibilities as customer service representative, medical office assistant, and education, counseling and administrative associate. The position as Patient Service Coordinator required them to possess and demonstrate exceptional oral and written communication and customer
service skills. Excellent telephone etiquette in addition to knowledge of medical
terminology or successful completion of a medical terminology course on being hired
was also a requirement. These skills are applied to clinical staff supportive functions
associated with screening for changes in health status, coaching and monitoring of
behavior change skills for improved self-management of the health plan members and
reminders of necessary testing as determined by clinical guidelines.

In preparation for data collection, the Patient Service Coordinators also received
about three months training specifically related to data collection and administration of
the larger health plan study intervention. This included a review of the survey on physical
activity, health risk perception and coronary artery disease risk factors by this author and
the Health Plan Vice-President of Clinical Care Services and Disease Management
Director in order to familiarize them with the questionnaire and how to administer it. The
Patient Service Coordinators were also provided with a CDC (2006) list of general
physical activities defined by level of intensity (moderate and vigorous) to aid in
clarification if a participant did not understand a question (See Appendix 5). This list was
adapted in accordance with CDC and ACSM guidelines from a compendium of physical
activities classifying energy costs of physical activities by Ainsworth et al. (as cited by
CDC, 2006).

Protection of Human Subjects

Approval from the Old Dominion University Institutional Review Board for
Human Subjects (see Appendix 6a.) was obtained prior to the release of secondary data
for this dissertation study along with a data use agreement drawn up by the Health Plan
recruiting the subjects for the Quality Improvement Program (see Appendix 6b.). Since
the Study Researcher was not involved directly in the Quality Improvement Program data collection efforts, the data is issued to the researcher by the aforementioned Health Plan as existing data in the form of a limited data set for research purposes only.

This dissertation study involves information pertaining to behaviors that could affect an individual's health and such information about health behaviors, even if it is pre-existing data, is classified as “Protected Health Information” according to DHHS issued regulations entitled ‘Standards for Privacy of Individually Identifiable Health Information’ and otherwise known as the HIPAA Privacy Rule (NIH, n.d., 2003, 2004, 2005). The information used in the dissertation study is therefore de-identified or stripped with regard to personal and direct identifiers not considered to be critical information needed for this project. This process occurred prior to disclosure of information to the dissertation study Researcher in the form of the limited dataset along with the data use agreement (Appendix 6b.).

The data set used for the dissertation study also includes unique codes /identifiers not listed as direct identifiers under Section 164.514 (e) 2 of the HIPAA Privacy Rule (NIH, n.d., 2003, 2004, 2005). The disclosure of information in the form of a ‘limited dataset’, however, permits disclosure of other data elements such as age, gender and ZIP codes needed for a project. Information of this nature may not be considered to be identifiable private information under the DHHS Protection of Human Subjects Regulations but are considered rather as indirect identifiers under the Privacy Rule (NIH, n.d., 2003, 2004, 2005). These unique identifying codes and indirect identifiers are not derived from or related to information about individual subjects that can be translated so as to identify the individual. Subjects, therefore, cannot be identified, directly or through
identifiers linked to the subjects under this "safe-harbor" de-identification standard of the Privacy Rule. This is addressed by the data use agreement issued along with the release of the 'limited dataset', which in addition, restricts this dissertation study Researcher from re-identifying the information or contacting the subjects (See Appendix 6b.).

The dissertation study Researcher's plan regarding the dataset provided is to return or destroy it after use either according to the terms of the data use agreement or not later than 5 years after project is completed if no such terms exist in the data use agreement. With this plan, the dissertation study Researcher during the period of the project, adheres to human subjects' protection requirements by keeping the dataset in a secured location when not in use. When being handled or used for the purposes of the research project, every effort is made to safeguard the dataset.

**Data Analyses Plan**

Data are analyzed using the current Statistical Package for the Social Sciences (SPSS) version 16.0 for Windows software. Before analyses, data are subjected to screening for bad values such as from out-of-range coding. Data are assessed for missing values and outliers using procedures like frequency distributions, crosstabs and scatterplots. Any case in the database that is missing 30% or greater of the data points is deleted.

Other missing data issues are addressed as discussed by Mertler and Vannatta (2002). For example, if missing values appear to be limited to a couple of variables that are not deemed central to the main research questions and subsequent analyses, those variables are dropped from the data set. If the pattern of missing data is such that deletion of cases or variables result in inappropriate sample sizes for proposed analyses or a
substantial decrease in the number of available measures, missing values are estimated in a systematic fashion using replace-missing values function in SPSS. Data analyses procedures then include analysis with and without missing values to verify similarity. (Mertler & Vannatta, 2002). The data are next examined for fulfillments of related test assumptions and transformed or recoded if necessary after verifying accuracy of values and usability of variables (Mertler & Vannatta, 2002) before analyses.

Data are analyzed in relation to the dissertation study research questions/hypotheses for testing. The analyses methodology involves descriptive statistics, bivariate and multivariate analyses. Descriptive statistics include computation of frequencies, means, standard deviations or median and range as appropriate for continuous data and proportions such as percentages for categorical data.

**Bivariate Analyses**

At the bivariate level of data analyses, appropriate bivariate methods of analyses are applied to the two data forms of the study dependent variable outcome of health enhancing physical activity (continuous and categorical) in order to identify those variables that are statistically significant in their association with HEPA. The relationship between nominal-level dichotomous independent variables and the ratio level dependent variable of HEPA are examined using an Independent-t test if the data is normally distributed, and if not, a Mann-Whitney-U test is used. With other non-dichotomous categorical independent variables and normally distributed ratio-level data, one-way Analysis of Variance tests are used for testing of hypotheses. If the data turns out to be non-normally distributed, Kruskal-Wallis tests are used instead. Testing of bivariate hypotheses using categorical/nominal independent variables and the nominal-level
dependent variable of HEPA involve the use of Chi-square tests. Tests of correlation
(Pearson’s for ratio-level variable data that is normally distributed or Spearman’s for
ordinal-level variable data or data that is non-normally distributed) are used where
appropriate. The appropriate tests finally used during bivariate data analyses are
summarized and presented in Table 3.6:
Table 3.6 Level of Data by HEPA Outcome and Method of Bivariate Analysis

<table>
<thead>
<tr>
<th>MODEL CONSTRUCTS WITH NUMBERED HYPOTHESIS</th>
<th>VARIABLE (LEVEL)</th>
<th>HEPAMETS (ratio)</th>
<th>HEPASUF (nominal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPPM Measures</td>
<td>#2a PERRES (ordinal)</td>
<td>Spearman’s correlation</td>
<td>Mann-Whitney U</td>
</tr>
<tr>
<td></td>
<td>#2b PERSEL (ordinal)</td>
<td>Spearman’s correlation</td>
<td>Mann-Whitney U</td>
</tr>
<tr>
<td></td>
<td>#2c PERSEV (ordinal)</td>
<td>Spearman’s correlation</td>
<td>Mann-Whitney U</td>
</tr>
<tr>
<td></td>
<td>#2d PERSUSC (ordinal)</td>
<td>Spearman’s correlation</td>
<td>Mann-Whitney U</td>
</tr>
<tr>
<td></td>
<td>#2e PEREFF (ordinal)</td>
<td>Spearman’s correlation</td>
<td>Mann-Whitney U</td>
</tr>
<tr>
<td></td>
<td>#2f PERTHR (ordinal)</td>
<td>Spearman’s correlation</td>
<td>Mann-Whitney U</td>
</tr>
<tr>
<td></td>
<td>#2g DISCVAL (ordinal)</td>
<td>Spearman’s correlation</td>
<td>Mann-Whitney U</td>
</tr>
<tr>
<td></td>
<td>#2h DISCCAT (nominal)</td>
<td>Kruskal-Wallis</td>
<td>Chi-Square</td>
</tr>
<tr>
<td>Coronary Heart Disease Risk</td>
<td>#3a CHDRCAT (ordinal/categorical)</td>
<td>Kruskal-Wallis</td>
<td>Chi-Square</td>
</tr>
<tr>
<td>Demographic Measures</td>
<td>#3b AGEYRS (ratio)</td>
<td>Spearman’s correlation</td>
<td>Independent-t</td>
</tr>
<tr>
<td></td>
<td>#3c GENDER (nominal/dichotomous)</td>
<td>Mann-Whitney U</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>#3d PEZIPCD as proxy for environment (nominal)</td>
<td>Kruskal-Wallis</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>PEZIPCD as proxy for income (ratio)</td>
<td>Spearman’s correlation</td>
<td>Independent-t</td>
</tr>
<tr>
<td></td>
<td>PEZIPCD as proxy for income group (categorical)</td>
<td>Kruskal-Wallis</td>
<td>Chi-Square</td>
</tr>
<tr>
<td>Other Independent Variables</td>
<td>#3e SMOCAT- (nominal)</td>
<td>Kruskal-Wallis</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>#3f FHFCHD (nominal/dichotomous)</td>
<td>Mann-Whitney U</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>#3g BMINDX (interval)</td>
<td>Spearman’s correlation</td>
<td>Mann-Whitney U</td>
</tr>
<tr>
<td></td>
<td>BMICAT (nominal)</td>
<td>Kruskal-Wallis</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>#3h DIACAT (nominal/dichotomous)</td>
<td>Mann-Whitney U</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>#3i HTNCAT (nominal/dichotomous)</td>
<td>Mann-Whitney U</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>#3j CHOLCAT (nominal/dichotomous)</td>
<td>Mann-Whitney U</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>#3k ASTCAT (nominal/dichotomous)</td>
<td>Mann-Whitney-U</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>#3l GENSAT (nominal)</td>
<td>Kruskal-Wallis</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>#3m PHEVAL (nominal)</td>
<td>Kruskal-Wallis</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>N/A SITTIN</td>
<td>Spearman’s correlation</td>
<td>Mann-Whitney U</td>
</tr>
</tbody>
</table>
Multivariate Analyses

Multivariate hypotheses related to Research Questions # 2-4 are tested at the multivariate level of data analyses. Binary logistic and multiple linear regression models are the multivariate types of analyses used to in order to predict the outcome variable of HEPA and also help control for confounding variables and rival hypotheses. The predictor variables that emerge as statistically significant at the bivariate level as well as all theoretical model constructs are used in the regression analyses to build binary logistic regression and multiple linear regression models as applicable. In the binary logistic regression analyses, the dependent variable outcome event of HEPA is the nominal-level variable dichotomized as 1: Sufficient (for a health benefit) and 0: Insufficient (for a health benefit). The multiple linear regression analysis uses the ratio-level HEPA variable expressed as total MET minutes per week. (See Table 3.5 and related text under ‘Operational Definition of Variables’).

Binary logistic regression analysis is preferred when the goal of a research is to predict outcome. This form of analysis does not require adherence to any assumption about the distribution of predictor variables (Mertler & Vannatta, 2002). A preliminary Multiple Linear Regression is however carried out to calculate Mahalanobis’ Distance in order to detect and eliminate outliers from analysis (given that regression models are sensitive to outliers (Mertler & Vannatta, 2002). This preliminary multiple regression procedure also permits an evaluation of tolerance or multi-collinearity among the initially selected predictor variables. This is because both binary logistic and multiple linear regression analysis are sensitive to multi-collinearity of predictor variables. The predictor variables or factors identified as redundant are not used in analyses in order to
eliminate the multi-collinear relationships while those that are not eliminated are put in
the models as appropriate.

The final binary logistic regression models are guided by the Nagelkerke pseudo-
$R^2$, Chi square results, odds ratios associated with the predictor variables, and percentage
of correct predictions (sensitivity and specificity) to see how well the statistical models
perform. In the case of the multiple linear regression analyses, the final regression model
is guided by three factors. These are the F-test of significance determining whether the
relationship between the set of independent variables and the dependent variable is large
enough to be meaningful, the multiple correlation ($R$) specifying how much information
about a dependent variable is contained in the combination of independent variables, and
the coefficient of determination ($R^2$) which is the proportion of variance in the dependent
variable that can be explained by a combination of independent variables. (Mertler &
Vannatta, 2002).

A multiple linear regression model tests one of the three multivariate hypotheses
under Research Question #2 relating to the ability of the EPPM to explain a substantial
amount of variance in HEPA equivalent to at least a coefficient of determination of .3.
Binary logistic regression models using EPPM variables only are built to test the other
two multivariate hypotheses relating to Research Question #2. Another logistic regression
model that includes the demographic and health status variables along with the EPPM
variables is next tested in view of the multivariate hypothesis related to Research
Question #3. Predictor variables that remain statistically significant in the model and
contribute to overall predictive power of the regression analyses, as explained by Mertler
and Vannatta (2002) are viewed as predictive of health enhancing physical activity. In
relation to the hypothesis associated with Research Question #4, the EPPM is tested by running three logistic regression models, one for each level of Coronary Heart Disease Risk, that again include the demographic and health status variables along with the EPPM variables.

**Description of the Sample (Independent Variables)**

The sampling frame for this dissertation study constitutes 305 employee survey response records. Data for 262 (85.9%) of the survey questionnaires data records were gathered by the phone survey method and the remainder of 43 (14.1%) response records were gathered from mailed out surveys. Regarding phone surveys, 28 (10.7%) were from male respondents and 234 (89.3%) were from females. Four (9.3%) of the mail surveys were from male respondents and 39 (90.7%) were from females.

**Demographic Characteristics**

Table 3.7 summarizes and displays the demographic characteristics for this dissertation study.
Table 3.7 Description of Sample Demographics

<table>
<thead>
<tr>
<th>Variable</th>
<th>N (%)</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>32 (10.5)</td>
<td>0</td>
</tr>
<tr>
<td>Female</td>
<td>273 (89.5)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-29</td>
<td>33 (10.8)</td>
<td></td>
</tr>
<tr>
<td>30-39</td>
<td>68 (22.3)</td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td>81 (26.6)</td>
<td></td>
</tr>
<tr>
<td>50-59</td>
<td>103 (33.8)</td>
<td></td>
</tr>
<tr>
<td>60-69</td>
<td>20 (6.6)</td>
<td></td>
</tr>
<tr>
<td>Zip code-to-city Region</td>
<td>297 (100)</td>
<td>8</td>
</tr>
<tr>
<td>Region 1</td>
<td>36 (12.1)</td>
<td></td>
</tr>
<tr>
<td>Region 2</td>
<td>136 (45.6)</td>
<td></td>
</tr>
<tr>
<td>Region 3</td>
<td>47 (15.8)</td>
<td></td>
</tr>
<tr>
<td>Region 4</td>
<td>20 (6.7)</td>
<td></td>
</tr>
<tr>
<td>Region 5</td>
<td>18 (6.1)</td>
<td></td>
</tr>
<tr>
<td>Region 6</td>
<td>15 (5.1)</td>
<td></td>
</tr>
<tr>
<td>All Other Regions</td>
<td>25 (8.4)</td>
<td></td>
</tr>
<tr>
<td>Average Income in dollars (zip code as proxy)</td>
<td>279 (100)</td>
<td>26</td>
</tr>
<tr>
<td>$15000 - $24999</td>
<td>12 (4.3)</td>
<td></td>
</tr>
<tr>
<td>$25000 - $34999</td>
<td>34 (12.2)</td>
<td></td>
</tr>
<tr>
<td>$35000 - $44999</td>
<td>73 (26.2)</td>
<td></td>
</tr>
<tr>
<td>$45000 - $54999</td>
<td>115 (41.2)</td>
<td></td>
</tr>
<tr>
<td>$55000 - $64999</td>
<td>31 (11.1)</td>
<td></td>
</tr>
<tr>
<td>$65000+</td>
<td>14 (5.0)</td>
<td></td>
</tr>
</tbody>
</table>
In all, 10.5% (32) of the sample of 305 was male and 89.5% (273) was female. The mean age for the sample was 44.8 (SD= 10.8) and median age was 47 ranging from 22 - 68. This variable was collapsed into five categories by decade for purposes of descriptive statistics. In terms of Zip code as proxy for Physical Environment, the sample (N=297) was stratified into seven zip code-to-city categories including one additional category comprising all other regions. The variable Zip code had an income component-Average household income based on zip code. Mean income [N=279; no available data on 26 (8.5 %)] for average household income using Zip code as proxy as measured by the year 1999 dollars (U.S. Census Bureau, 2000) was $45062 (SD= 10831) and ranged from $15779 to $74900. This variable was also collapsed into six categories by increments of $10,000 for purposes of descriptive statistics.

**Independent Variables other than the EPPM Variables**

Table 3.8 lists the independent variable characteristics (other than the EPPM perception variables) of the sample with their accompanying mean scores or frequencies.
<table>
<thead>
<tr>
<th>Variable</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body Mass Index (BMI)</strong></td>
<td></td>
</tr>
<tr>
<td>Normal (BMI &lt; 25)</td>
<td>24%</td>
</tr>
<tr>
<td>Overweight (25 ≤ BMI &lt; 30)</td>
<td>33%</td>
</tr>
<tr>
<td>Obese (BMI ≥ 30)</td>
<td>43%</td>
</tr>
<tr>
<td><strong>Smoking</strong></td>
<td></td>
</tr>
<tr>
<td>Current smoker</td>
<td>8%</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>10.5%</td>
</tr>
<tr>
<td><strong>Hypertension</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>19%</td>
</tr>
<tr>
<td><strong>High Blood Cholesterol</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>41%</td>
</tr>
<tr>
<td><strong>Asthma</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>12%</td>
</tr>
<tr>
<td><strong>General Satisfaction with Life</strong></td>
<td></td>
</tr>
<tr>
<td>Not satisfied</td>
<td>3.9%</td>
</tr>
<tr>
<td>Partly satisfied</td>
<td>31.5%</td>
</tr>
<tr>
<td>Mostly satisfied</td>
<td>64.6%</td>
</tr>
<tr>
<td><strong>Personal Health Evaluation</strong></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>0.7%</td>
</tr>
<tr>
<td>Fair</td>
<td>14.1%</td>
</tr>
<tr>
<td>Good</td>
<td>63.3%</td>
</tr>
<tr>
<td>Excellent</td>
<td>22.0%</td>
</tr>
<tr>
<td><strong>Coronary Heart Disease (CHD) Risk Level</strong></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>26%</td>
</tr>
<tr>
<td>Moderate</td>
<td>27%</td>
</tr>
<tr>
<td>High</td>
<td>47%</td>
</tr>
<tr>
<td><strong>Family History of CHD</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>36%</td>
</tr>
</tbody>
</table>
The Mean Body Mass Index (BMI) was 29.8 (SD= 6.951) (N=304). When collapsed into the categorical variable of ‘BMI less than 25’, ‘BMI greater than or equal to 25 but less than 30’, and ‘BMI greater than or equal to 30’ the sample was split into 24.3% (74), 32.6% (99), and 43.1% (131) respectively. 8.2% (25) of the sample identified themselves as ‘current smoker’ while 91.8 % (280) did not identify themselves as such.

Overall, 10.5% (32) of respondents were identified as diabetic, 18.7% (57) as hypertensive, 41.3% (126) as individuals with high blood cholesterol levels and 12.4% (37) (N=298) as asthmatic. In terms of general satisfaction with life, 64.6% (197) were mostly satisfied, 31.5% (96) were partly satisfied, and 3.9% (12) were not satisfied. Because of resulting small cell sizes during analysis, this variable was dichotomized as ‘Mostly satisfied’ and ‘Not mostly satisfied’. When asked to rate their own health in line with the four choices given, 22% (67) responded as ‘excellent’, 63.3% (193) as ‘good’, 14.1% (43) as ‘fair’ and 0.7% (2) as ‘poor’. Again, because of the resulting small cell sizes during analysis, the choices of ‘fair’ and ‘poor’ were collapsed into one personal health rating category labeled ‘not good or excellent’.

In terms of other data on independent variables other than the EPPM variables, 26% (77) of the sample were categorized as ‘low’ regarding level of risk for Coronary Heart Disease, 27% (83) as ‘moderate’ and 47% (144) as ‘high’ by following the ACSM guidelines for risk stratification (ACSM, 2000) spelt out earlier in this chapter. Regarding family history of Coronary Heart Disease, 35.7% (109) of the sample responded in the affirmative. One additional variable, captured by the IPAQ was ‘time spent sitting on a week day’. This variable, reported as median values and inter-quartile ranges, was measured by item 9 on the IPAQ (Questionnaire items 1-9, Appendix 2), the instrument
used to survey the sample on HEPA. Though not used in computation of any summary score of HEPA, it is an ‘additional indicator variable of time spent in sedentary activity’ (IPAQ Committee, 2005). The sample median for this variable (N=303) was 360 minutes (IQR=210-480) and the mean was 367.9 minutes (SD=198.9). The relationship between this variable and HEPA when examined in bivariate analyses was found to be statistically significant in its relationship with HEPA as demonstrated by a Spearman’s test of correlation (p< 0.001) and a Mann-Whitney U test (p=0.005).

**EPPM Independent Variables**

The EPPM variables were measured by the 12 RBDS items in the survey questionnaire constituted by items 8-19. Scores for the four subscale measures of Perceived Severity, Susceptibility, Response Efficacy and Self-Efficacy ranged from 3-21. Scoring followed the guidelines provided by Witte et al. (2001). An examination of the frequency distribution of each item and EPPM theoretical variable was carried out to ascertain where members of the sample population fell in terms of their levels of perceived response efficacy, self-efficacy, severity, and susceptibility. Table 3.9 provides a descriptive summary of the EPPM measures.
Table 3.9 Description of EPPM Variables

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<tr>
<th>Construct /Survey RBDS item</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>IQR</th>
<th>% In agreement</th>
<th>% In disagreement</th>
<th>% Neutral</th>
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The EPPM Variable of Perceived Response Efficacy

The average score for Questionnaire items 8-10 constituting the perceived response efficacy subscale was 18.87 (SD= 2.259) with possible scores ranging from 3-21. The median score was 19 (IQR= 18-21). 96.8% (295) of the sample were in agreement (ratings of 5-7) with Questionnaire item 8 which states that accumulating 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week is effective in preventing a heart attack. 91.8% (280) of the sample were in agreement with Questionnaire item 9 which stated that accumulating 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week works in preventing a heart attack. In terms of Questionnaire item 10, 91.5% (279) of the sample were in agreement with the statement ‘If I accumulate 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week, I am less likely to experience a heart attack’.

The EPPM Variable of Perceived Self-Efficacy

The combined scores for Questionnaire items 11-13 constituted the perceived self-efficacy subscale score. The mean score for this subscale was 16.02 (SD= 3.496) and the median was 17 (IQR= 14-19). 81.7% (249) of the sample were in agreement with Questionnaire item 11 which stated ‘I am able to accumulate 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week to prevent
experiencing a heart attack’. 53.4% (163) agreed with Questionnaire item 12 stating ‘it is easy to accumulate 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week to prevent experiencing a heart attack. 85.5% (261) of the sample agreed with Questionnaire item 13. This item statement was ‘I can accumulate 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week to prevent experiencing a heart attack’.

**The EPPM Variable of Perceived Severity**

Questionnaire items 14-16 constituted the perceived severity subscale and the mean score for this subscale was 18.41 (SD= 2.463). The median score was 19 (IQR= 16-21). 61.6% (188) of the sample agreed with Questionnaire item 14 stating ‘I believe that a heart attack is a severe threat to my health’. With Questionnaire item 15 which stated ‘I believe that a heart attack has serious negative consequences’, 95.7% (292) of the sample were in agreement. In response to Questionnaire item 16, 98.7% (301) of the sample agreed with the statement ‘I believe that a heart attack is extremely harmful’.

**The EPPM Variable of Perceived Susceptibility**

Questionnaire items 17-19 scores were summed up to arrive at the perceived susceptibility subscale scores and the mean score for this subscale was 11.40 (SD= 4.521). The median score was 11 (IQR= 8-14.5). Overall, 59% (180) of the perceived susceptibility subscale scores were scores of ‘12’ and below reflecting the perception in general by the sample of low susceptibility to a heart attack. However, 41% of the sample also agreed that they were susceptible to a heart attack to some extent resulting in an
almost even split. Concerning the individual items, 22% (67) of the sample agreed with Questionnaire item 17, which, stated ‘It is likely that I will experience a heart attack’.

With respect to Questionnaire item 18, 41.3% (126) of the sample agreed with the statement ‘I am at risk for experiencing a heart attack’. For Questionnaire item 19, 38.4% (117) of the sample agreed with the statement ‘It is possible that I will experience a heart attack’.

*The EPPM Variables of Perceived Efficacy and Perceived Threat*

The sample mean score on the Perceived Efficacy subscale (made up of the perceived efficacy response subscale and perceived self-efficacy subscale scores combined) was 34.89 (SD= 4.398). The median score was 35 (IQR= 32-38). The sample mean score on the Perceived threat subscale (made up of the perceived severity subscale and perceived susceptibility subscale scores combined) was 29.80 (SD= 5.974) and the median score was 30 (IQR= 25-34).

*The EPPM Interval Discriminating Value Score Variable*

The Interval Discriminating Value score was arrived at by subtracting Perceived Threat scores (made up of the perceived severity subscale and perceived susceptibility subscale scores combined) from Perceived Efficacy scores (made up of the perceived efficacy response subscale and perceived self-efficacy subscale scores combined). The sample Mean Interval Discriminating Value score was 5.08 (SD=7.592) and the median was ‘6’ (IQR= 0-10). The minimum score possible for this value is -36 and the maximum is 36.

A Categorical Discriminating Value variable was created using the Interval Discriminating Value scores. 71.8% (219) had interval discriminating scores that were
positive in value and they were therefore classified as those in 'danger control'. 23% (70) had scores with negative values indicating fear control processes as hypothesized by the EPPM and were thus categorized under 'fear control'. 5.2% (16) of the sample had value scores of '0' which is defined as 'no perceived threat or irrelevant threat' and therefore no motivation to act. They were placed in a category labeled 'no perceived threat'. (Witte et al., 2002-2003).

Reliability of the RBDS and Sub-Scales

It is considered imperative with the use of Likert-type scales, to calculate and report Cronbach’s alpha coefficient for internal consistency reliability regarding scales or subscales (Gliem & Gliem, 2003) and so an internal consistency reliability analysis of the data pertaining to the RBDS summated scales and subscales was also conducted before data analyses begun. The Cronbach’s alpha reliability coefficient for the RBDS subscales of Response Efficacy, Perceived Self-Efficacy, Perceived Severity, and Perceived Susceptibility were 0.5476, 0.6663, 0.2206 and 0.8034 respectively. The reliability coefficient for the Perceived Efficacy (Perceived Response Efficacy and Perceived Self-Efficacy combined items) subscale was 0.5788 and for the Perceived Threat (Perceived Severity and Perceived Susceptibility combined items) subscale, the reliability coefficient was 0.7097. The Cronbach’s alpha reliability coefficient for the overall RBDS used in this study was 0.5704 which is a moderate value according to Morrow et al. (2004). Morrow et al. suggest that such values may indicate that the scale items measured different constructs or that the values were obtained for other reasons such as a small number of items, skewed scores or poorly worded items.
Although a value of 0.7-0.8 is a generally accepted value, values below 0.7, according to Field (2005), can realistically be expected when dealing with psychological constructs because of the diversity of constructs being measured. He adds that these generally accepted guidelines of 0.7-0.8 need to be used with caution because the value of alpha depends on the number of items in the scale and because reliability estimates depend strongly on uni-dimensionality assumptions. Mahon, Yarcheski and Yarcheski (2003) add that low reliability might be expected in as much as each subscale consists of 3-5 items.

The RBDS seemed to have achieved a good balance between brevity and reliability except for the lower level of reliability for the Perceived Severity Scale. Winne and Belfry, as far back as 1982, explain that social desirability response biases can systematically influence responses about oneself. Such systematic determinants of response could add components to the covariance in the observed validity correlations that are not contained in the alpha reliability coefficients. Any tendency for persons to respond differently to different items because of their level of self-concept and the different content in the items contributes to variance in the subscale scores. This component of variance resulting from person-item interaction is treated as a random effect or error in computing alpha coefficients of reliability. The component of variance arising from person-item interaction is, however, not error in the observed validity coefficients. This is because the observed correlations between subscales are based on fixed item content in the sense that the same content was represented in the set of items on each subscale though it varied with respect to response format. Because of this, Winne and Belfry (1982) also caution that yielding to a strong temptation to correct for
attenuation or deflated alpha because the scales were short may lead to considerable uncertainty in knowing how to interpret the disattenuated correlations.

O'Connor (n.d.), with reference to others mentions that the correlation between any two items is affected by both their substantive (content-based) similarity as well as by similarity of their statistical distribution. In addition, he refers to the issue of commonly endorsed items tending to form factors that are distinct from less commonly endorsed items even when all of the items measure the same uni-dimensional latent variable. As a result, some factors may be based solely on item distribution similarity on the one hand, while on the other hand, items may appear multidimensional when in fact they are not. O'Connor finally suggests the combining of test items into mini-scales in this case, and then factoring these mini-scales and/or conducting extension or higher order factor analyses.

Factor Analyses

As a result of low reliability, which is a limitation of this dissertation study, a factor analysis (as summarized in Table 3.10 presenting loadings of the EPPM measures by each component solution) using principal components analysis with varimax rotation was carried out to determine the consistency of the underlying factorial structure existing for the RBDS used in this dissertation study with the predefined multi-item constructs.
### Table 3.10 Factor Analyses - Principal Component Analysis

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<th>Component</th>
<th>Component</th>
<th>Component</th>
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<td>2</td>
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<td>2-Factor Solutions</td>
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</tbody>
</table>
A two factor solution corresponding to a simple structure of threat and efficacy as hypothesized by the EPPM was accepted. Prior to analysis, 10 outliers were eliminated. The analyses produced a two-component higher order solution and a four-component solution for all items. A principal components analysis was applied to each predefined group of items and in each case the analysis yielded a one-component solution. The solutions were evaluated with the criteria of eigenvalue, scree-plot and residuals. With the two factor solution, component 1 consisted of Perceived Susceptibility with a loading of 0.841 and Perceived Severity with a loading of 0.809. The second component had the two remaining variables of Response Efficacy with a loading of 0.753, and Perceived Self-Efficacy with a loading of 0.747.

The RBDS was judged to fit the data adequately and demonstrate construct validity based on the factor analysis. Schmitt (1996) further states that when a measure has other desirable properties such as meaningful content coverage of domains and reasonable uni-dimensionality, a low reliability may not be a major impediment to its’ use. As recommended, however, interpretations in this study include caveats about low reliability and the potential for underestimating any relationships between the EPPM measures and other variables of interest.
CHAPTER FOUR: RESULTS

Research Questions and Testing of Hypotheses

Research Question 1: To what extent do working adults participate in health enhancing physical activity?

Health Enhancing Physical Activity (HEPA) (N=304), was measured both as a continuous (total METs per week) and a dichotomous variable (insufficient/ sufficient HEPA) (Table 4.1). The distribution of the total METs expended per week was severely skewed (skewness 2.022; kurtosis 5.194) and therefore values for the median are reported in addition to the mean. The mean weekly energy expenditure in METs for the sample was 2225 (SD 2216.5) and median was 1508 [Inter-quartile range (IQR) = 728.5 - 2790.9]. When dichotomized, 73% (222) of the sample was categorized under participation in physical activity that was insufficient for a health benefit (insufficient HEPA). The physical activity behavior of 27% (82) was categorized under sufficient HEPA. The median HEPA level for those classified as having insufficient HEPA was 1081 (IQR = 577 - 1652) while that for those classified as having sufficient HEPA was 4641 (IQR = 3252 - 6453).

Table 4.1 Physical Activity Characteristics of Sample

<table>
<thead>
<tr>
<th>Sample Physical Activity Characteristic</th>
<th>% (N)</th>
<th>Median</th>
<th>IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Activity in METs/week</td>
<td>100% (304)</td>
<td>1508</td>
<td>728.5 - 2790.9</td>
</tr>
<tr>
<td>Insufficient HEPA</td>
<td>73% (222)</td>
<td>1081</td>
<td>577 - 1652</td>
</tr>
<tr>
<td>Sufficient HEPA</td>
<td>27 % (82)</td>
<td>4641</td>
<td>3252 - 6453</td>
</tr>
</tbody>
</table>
Research Question 2: To what extent does the Expanded Parallel Process Model (EPPM) explain participation in health enhancing physical activity by working adults who elect to participate in the Health Plan Quality Improvement Program?

Two of the four key EPPM variables, Perceived Self-Efficacy and Perceived Susceptibility significantly correlated with HEPA. Other EPPM related variables that were statistically significant in their correlation with HEPA were Perceived Efficacy and the Discriminating Value score. When HEPA was dichotomized as sufficient and insufficient, Perceived Self-Efficacy was the only one out of the four key EPPM variables to achieve a statistically significant bivariate relationship with HEPA as demonstrated by Mann-Whitney U test statistics.

The only other EPPM related variable to achieve bivariate statistical significance was the Discriminating Value score. In the multivariate phase of hypotheses testing, the binary logistic statistical models incorporating EPPM variables only or with interaction effects that were generated, approached but failed to achieve significance and also explain a substantial amount of the variance in the outcome variable HEPA. Tables showing the results of bivariate analyses are presented by corresponding hypothesis.

Research Question 2 Bivariate Analyses

Hypotheses 2a: Those with higher response efficacy perceptions will be significantly more likely to engage in HEPA.

The data did not support this hypothesis. No significant correlation between response efficacy perceptions and HEPA as measured in METs was found (Table 4.2). There was also no significant difference in perception between those categorized under
insufficient HEPA and those categorized under sufficient HEPA as shown by a Mann-Whitney U test (Table 4.2).

Table 4.2 Results of Testing of Research Question 2: Hypothesis 2a

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Spearman’s test of correlation rho / r²</th>
<th>p value</th>
<th>Mann-Whitney U testing of EPPM variable means by HEPA dichotomous</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Response Efficacy</td>
<td>0.033/ 0.001089</td>
<td>0.567</td>
<td>Insufficient HEPA 18.89 (2.125) Sufficient HEPA 18.83 (2.614)</td>
<td>0.612</td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 2b: Those with higher self-efficacy perceptions will be significantly more likely to engage in HEPA.

There was support for this hypothesis. Results suggest that the correlation between self-efficacy perceptions and HEPA (rho= 0.192, p= 0.001) is statistically significant (Table 4.3). A Mann-Whitney U test indicates that perceptions of self-efficacy held by those categorized as having insufficient HEPA and those categorized under sufficient HEPA are statistically significantly different (p= 0.026). The mean score for those with insufficient HEPA was 15.72 and for those with sufficient HEPA, it was 16.77 (Table 4.3).

Table 4.3 Results of Testing of Research Question 2: Hypothesis 2b

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Spearman’s test of correlation rho / r²</th>
<th>p value</th>
<th>Mann-Whitney U testing of EPPM variable means by HEPA dichotomous</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Self-Efficacy</td>
<td>0.192/ 0.036864</td>
<td>0.001*</td>
<td>Insufficient HEPA 15.72 (3.554) Sufficient HEPA 16.77 (3.206)</td>
<td>0.026*</td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.
Hypotheses 2c: Those with higher severity perceptions will be significantly more likely to engage in HEPA.

The data did not support this hypothesis. There was a negative correlation between severity perceptions and HEPA which was however, not statistically significant (Table 4.4). There was also no significant difference in severity perceptions between those categorized as having insufficient HEPA and those categorized under sufficient HEPA as demonstrated by a Mann-Whitney U test (Table 4.4).

Table 4.4 Results of Testing of Research Question 2: Hypothesis 2c

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Spearman's test of correlation rho/ r²</th>
<th>p value</th>
<th>Mann-Whitney U testing of EPPM variable means by HEPA dichotomous</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Severity</td>
<td>-0.049/ 0.002401</td>
<td>0.395</td>
<td>Insufficient HEPA 18.40 (2.453) Sufficient HEPA 18.39 (2.471)</td>
<td>0.956</td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 2d: Those with higher susceptibility perceptions will be significantly more likely to engage in HEPA.

The data did not support this hypothesis as stated. Results of a test of correlation showed a contrary negative correlation between susceptibility perceptions and HEPA (rho= -0.120, p= 0.036) that was, however, statistically significant (Table 4.5). A Mann-Whitney U test showed the relationship between perceived severity and the sufficiency of HEPA was at a level approaching significance (p= 0.098). The mean score for those with insufficient HEPA was 11.64 (SD= 4.434) and for those with sufficient HEPA, it was 10.79 (SD= 4.721) (Table 4.5).
Table 4.5 Results of Testing of Research Question 2: Hypothesis 2d

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Spearman’s test of correlation rho/ $r^2$</th>
<th>p value</th>
<th>Mann-Whitney U testing of EPPM variable means by HEPA dichotomous</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Susceptibility</td>
<td>-0.120/ 0.0144</td>
<td>0.036*</td>
<td>Insufficient HEPA 11.64 (4.434) Sufficient HEPA 10.79 (4.721)</td>
<td>0.098</td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 2e: There will be an overall effect of efficacy (response efficacy and self-efficacy perceptions) on HEPA.

The data in part supported this hypothesis. The correlation between perceived efficacy and HEPA (rho= 0.161, p= 0.005) was statistically significant but not strong (Table 4.6). The Mann-Whitney U test showed a difference in perceptions between those categorized as having insufficient HEPA and those categorized under sufficient HEPA that was approaching statistical significance (p= 0.082) (Table 4.6).

Table 4.6 Results of Testing of Research Question 2: Hypothesis 2e

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Spearman’s test of correlation rho/ $r^2$</th>
<th>p value</th>
<th>Mann-Whitney U testing of EPPM variable means by HEPA dichotomous</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Efficacy</td>
<td>0.161/ 0.025921</td>
<td>0.005*</td>
<td>Insufficient HEPA 34.60 (4.332) Sufficient HEPA 35.60 (4.510)</td>
<td>0.082</td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 2f: There will be an overall effect of threat (severity and susceptibility perceptions) on HEPA.

The data did not support this hypothesis. The negative correlation between threat perceptions and HEPA obtained borderline statistical significance (rho= -0.109, p= 0.059) (Table 4.7). There was no statistically significant difference in threat perceptions between those categorized as having insufficient HEPA and those
categorized under sufficient HEPA as demonstrated by a Mann-Whitney U test (Table 4.7).

**Table 4.7 Results of Testing of Research Question 2: Hypothesis 2f**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Spearman's test of correlation rho/ r²</th>
<th>p value</th>
<th>Mann-Whitney U testing of EPPM variable means by HEPA dichotomous</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Threat</td>
<td>-0.109/ 0.011881</td>
<td>0.059</td>
<td>Insufficient HEPA 30.05 (5.829) Sufficient HEPA 29.18 (6.376)</td>
<td>0.202</td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 2g: There will be a positive correlation between HEPA and overall ‘Discriminating Value Formula’ ($\Sigma$ efficacy - $\Sigma$ threat) scores on the RBDS.

The data supported this hypothesis. The positive correlation between HEPA levels and overall ‘Discriminating Value’ scores (rho= 0.189, p= 0.001) was statistically significant (Table 4.8). The Mann-Whitney U test also showed a statistically significant difference (p= 0.043) in scores between those categorized as having insufficient HEPA and those categorized as having sufficient HEPA. The mean score for those with insufficient HEPA was 4.56 (SD= 7.294) and for those with sufficient HEPA, it was 6.42 (SD= 8.247) (Table 4.8).

**Table 4.8 Results of Testing of Research Question 2: Hypothesis 2g**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Spearman's test of correlation rho/ r²</th>
<th>p value</th>
<th>Mann-Whitney U testing of EPPM variable means by HEPA dichotomous</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interval Discriminating Value</td>
<td>0.189/ 0.035721</td>
<td>0.001*</td>
<td>Insufficient HEPA 4.56 (7.294) Sufficient HEPA 6.42 (8.247)</td>
<td>0.043*</td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.
Hypotheses 2h: Those in danger control as objectively defined and measured by the RBDS 'Discriminating Value Formula' (Σ efficacy - Σ threat) score will be significantly more likely to have sufficient levels of HEPA compared to those with 'no perceived or irrelevant threat' or those in fear control.

The data did not support this hypothesis. The Kruskal-Wallis test statistic suggests there is no statistically significant difference existing among the three groups (Table 4.9). Chi-square test results indicate there is no statistically significant relationship between the Discriminating Value categorical scores and sufficiency of HEPA (Table 4.9).

Table 4.9 Results of Testing of Research Question 2: Hypothesis 2h

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Kruskal-Wallis test of median HEPA by EPPM variable category</th>
<th>p value</th>
<th>Chi-Square test of association (% Sufficient HEPA by EPPM variable category)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Categorical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discriminating Value</td>
<td>No perceived threat 1258 (14358)</td>
<td>0.227</td>
<td>No perceived threat 19%</td>
<td>0.458</td>
</tr>
<tr>
<td></td>
<td>Fear Control 1253 (10905)</td>
<td></td>
<td>Fear Control 23%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Danger Control 1585 (10638)</td>
<td></td>
<td>Danger Control 29%</td>
<td></td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Research Question 2 Multivariate Analyses

Hypotheses 2i: The EPPM variables considered together in the same model will be better predictors of HEPA than when considered and tested as individual predictors.

Testing the EPPM using the HEPA Dichotomous Outcome Variable

In the testing of the four EPPM variables together in one model, none of the variables emerged as relatively better predictors in this EPPM only multivariate model than when assessed as individual predictors. Perceived Self-Efficacy was the only significant predictor variable in the 'EPPM variables only' multivariate model with a
significance level of $p = 0.027$ and an odds ratio of $1.097$ (Table 4.10). The percentage of correct predictions which was at 73.2 for the null model stayed at 73.2 for the full model for this ‘EPPM variables only’ statistical model and furthermore, the model did not achieve significance ($p = 0.120$). When tested as an individual predictor, the level of significance of the bivariate relationship between Perceived Self-Efficacy and HEPA dichotomized as sufficient and insufficient was $p = 0.026$ as demonstrated by a Mann-Whitney U test (Table 4.3). The other three EPPM variables of Perceived Response Efficacy, Susceptibility, and Severity did not achieve significance as predictors either as individual predictors or when considered together in the ‘EPPM variables only’ multivariate statistical model (Tables 4.2, 4.4, 4.5 and 4.10).

Table 4.10 Results of Binary Logistic Regression Analyses-EPPM Variables

<table>
<thead>
<tr>
<th>EPPM factor</th>
<th>$b$</th>
<th>OR</th>
<th>95%CI</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Response Efficacy</td>
<td>-0.005</td>
<td>0.995</td>
<td>0.833-1.121</td>
<td>0.934</td>
</tr>
<tr>
<td>Perceived Self- Efficacy</td>
<td>0.093</td>
<td>1.097</td>
<td>1.010-1.192</td>
<td>0.027*</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>0.022</td>
<td>1.023</td>
<td>0.912-1.148</td>
<td>0.702</td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>-0.034</td>
<td>0.966</td>
<td>0.907-1.030</td>
<td>0.294</td>
</tr>
</tbody>
</table>

Model Chi Square: 7.326, $p = .120$; Nagelkerke R Square: .035

* Denotes significance at an alpha set at the 0.05 level

Interaction effects of Perceived Response Efficacy and Self-Efficacy as well as that of Perceived Susceptibility and Severity were next introduced in another statistical model and tested along with the four individual EPPM variables only. Relative to the statistical model using only the four key EPPM variables, Perceived Self-Efficacy
dropped out of the regression equation as a statistically significant predictor variable. Perceived Susceptibility (p= 0.044, odds ratio= 0.589) rather, was the only statistically significant predictor variable while the interaction between Perceived Susceptibility and Severity (p= 0.056, odds ratio= 1.026) approached significance (Table 4.11). The percentage of correct predictions which was at 73.2 for the null model increased only to 73.8 for the full model. This statistical model which included interaction effects, however, only approached but did not attain significance (p= 0.085).

**Table 4.11 Results of Binary Logistic Regression Analyses - EPPM and Interaction(*) Variables**

<table>
<thead>
<tr>
<th>EPPM factor</th>
<th>β</th>
<th>OR</th>
<th>95%CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Response Efficacy</td>
<td>-0.050</td>
<td>0.952</td>
<td>0.517-1.750</td>
<td>0.873</td>
</tr>
<tr>
<td>Perceived Self-Efficacy</td>
<td>0.037</td>
<td>1.038</td>
<td>0.519-2.076</td>
<td>0.917</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>-0.212</td>
<td>0.809</td>
<td>0.621-1.053</td>
<td>0.115</td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>-0.530</td>
<td>0.589</td>
<td>0.352-0.985</td>
<td>0.044*</td>
</tr>
<tr>
<td>Perceived Response Efficacy * Perceived Self-Efficacy</td>
<td>0.003</td>
<td>1.003</td>
<td>0.967-1.040</td>
<td>0.884</td>
</tr>
<tr>
<td>Perceived Severity* Perceived Susceptibility</td>
<td>0.026</td>
<td>1.026</td>
<td>0.999-1.054</td>
<td>0.056</td>
</tr>
</tbody>
</table>

Model Chi Square: 11.120, p= .085; Nagelkerke R Square: .053

* Denotes significance at an alpha set at the 0.05 level

*Testing the EPPM using the HEPA Ratio Outcome Variable*

This hypothesis was not supported in analysis. The multiple linear regression analysis performed using the EPPM variables yielded a non-significant model [F (4, 297,) =1.648, p<.05]. With the exception of the variable Perceived Self-Efficacy which had a
regression coefficient contributing to the model at a level approaching significance, none of the other EPPM variables had regression coefficients that were significantly different from zero. A summary of the coefficients for the regression model is presented in Table 4.12 and indicates that none of the four EPPM variables significantly contributed to the model.

**Table 4.12 Coefficients for EPPM Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unstandardized Coefficient B</th>
<th>Standard Error</th>
<th>Standardized Coefficient (beta)</th>
<th>t</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Response Efficacy</td>
<td>11.307</td>
<td>58.661</td>
<td>0.011</td>
<td>0.193</td>
<td>0.847</td>
</tr>
<tr>
<td>Perceived Self-Efficacy</td>
<td>67.773</td>
<td>37.242</td>
<td>0.110</td>
<td>1.874</td>
<td>0.062</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>42.914</td>
<td>57.234</td>
<td>0.048</td>
<td>0.750</td>
<td>0.454</td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>-43.068</td>
<td>31.583</td>
<td>-0.088</td>
<td>-1.364</td>
<td>0.174</td>
</tr>
</tbody>
</table>

Hypotheses 2j: The EPPM will explain a substantial amount of variance in HEPA greater than or equal to a standard of a coefficient of determination of .3 as documented in the physical activity literature.

The hypothesis is rejected as the EPPM variables only statistical model failed to obtain significance in multiple linear regression analysis. In addition, the $R^2$ for this model with the EPPM variables was 0.022 and the Adjusted $R^2$ was 0.009. A summary of this model predicting HEPA is presented in Table 4.13.
Table 4.13 EPPM Model Predicting HEPA

<table>
<thead>
<tr>
<th>R</th>
<th>R²</th>
<th>Adjusted R²</th>
<th>Std. Error of the Estimate</th>
<th>Change Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.147</td>
<td>.022</td>
<td>.009</td>
<td>2206.84964</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.022</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.648</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>297</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.162</td>
</tr>
</tbody>
</table>

Hypotheses 2k: The odds of sufficient HEPA as objectively measured by the IPAQ can be reliably predicted from knowledge of perceptions of severity, susceptibility, response efficacy and self-efficacy and interaction effects of response efficacy and self-efficacy, and severity and susceptibility.

This hypothesis as stated is not supported by the data. In the model using other competing predictor variables along with the EPPM variables, out of the four individual EPPM variables, the odds of HEPA could be reliably predicted from only Perceived Susceptibility (p= 0.024 odds ratio= 0.531). This was disregarded in view of the fact that there was a significant interaction between Perceived Susceptibility and Severity (p= 0.034; odds ratio= 1.031). Perceived Severity (p= 0.088 odds ratio= 0.780) only approached statistical significance as a predictor variable (Table 4.14).
Table 4.14 Results of Binary Logistic Regression Analyses- EPPM and Interaction(*) Variables Plus Additional Covariates

<table>
<thead>
<tr>
<th>Factor</th>
<th>β</th>
<th>OR</th>
<th>95%CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Response Efficacy</td>
<td>-0.115</td>
<td>0.891</td>
<td>0.445-1.785</td>
<td>0.745</td>
</tr>
<tr>
<td>Perceived Self- Efficacy</td>
<td>-0.057</td>
<td>0.945</td>
<td>0.429-2.082</td>
<td>0.889</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>-0.249</td>
<td>0.780</td>
<td>0.586-1.038</td>
<td>0.088</td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>-0.633</td>
<td>0.531</td>
<td>0.307-0.902</td>
<td>0.024*</td>
</tr>
<tr>
<td>Perceived Response Efficacy * Perceived Self- Efficacy</td>
<td>0.007</td>
<td>1.007</td>
<td>0.966-1.049</td>
<td>0.751</td>
</tr>
<tr>
<td>Perceived Severity* Perceived Susceptibility</td>
<td>0.031</td>
<td>1.031</td>
<td>1.002-1.061</td>
<td>0.034*</td>
</tr>
<tr>
<td>Age</td>
<td>0.034</td>
<td>1.035</td>
<td>1.007-1.064</td>
<td>0.015*</td>
</tr>
<tr>
<td>Gender</td>
<td>0.703</td>
<td>0.495</td>
<td>0.210-1.169</td>
<td>0.109</td>
</tr>
<tr>
<td>Smoking</td>
<td>1.029</td>
<td>2.809</td>
<td>1.057-7.404</td>
<td>0.038*</td>
</tr>
<tr>
<td>Sitting</td>
<td>-0.002</td>
<td>0.998</td>
<td>0.997-1.000</td>
<td>0.013</td>
</tr>
</tbody>
</table>

Model Chi Square: 33.808, p= .006; Nagelkerke R Square: .157

* Denotes significance at an alpha set at the 0.05 level

**Research Question 3: To what extent is the EPPM explanation of participation in health enhancing physical activity moderated by demographic and health status variables?**

With the appropriate bivariate statistics for all independent variables completed, those variables that were statistically significant at a level of p= 0.25 were used in multivariate analyses to build a Binary Logistic Regression model along with those with strong theoretical reason to be included. The alpha level of significance was set at 0.05.
Odds ratios were then calculated for Perceived Response Efficacy, Self-Efficacy, Severity, and Susceptibility and their hypothesized interaction effects as well as for the variables of Age, Gender, Coronary Heart Disease Risk, BMI, Smoking Status, Asthma Status, Diabetes Status, General Satisfaction with Life, Personal Health Evaluation, Environment using Zip Code as proxy, and Time spent sitting to determine their influence each on HEPA while controlling for the other variables in the model. The method of survey completion variable was also included to assess if that had an impact on the variance in responses.

The EPPM Discriminating Value, Perceived Efficacy and Perceived Threat were identified as collinear variables during the preliminary multiple regression to assess multicollinearity and identify multivariate outliers and were therefore not included in analyses. The Coronary Heart Disease Risk and Environment using Zip Code as proxy variables did not contribute to the model and were removed from final analyses in the effort to achieve parsimony. The statistical model including the additional covariates was significant (p= 0.006) and explained 15.75% of the variance in outcome. Out of the four individual EPPM variables, the odds of HEPA could still be reliably predicted from only Perceived Susceptibility (p= 0.024) but there was however a significant interaction between Perceived Susceptibility and Severity (p= 0.034). Notably, the statistical model testing only the EPPM variables and interaction effects which also had a significant interaction between Susceptibility and Severity (p= 0.056) occurring was non-significant.
Research Question 3 Bivariate Analyses

Hypotheses 3a: Level of risk for coronary heart disease will be significantly associated with HEPA with high and low levels of risk being significantly associated with lower levels of HEPA compared to medium levels of risk.

The data did not support this hypothesis. The Kruskal-Wallis test statistic suggests there is no statistically significant difference existing among the three risk level groups though the median for low (1539 METs, Range= 14292) and high risk (1341 METs, Range= 10971) was lower than that of the moderate risk group (1692 METs, Range= 12038) as hypothesized (Table 4.15). Chi-square test results also suggest that there is no statistically significant relationship between level of risk for coronary heart disease and sufficiency of HEPA (Table 4.15).

Table 4.15 Results of Testing of Research Question 3: Hypothesis 3a

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Kruskal-Wallis testing of median HEPA by Health Status variable Category</th>
<th>p value</th>
<th>Chi-Square test of association (%) Sufficient HEPA by Health Status variable category</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary Heart Disease risk level</td>
<td>Low 1539 (14292) Moderate 1692 (12038) High 1341 (10971)</td>
<td>0.400</td>
<td>Low 19.5% Moderate 34% High 27%</td>
<td>0.127</td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 3b: Younger adults will be significantly more likely to have higher levels of HEPA compared to older adults.

This hypothesis was partially supported. Age was not significantly correlated with HEPA as measured by energy expenditure in METs (Table 4.16) but Independent-t test results suggested that there was a significant difference in mean age (p= 0.025) between those with sufficient HEPA (47.01, SD= 10.45) and those with insufficient HEPA (43.97,
SD= 10.88) (Table 4.16). A Kruskal Wallis test applied to the sample using age group data was not significant (Table 4.16).

**Table 4.16 Results of Testing of Research Question 3: Hypothesis 3b**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Spearman’s test of correlation rho/ r²</th>
<th>p value</th>
<th>Independent-t test of Demographic variable means by HEPA dichotomous</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronological age</td>
<td>0.043/ 0.001849</td>
<td>0.460</td>
<td>Insufficient HEPA 43.97 (10.88)</td>
<td>0.030*</td>
</tr>
<tr>
<td>Age collapsed into Age Groups</td>
<td></td>
<td></td>
<td>Sufficient HEPA 47.01 (10.45)</td>
<td></td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 3c: Males will be significantly more likely to have sufficient HEPA levels compared to females.

There was support from the data for this hypothesis. A Mann-Whitney U test showed a statistically significant difference between males and females (p=0.030) with respect to HEPA levels (Table 4.17). The median level for males was 1872 METs and that for females was 1440 METs. Chi-square test results showed a statistically significant relationship between gender and sufficiency of HEPA (p=0.048) (Table 4.17).

**Table 4.17 Results of Testing of Research Question 3: Hypothesis 3c**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Mann-Whitney U test of Demographic variable by median HEPA levels</th>
<th>p value</th>
<th>Chi-Square test of association (% Sufficient HEPA by Demographic variable category)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female 1440 (12037) Male 2052 (14278)</td>
<td>0.030*</td>
<td>Female 25% Male 42%</td>
<td>0.048*</td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.
Hypotheses 3d: Zip code-to-city areas of residence with higher levels of mean ‘average household income’ as defined by zip code as proxy for average household income will be significantly more likely to have sufficient HEPA levels.

This hypothesis was rejected because it was not supported by the data. There was no statistically significant difference in HEPA levels among the Zip code-to-city Regions as suggested by the Kruskal-Wallis test statistic (Table 4.18a). Results of chi-square tests for differences in sufficiency of HEPA by Zip code-to-city Regions were also not statistically significant (Table 4.18a). Average income as defined by zipcode did not correlate significantly with HEPA. The sample when dichotomized by sufficiency of HEPA also did not differ significantly in their mean average income as demonstrated by an Independent-t test (Table 4.18b). The Kruskal-Wallis test statistic did not suggest significant differences in HEPA by income groups (Table 4.18b). Because the level of significance for the tests for the Zip code-to-city Regions made the .25 cut off level (p= 0.173; 0.153) for inclusion in multivariate analyses, the Zip code variable was included in the initial stages of multivariate analyses. This variable did not contribute to the prediction of HEPA as a Zip code-to-city Region variable or as a variable reflecting mean ‘average income of Zip code-to-city Region’ and so it was dropped from the models used in the final analyses.
Table 4.18a Results of Testing of Research Question 3: Hypothesis 3d

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Kruskal-Wallis test of median HEPA by Socio-demographic variable category</th>
<th>p value</th>
<th>Chi-Square test of association (%) Sufficient HEPA by Socio-demographic variable category</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment using Zip Code as proxy</td>
<td>Region 1 1408 (10971) Region 2 1572 (10638) Region 3 1413 (8958) Region 4 1241 (6918) Region 5 2121 (6892) Region 6 1017 (4640) All Other Regions 2391 (13991)</td>
<td>0.173</td>
<td>Region 1 22% Region 2 28% Region 3 21% Region 4 30% Region 5 39% Region 6 7% All Other Regions 44%</td>
<td>0.153</td>
</tr>
</tbody>
</table>

N= 296; * Denotes significance at an alpha set at the 0.05 level

Table 4.18b Results of Testing of Research Question 3: Hypothesis 3d

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Spearman's test of correlation rho/ r²</th>
<th>p value</th>
<th>Mann-Whitney U test of Socio-demographic variable by HEPA dichotomous</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average income using Zip Code as proxy</td>
<td>0.048/0.002304</td>
<td>0.428</td>
<td>Insufficient HEPA 44914 (10889) Sufficient HEPA 45344 (10748)</td>
<td>0.728</td>
</tr>
<tr>
<td>Independent Variable</td>
<td>Kruskal-Wallis test of median HEPA by Socio-demographic variable category</td>
<td>p value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average income using Zip Code as proxy</td>
<td>$15000 - $24999 1130 (14298) $25000 - $34999 1413 (7638) $35000 - $44999 1530 (8958) $45000 - $54999 1461 (10971) $55000 - $64999 2190 (6582) $65000+ 1355 (6259)</td>
<td>0.874</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N= 278; * Denotes significance at an alpha set at the 0.05 level

Hypotheses 3e: Those who report smoking will have significantly lower levels of HEPA compared to self-reported non-smokers.

This hypothesis as stated was not supported by the data. A Mann-Whitney U test showed no statistically significant relationship between HEPA levels and smoking status (Table 4.19). The results of a Chi-square test was statistically significant (p=0.045), but contrary to the stated hypothesis (Table 4.19). Those who identified themselves as current
smokers had a median HEPA level of 2210 METs while those not identified as current smokers had a median HEPA level of 1497 METs.

**Table 4.19 Results of Testing of Research Question 3: Hypothesis 3e**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Mann-Whitney U test of median HEPA levels by Health Status variable</th>
<th>p value</th>
<th>Chi-Square test of association (% Sufficient HEPA by Health Status variable category)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1497 (10971)</td>
<td>0.148</td>
<td>No 25%</td>
<td>0.045*</td>
</tr>
<tr>
<td>Yes</td>
<td>2210 (13958)</td>
<td></td>
<td>Yes 44%</td>
<td></td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 3f: Those with a family history of coronary heart disease will have significantly higher levels of HEPA compared to those without a family history.

This hypothesis is not supported by the data. No statistically significant relationship between HEPA levels and family history of coronary heart disease was demonstrated by the Mann-Whitney U test (Table 4.20). The results of a Chi-square test showed no statistically significant differences (Table 4.20).

**Table 4.20 Results of Testing of Research Question 3: Hypothesis 3f**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Mann-Whitney U test of median HEPA levels by Health Status variable</th>
<th>p value</th>
<th>Chi-Square test of association (% Sufficient HEPA by Health Status variable category)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family History of Coronary Heart Disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1519.5 (14358)</td>
<td>0.566</td>
<td>No 28%</td>
<td>0.706</td>
</tr>
<tr>
<td>Yes</td>
<td>1413 (12037)</td>
<td></td>
<td>Yes 26%</td>
<td></td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 3g: There will be a negative association between Body Mass Index (BMI) and HEPA.

This hypothesis is partially supported by the data. The negative correlation between BMI and HEPA levels (rho= -0.130, p= 0.023) was statistically significant.
(Table 4.21). The Mann-Whitney U test did not demonstrate a statistically significant association between BMI and sufficiency of HEPA (Table 4.21). The categorical variable of BMI [categorized as BMI less than 25 and therefore normal; BMI greater than or equal to 25 but less than 30 and thereby considered overweight; and BMI greater than or equal to 30 which is considered obese] was not found to be statistically significant in its relationship with HEPA as suggested by both the Kruskal-Wallis (Table 4.21) and Chi-square test statistic results (Table 4.21).

**Table 4.21 Results of Testing of Research Question 3: Hypothesis 3g**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Spearman’s test of correlation rho/ r²</th>
<th>p value</th>
<th>Mann-Whitney U test of Health Status variable by HEPA dichotomous</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index</td>
<td>-0.130/ 0.0169</td>
<td>0.023*</td>
<td>Insufficient HEPA  28.347 (33.666)  Sufficient HEPA  27.281 (26.562)</td>
<td>0.181</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Kruskal-Wallis test of median HEPA by Health Status variable category</th>
<th>p value</th>
<th>Chi-Square test of association (% Sufficient HEPA by Health Status variable category)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index</td>
<td></td>
<td>0.117</td>
<td>Normal 31%  Overweight 29%  Obese 23%</td>
<td>0.455</td>
</tr>
<tr>
<td>collapsed into Groups</td>
<td>Normal 1643 (10638)  Overweight 1657 (14358)  Obese 1208 (12037)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 3h: Those who report diabetes will have significantly lower levels of HEPA compared to those who do not.

This hypothesis is not supported by the data. Status with regard to diabetes was not found to be statistically significant in its relationship with HEPA as suggested by both the Mann-Whitney U (Table 4.22) and Chi-square test statistic results (Table 4.22).
Hypotheses 3i: There will be a significant association between having hypertension and HEPA.

This hypothesis is not supported by the data. Status with regard to hypertension was not found to be statistically significant in its relationship with HEPA as suggested by both the Mann-Whitney U (Table 4.23) and Chi-square test statistic results (Table 4.23).

**Table 4.23 Results of Testing of Research Question 3: Hypothesis 3i**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Mann-Whitney U test of median HEPA levels by Health Status variable</th>
<th>p value</th>
<th>Chi-Square test of association (% Sufficient HEPA by Health Status variable category)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>No 1470 (14358)  Yes 1626 (8793)</td>
<td>0.944</td>
<td>No 28%  Yes 23%</td>
<td>0.432</td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 3j: Those who report high blood cholesterol will have significantly higher levels of HEPA compared to those who do not.

This hypothesis is not supported by the data. Status with regard to high blood cholesterol was not found to be statistically significant in its relationship with HEPA as suggested by both the Mann-Whitney U (Table 4.24) and Chi-square test statistic results (Table 4.24).
Table 4.24 Results of Testing of Research Question 3: Hypothesis 3j

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Mann-Whitney U test of median HEPA levels by Health Status variable</th>
<th>p value</th>
<th>Chi-Square test of association (% Sufficient HEPA by Health Status variable category)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Blood Cholesterol</td>
<td>No 1470 (14358) Yes 1564 (12037)</td>
<td>0.977</td>
<td>No 26% Yes 29%</td>
<td>0.597</td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 3k: Those who report asthma will be significantly less likely to have sufficient levels of HEPA compared to those who do not.

This hypothesis does not appear to be supported by the data. Status with regard to asthma was not found to be statistically significant in its relationship with HEPA as suggested by both the Mann-Whitney U (Table 4.25) and Chi-square test statistic results (Table 4.25).

Table 4.25 Results of Testing of Research Question 3: Hypothesis 3k

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Mann-Whitney U test of median HEPA levels by Health Status variable</th>
<th>p value</th>
<th>Chi-Square test of association (% Sufficient HEPA by Health Status variable category)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>No 1542.5 (14358) Yes 1306.5 (11873)</td>
<td>0.700</td>
<td>No 26% Yes 35%</td>
<td>0.251</td>
</tr>
</tbody>
</table>

N= 297; * Denotes significance at an alpha set at the 0.05 level.

Hypotheses 3l: General satisfaction with life will be positively associated with HEPA.

This hypothesis is not supported by the data. Status with regard to satisfaction with life was not found to be statistically significant in its relationship with HEPA as suggested by both the Mann-Whitney U test (Table 4.26) and Chi-square test statistic results (Table 4.26).
Table 4.26 Results of Testing of Research Question 3: Hypothesis 31

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Mann-Whitney U testing of median HEPA by Health Status variable category</th>
<th>p value</th>
<th>Chi-Square test of association (% Sufficient HEPA by Health Status variable category)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Satisfaction with Life</td>
<td>Not mostly Satisfied 1349 (8958) Mostly satisfied 1530 (14358)</td>
<td>0.159</td>
<td>Not mostly Satisfied 24% Mostly satisfied 29%</td>
<td>0.398</td>
</tr>
</tbody>
</table>

N= 304; alpha set at the 0.05 level.

Hypotheses 3m: Evaluation of personal health will be positively associated with HEPA.

This hypothesis is supported by the data. Status with regard to evaluation of personal health was found to be statistically significant in its relationship with HEPA as suggested by the Kruskal-Wallis test statistic (p= 0.050) (Table 4.27). Chi-square test statistic results also suggested a statistically significant relationship between evaluation of personal health and sufficiency of HEPA (p= 0.028) (Table 4.27).

Table 4.27 Results of Testing of Research Question 3: Hypothesis 3m

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Kruskal-Wallis testing of median HEPA by Health Status variable category</th>
<th>p value</th>
<th>Chi-Square test of association (% Sufficient HEPA by Health Status variable category)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Health Evaluation</td>
<td>Fair 1294 (7716) Good 1445 (12037) Excellent 1904 (14358)</td>
<td>0.050*</td>
<td>Not good or excellent 29% Good 22% Excellent 40%</td>
<td>0.013*</td>
</tr>
</tbody>
</table>

N= 304; * Denotes significance at an alpha set at the 0.05 level.

Research Question 3 Multivariate Analysis

Hypothesis 3n: When considered in one model, the EPPM variables will be most influential as predictor variables and the demographic and health status variables will not contribute significantly to the prediction of HEPA.
This hypothesis as stated was not substantially supported in analysis. Including demographic and health status variables did contribute significantly to the prediction of HEPA. The statistical model using the overall sample was significant (p = 0.006) and explained 15.7% of the variance by the Nagelkerke Pseudo R². Results showed Age (p = 0.015, odds ratio = 1.035), and being a smoker (p = 0.038, odds ratio = 2.798) emerging as significant predictor variables in addition to Perceived Susceptibility (p = 0.024, odds ratio = 0.531). The influence of Perceived Susceptibility was overlooked in favor of a significant interaction between Perceived Severity and Perceived Susceptibility (p = 0.034, odds ratio = 1.031). The effect of the interaction between perceived severity and perceived susceptibility did not supersede that of age and smoking. Time Spent Sitting (p = 0.013, odds ratio = 0.998) had an odds ratio confidence interval upper boundary limit value close enough to be rounded off as 1.000 as explained by Shields (2004), and, in the context of this dissertation study was taken only as a finding of statistical but not theoretical significance. (Table 4.14).

*Research Question 4: Does the EPPM perform differently with people who are at different levels of coronary artery disease risk as objectively defined by the American College of Sports Medicine (ACSM)?*

A statistical model similar to the one built for the overall sample and used in binary logistic regression to answer research question two was built. This statistical model, which included significant predictor variables in addition to the EPPM variables, was separately run against sample subgroups characterized by Coronary Heart Disease risk levels to assess the extent to which the predictor variables predicted HEPA outcome in individuals at different levels of risk. The theoretical model seemed to perform
partially for individuals characterized as low or medium in their risk for Coronary Heart Disease but not for those with a high level of risk.

**Research Question 4 Multivariate Analyses**

4a) Prediction of HEPA by the EPPM variables will be similar for people who are at different levels of coronary artery disease risk as objectively defined by the ACSM.

For the sub-sample with a low level of risk, the model was significant (p = 0.011). In terms of the EPPM, only the variable of Perceived Response Efficacy (p = 0.029, odds ratio = 0.124) emerged as a significant predictor variable. An interaction between Perceived Response Efficacy and Self-Efficacy (p = 0.055, odds ratio = 1.105) approached but did not obtain significance. Gender (p = 0.026, odds ratio = 0.003) and Age (p = 0.038, odds ratio = 1.161) were the only other significant predictors in the model while Personal Evaluation of Health (p = 0.094, odds ratio = 6.509) approached but did not achieve significance (Table 4.28). Using the Nagelkerke Pseudo R2 as an overall measure of the explanatory power of logistic regression models, this model accounted for 54% of the variance in the odds that an individual will engage in sufficient HEPA and increased the percentage of correct predictions from 80.3% in the null model to 84% in the full model.

The overall statistical model was also significant for those with a moderate level of risk (p = 0.004). The EPPM variables of Perceived Self-Efficacy (p = 0.041, odds ratio = 25.259), Perceived Severity (p = 0.020, odds ratio = 0.329) and Perceived Susceptibility (p = 0.005, odds ratio = 0.107) achieved statistical significance as predictors in the model. The influence of Perceived Susceptibility and Severity individually was however overlooked in favor of a significant interaction between them that was statistically
significant (p = 0.005, odds ratio = 1.127). Perceived Response Efficacy was the only key EPPM variable that did not emerge as a statistically significant predictor though it did approach but fail to achieve significance (p = 0.068, odds ratio = 11.153). The interaction of Perceived Response Efficacy with Perceived Self-Efficacy (p = 0.051, odds ratio = 0.859) also approached but did not obtain significance. Diabetes status (p = 0.038, odds ratio = 7.738) was the only non-EPPM variable that achieved statistical significance as a predictor in the model while Health Status of Asthma (p = 0.090, odds ratio = 13.830) approached but did not obtain significance (Table 4.28). The statistical model accounted for 48.6% of the variance and improved the percentage of correct predictions from 65.4% in the null model to 82.7% in the full model.

In the case of the sub-sample with a high level of risk, the only significant predictor variables that emerged were Time Spent Sitting (p = 0.009, odds ratio = 0.997) Smoking (p = 0.09, odds ratio = 3.875) approached but did not obtain significance (Table 4.28). The overall statistical model more importantly was not significant (p = 0.239).
Table 4.28 Results of Binary Logistic Regression Multivariate Analyses using Samples Stratified by Risk for Coronary Heart Disease

<table>
<thead>
<tr>
<th>Factor</th>
<th>Sub-sample with Low risk</th>
<th>Sub-sample with Moderate risk</th>
<th>Sub-sample with High risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>OR</td>
<td>95%CI</td>
</tr>
<tr>
<td>Response Efficacy</td>
<td>-2.087</td>
<td>.124</td>
<td>.019-.811</td>
</tr>
<tr>
<td>Severity</td>
<td>-.749</td>
<td>.473</td>
<td>.136-1.638</td>
</tr>
<tr>
<td>Susceptibility</td>
<td>-1.167</td>
<td>.311</td>
<td>.019-5.122</td>
</tr>
<tr>
<td>Response Efficacy * Self-Efficacy</td>
<td>.100</td>
<td>1.105</td>
<td>.998-1.223</td>
</tr>
<tr>
<td>Severity * Susceptibility</td>
<td>.059</td>
<td>1.060</td>
<td>.911-1.223</td>
</tr>
<tr>
<td>Age</td>
<td>.149</td>
<td>1.161</td>
<td>1.009-1.336</td>
</tr>
<tr>
<td>Gender</td>
<td>-5.889</td>
<td>.003</td>
<td>.000-48.8</td>
</tr>
<tr>
<td>Sitting</td>
<td>-.054</td>
<td>.006</td>
<td>.989-1.001</td>
</tr>
</tbody>
</table>

Model Chi Square: 31.605, p=.540 Model Chi Square: 35.175, p=.486 Model Chi Square: 19.595, p=.540

* Denotes significance at an alpha set at the 0.05 level.
CHAPTER V: DISCUSSION AND CONCLUSION

Overview

This chapter discusses the extent to which the results of data analyses in this dissertation study support the Expanded Parallel Process Model (EPPM). Recommendations pertaining to research and professional practice as applied to the field of health promotion and the domain of physical activity in particular are also offered. This dissertation study examined secondary data consisting of records of responses from a sample of working adults obtained through cross-sectional survey. The dissertation study involved analyses of data on self-reported demographics, physical activity levels, health status characteristics and perceptions measured on a Likert-type scale. The perceptions measured covered the threat to one’s health that a heart attack poses in terms of severity and one’s susceptibility as well as perceptions about the effectiveness of physical activity to reduce or avert this threat and one’s ability to engage in the required amount of physical activity to obtain this health benefit. The dissertation study sought to assess whether these perceptions are related to meeting health enhancing physical activity requirements. Overall, the results of data analyses offer limited and weak support for the use of the EPPM to explain differences in health enhancing physical activity (HEPA) behavior of working adults.

Health Enhancing Physical Activity Data Summary

Physical Activity in this dissertation study was measured in terms of energy expenditure and expressed in metabolic equivalents (METs). Stutts (2002) reported that few studies exist in which physical activity is reported in MET levels, making comparison of findings with those of other studies difficult. Regardless of this, the
physical activity behavior data (73% with insufficient HEPA) examined in this
dissertation study was found to have a pattern similar to findings reported in the literature
(Martin et al., 2000; Hootman, Macera, Ham, Helmick, & Sniezek, 2003; Barnes &
Schoeborn, 2003; Morrow et al., 2004; Caban-Martinez et al., 2007) in terms of the
descriptive statistics on adequacy of physical activity or sedentary lifestyle. These studies
found in the literature, in general, indicate that about seven in ten American adults do not
regularly engage in physical activity described as meeting recommended levels, adequate,
or sufficient to achieve a health benefit. and only about one in five engage in a high level
of overall physical activity which includes work and leisure time.

The National Center for Health Statistics (Barnes & Schoeborn, 2003), after
interviewing 32,000 adults aged 18 and older in 2000, concluded there had been no
significant change in the percentage of adults who were physically active in their leisure
time since the 1997-1998 National Health Interview Surveys were conducted. The
evaluation of over 153,000 U.S. workers participating in National Health Interview
Surveys from 1997 to 2004 by Caban-Martinez et al. (2007) also revealed 'no significant
upward or downward' prevalence trends in leisure-time physical activity among U.S.
workers over that time period. In terms of meeting the recommended 'Healthy People
2010' leisure-time physical activity guidelines, the analyses of data by Caban-Martinez et
al. indicated 'sub-optimal leisure-time physical activity levels among all major U.S.
worker groups' though there was substantial variability across occupations. Another
consideration is that the percentage of working adults in low physical activity
occupations increased from 23% in 1950 to 41% in 2000 while those in high activity
occupations decreased from 30% to 23% (Brownson et al., 2005) in the same time frame.
The physical activity behavior data of the sample in this dissertation study in this context brings up the productivity of working adults as a health related issue that cannot be taken for granted especially if they are viewed as a target population for the development of coronary heart disease (Rennie et al., 2003). There is a need for continued promotion of strategies and highlighting of opportunities to increase physical activity among adults in their workplaces and respective communities by health promotion professionals.

**Impact of EPPM Variables on HEPA**

The results of bivariate and multivariate analyses in this dissertation study do not provide substantial support for the EPPM as a predictive model for HEPA. The four EPPM component variables examined were not consistently related to HEPA outcomes and the hypotheses evaluated in the dissertation study in general, were only partly upheld. Consistent with the literature (Miller, Stewart, Trost, & Brown, 2002; Stutts, 2002; Trost et al., 2002), those with higher levels of self-efficacy were more likely to have higher levels of physical activity or levels considered sufficient for a health benefit. Bivariate analysis of data indicated that perceptions of self-efficacy towards physical activity were significantly correlated with the HEPA ratio variable and those categorized as having sufficient HEPA had a median HEPA level slightly higher than those categorized as having insufficient HEPA.

At the multivariate level of analysis, an overall model with all four EPPM variables in which Self-Efficacy perceptions emerged as the only predictor of sufficiency of HEPA, failed itself to attain significance however. When the effects of threat (interaction between Perceived Severity and Susceptibility) and efficacy (interaction between Perceived Response Efficacy and Self-Efficacy) were addressed as well together
with the four EPPM variables in the same model, Perceived Self-Efficacy failed to retain its influence as a significant predictor giving way rather to Perceived Susceptibility as the only statistically significant predictor variable. An interaction between Perceived Susceptibility and Severity approached significance and the overall model also only approached significance. When the EPPM was next tested in the presence of other competing predictor variables, the odds of HEPA could be reliably predicted from only Perceived Susceptibility where individuals were about half as likely to have sufficient HEPA for every unit increase in perceptions of susceptibility. The interaction between Perceived Susceptibility and Severity this time attained significance though the odds ratio was not far from 1.000 (odds ratio= 1.031) indicating that the influence as a predictor on engaging in sufficient HEPA was weak.

The literature does contain some studies with findings (Castro, Sallis, Hickman, Lee, & Chen, 1999; Pinto, Lynn, Marcus, DePue, & Goldstein, 2001) contrary to the hypothesis of a positive relationship between self-efficacy and physical activity or to the hypothesis of self efficacy as a mediator of physical activity. Lewis et al. (2002) surmised that a possible explanation for the effects of self-efficacy as a mediator going in the opposite direction as hypothesized in the study by Castro et al. (1999) was that the participants may have become more realistic in their expectations and therefore more accurate in their estimation of their self-efficacy towards maintenance of physical activity. The amount of difficulty associated with carrying out preventive actions has indeed been demonstrated to be an aspect in decision making that is frequently underestimated (Weinstein, 1999). Pinto et al. (2001) did not find self-efficacy to be a mediator of physical activity behavior change in a primary care setting.
Bauman et al. (2002) point out, in this context of mixed findings, that theoretical variables operate in different ways under different circumstances and that this is especially so when it comes to behavioral research. Using self-efficacy as an example, they explain that with one set of circumstances, it could act as a mediator with the result being that a change in self-efficacy would lead to increases in physical activity. In other circumstances, self-efficacy could act as a moderator that modifies the effect of another variable on physical activity to produce different effects for people at different levels of self-efficacy. Self-efficacy could yet again act as a confounder where confounding aspects would be evident, for instance, in a study in which individuals with increased self-efficacy are likely to participate. (Bauman et al., 2002).

Considering that the overall regression model in which self-efficacy emerged as a significant predictor was not significant itself in the modeling of HEPA and that the sample self-efficacy mean was 16.02 (SD= 3.496) with possible scores ranging from 3-21, it could have been that the findings in this dissertation study regarding self-efficacy are due to the confounding effects of the variable. The intervention group sample that generated the secondary data used in this dissertation study can be ultimately considered as a self-selected sample. This is because opting to participate in the study initially was on a voluntary basis though subsequent selection into the intervention group occurred through randomization. On the other hand, it could be that the additive influence of beliefs about susceptibility and severity had a moderating effect on that of self-efficacy. Thus it may have taken the introduction of interactive effects of these variables in analyses to make either of these effects discussed apparent.
Another EPPM related variable that emerged as statistically significant at the bivariate level of analyses was the ‘Discriminating Value’ score. This variable was positively correlated with the HEPA ratio variable and those categorized as having insufficient HEPA had a mean ‘Discriminating Value’ score that was significantly lower than that of those categorized as having sufficient HEPA. This variable was identified as collinear with the four key EPPM variables and was therefore not included in multivariate analyses. According to the theory behind the EPPM, the numerical ‘Discriminating Value’ is a hypothetical value offering a rough distinction between those in fear control with negative value scores (reject the implicit recommendation to reduce the threat) and those in danger control with positive value scores (accept the implicit recommendation to reduce the threat). If there is no threat perceived, there is no response to the threat hence, ‘0’ levels of acceptance of the implicit recommendation on how to reduce the threat. The Interval Discriminating Value score was arrived at by subtracting Perceived Threat scores (made up of the perceived severity subscale and perceived susceptibility subscale scores combined) from Perceived Efficacy scores (made up of the perceived efficacy response subscale and perceived self-efficacy subscale scores combined) [Witte et al., 2001].

As a group, the sample studied in this dissertation study had an average ‘Discriminating Value’ score of 5.08 (SD=7.592) and the median was ‘6’ (IQR= 0-10). The minimum score possible for this value was -36 and the maximum was 36 and therefore this score, though positive, is not high on the continuum of danger control. Also, 71.8% (219) of the sample had interval discriminating scores that were positive in value and were therefore classified as being in ‘danger control’ while only 5.2% (16) had
value scores of ‘0’ which is defined as ‘no perceived threat or irrelevant threat’ and therefore no motivation to act. In Table 2.1 showing a chart of the EPPM variables, expected responses and message strategies, individuals with low threat and high efficacy perceptions are depicted as those who tend to exhibit some protective action but have little motivation to act and therefore reflect a lesser amount of danger control (Witte et al., 2002-2003). In view of a sample mean ‘Discriminating Value’ score that is low on the positive continuum closer to ‘0’ than to 36 and the fact that the majority of the sample were classified under danger control (implying that efficacy was high), the sample, as a group, may well be classified as one that had little motivation to engage in HEPA, because they were low on threat and high on efficacy.

This assertion is borne out by an examination of the descriptive data on the sample EPPM measures. The sample mean score on the severity subscale was 18.41 (SD=2.463) and the median was 19 (IQR=16-21). This reflects a perception in general by the sample that a heart attack was a severe threat to one’s health. The sample as a whole, on the other hand had a low mean score (defined as scores of 12 and below) of 11.40 (SD=4.521) on the perceived susceptibility subscale and a median score of 11 (IQR=8-14.5). Though 41% of the sample had scores reflecting agreement with the perception that they were susceptible to a heart attack, 51% of the scores were scores of ‘12 and below’ reflecting the perception in general by the sample of low susceptibility to a heart attack. This may explain why the odds ratios calculated, though significant, had low values when it came to the effect of Perceived Susceptibility or the effect of its interaction with Perceived Severity. The sample as a whole may therefore not have considered itself as being threatened by the possibility of a heart attack (in terms of
susceptibility though it was considered a severe event) even though respondents seemed self-assured that they could do whatever was required regardless of their level of susceptibility as reflected by the uniformly high scores regarding efficacy perceptions.

In an effort to address the issue of current theories failing to predict either behavior, or behavior change at high enough levels, Baranowski et al. (1998) draw attention to the common practice of estimating relationships between mediating variables and behavior from cross-sectional data. They indicate that a possible problem with this is that the relationships estimated by cross-sectional data may be really due to some other common antecedent variables and not be causally related. Alternatively, the relationships obtained in cross-sectional data may be functionally different in longitudinal studies.

Daniel and Messer (2002) for instance found that while previous research with cross-sectional designs mostly observed the link between level of perceptions of severity of diabetes complications and glycemic control as reflected by ‘healthful’ glycated hemoglobin concentrations (HbA1c) to be inversely related, results of their longitudinal study yielded different findings. Despite lack of evidence of a relationship between baseline perceptions of the severity of diabetes and baseline HbA1c concentrations, the baseline perceptions did predict desired reduced HbA1c concentrations at the 18-month follow-up and at that same point in time, follow-up perceptions of the severity of diabetes were also related to ‘healthful’ as well as reduced HbA1c concentrations (Daniel & Messer, 2002). Given that the secondary data came from an intervention group sample, it could have been that a longitudinal study design approach applied to this dissertation study would have yielded findings [such as results reflecting a sample adjustment of perceptions to become more realistic or changes in health enhancing physical activity
(HEPA) behavior corresponding with changes in the measures of the Expanded Parallel Process Model (EPPM) theoretical variables] that would have added more to current understanding about physical activity behavior.

The EPPM suggests that danger control responses should be more prominent than fear control for those performing a desired behavior (Witte, 1994). Because the sample in general perceived a heart attack as a severe threat, it is possible that fear control processes such as denial or reactance as a result of perceived manipulation by respondents may have been present and may have influenced responses on susceptibility or else, there was an effect of optimistic bias. However, both the concept and the measurement of fear control processes other than the outcome of engaging in insufficient HEPA were missing from the survey and thus, the dissertation study. The low scores on susceptibility draw attention to the concept of optimistic bias possibly playing a role. Reactance on the other hand could have been elicited if certain respondents perceived that the likelihood of experiencing a heart attack was manipulated in the phrasing of questionnaire items so as to appear exaggerated in the survey. This could have been triggered by what is referred to as the concept of social desirability/undesirability. If an item is phrased in a socially undesirable direction to the extent that agreeing with the items could be perceived as pointing to the existence of a problem or a need for intervention, then that item may appear to some people as intrusive leading to the likelihood that they will minimize or underreport the issue (Nitko, n.d.).

It is possible that the low reliability coefficient of the Perceived Severity subscale was a result of inconsistent reasoning by the sample due to social undesirability of items. Indeed the factor analysis conducted on the underlying structure of the Risk Behavior
Diagnosis Scale predefined constructs shows that for the four-factor solution, there was an inclination for Questionnaire item 14 measuring perceived severity to load more strongly onto the same component as Questionnaire items 17-19 that measured perceived susceptibility. Questionnaire item 14 nevertheless had a salient loading [defined as greater than 0.30 (McIntosh & Fischer, 2000; Li & Ford, 2007)] of 0.414 along with Questionnaire items 15 (0.823) and 16 (0.772) in a 1-factor solution. Questionnaire item 14 stated ‘I believe that a heart attack is a severe threat to my health’ and 62% (188) of the sample were in agreement while 12% (36) had neutral responses. Of the 26% (81) who were in disagreement with this item, almost 50% (40) had a rating of ‘2’ on a continuum of 1-7 with 1 reflecting strong disagreement and this again underscores the sample perception in general of low susceptibility. For a population such as this, Witte et al. (2001) state that it is important to break through the ‘invulnerability barriers with high perceived susceptibility messages’ though ‘any attempt to increase perceptions of threat should be accompanied by messages increasing perceptions of efficacy as well’ (Witte et al., 2001; pg. 75).

The sample mean score for Questionnaire item 14 was 4.97 (SD=2.043) and the median was 5 (IQR=3-7). This contrasts with the mean scores for the other two items (Questionnaire items 15 & 16) that measured Perceived Severity as well. Both of these items had mean scores greater than ‘6’ with standard deviations less than 1.0, and median scores of ‘7’ with inter quartile ranges of 7-7. The tendency for people to respond differently to an item because of their level of self-concept and the content in the item, as discussed earlier in chapter three, contributes to variance in subscale scores (Winne & Belfry, 1982). Such variance resulting from person-item interaction are treated as random
error as far as alpha coefficients of internal consistency reliability are concerned whereas the internal consistency reliability values may actually have been constrained by inconsistent reasoning on the items on the part of the sample. In such cases, a better measure of reliability according to Lane-Getaz (2007) might be a test-retest correlation for stability rather than internal consistency.

The idea of a test-retest correlation for stability as a more suitable measure of reliability brings up the issue again of longitudinal studies. It has been stated that the first step in examining ‘new mediators or mediators with little or mixed support’ should be an examination of whether an intervention produces changes in a theoretical construct as opposed to use of a control group (Lewis et al., 2002). This helps to avoid the ‘premature’ step of conducting ‘full analysis of mediators before the effect of the intervention on the potential mediator is established’ (Lewis et al., 2002. pg 33). The relationship between mediating theoretical variables and the behavior they are hypothesized to predict can be expressed in terms of this change according to Baranowski et al. (1998) and change in the theoretical variables related to a behavior should result in change in the behavior.

Baranowski et al. (1998) note that interventions demonstrated to have an effect on behavior change but not on the selected mediating variables such as exercise related beliefs will provide opportunity to examine other potential mediating variables. Baranowski et al. also suggest that a primary value of ‘focusing on effecting change in mediating variables’ is a reduction in the cost of such developmental research. They maintain that mediators should be easier to change than behavior and therefore research demonstrating change in mediating variables will take relatively shorter periods of time.
and smaller samples. To this end they advocate that intervention research such as the larger health plan Quality Improvement Study that generated the secondary data used in this dissertation study must ‘focus more carefully on understanding mediating mechanisms’.

An example of a study examining mediating variables and involving the Expanded Parallel Process Model (EPPM) was conducted by Gore and Bracken (2005). This study found a pattern of results consistent with the main predictions of the EPPM in that it demonstrated that a high efficacy/no threat message almost had no effect on attitude towards meningitis vaccination (as evidenced by post-test scores) for respondents who held danger control responses (as reflected by pre-test scores) while the same message moved those with pre-test fear responses toward post-test danger control responses. On the other hand, respondents with negative pre-test discriminating value scores indicating fear control responses scored even higher in terms of negative discriminating value scores indicating they had moved further into fear control after exposure to a high threat/no efficacy message health risk message about meningitis (Gore & Bracken, 2005). This dissertation study only examined data that were gathered on a cross-sectional basis and as such could not fully test the predictive ability of the EPPM as a process theory.

Other Findings: Impact of Socio-Demographic and Other Health Status Variables

Baranowski et al. (1998) have indicated that one of the ways to conduct substantially more basic behavioral and social science research is to stratify samples on variables that may have a moderating effect on the predictive ability of models or the effects of possible interventions. Another way is to assess the co-occurrence of physical
activity and other health related behaviors and the factors influencing such co-occurrence. This dissertation study examined the moderating effect of a number of socio-demographic and health status related variables to the extent permitted by the variables available in the secondary data set and the overall goals of this dissertation study.

**Impact of Socio-Demographic Variables on HEPA**

Analyses of data provide support for only one out of the four socio-demographic relationships with HEPA that were examined in this dissertation study. Bivariate analyses showed a statistically significant difference between males and females with males having higher values with respect to both levels of physical activity and the gender percentage with physical activity that was sufficient for a health benefit. This is consistent with the repeatedly documented positive association of male gender with physical activity found in the literature on physical activity behavior in adults (Martin et al., 2000; Bauman et al., 2002; Trost et al., 2002; Caban-Martinez et al., 2007) though a study by Klesges (as cited in Stutts, 2002) suggested that men had a tendency to over-represent activity levels.

The data, when analyzed at the bivariate level, was not supportive of the hypothesis that younger adults are more likely to have higher levels of HEPA compared to older adults. In general, age is reported as having an inverse relationship with physical activity in the literature (Brownson, Eyler, King, Brown, Shyu, & Sallis, 2000; Salmon, Owen, Bauman, Schmitz & Booth, 2000; Bauman et al., 2002; Stang, 2002; Haase et al., 2004). Age, in this dissertation study, was not significantly correlated with HEPA levels as measured in METs. The mean age for those with sufficient HEPA was slightly but nevertheless higher than that of those with insufficient HEPA. Though age is reported in
the literature as another most consistent demographic correlate of physical activity behavior for adults in addition to gender (Trost et al., 2002), Martin et al. (2000) found age, overall, not to be significantly associated with meeting CDC/ American College of Sports Medicine recommended guidelines for physical activity. Martin et al. did observe though that there was some association between older age and the failure to meet physical activity guidelines.

In this dissertation study, though the tendency was for median HEPA levels to decrease as age group moved by decade from 18-29 to that of 30-39 and increase in the 40-49 age group, HEPA levels consistently decreased with age group by decade thereafter. One reason for this trend, though not significant, could be the fact that those in the 30-39 age group, especially women, are in a life-stage where they often ‘decrease or suspend their participation in leisure pursuits, including physical activity’ as a result of physiological and psychological transitions (such as managing young families or simultaneously caring for aging relatives) which put them under increased stress and leave them with limited personal time (Dearden & Sheahan, 2002; Miller et al., 2002).

In this dissertation study, no significant relationships were found between HEPA and the Zip code variable which was examined in two ways- as a proxy for the physical environment and also as a proxy for average household income. In the literature, an examination of the relationship between degree of sprawl within counties or metropolitan areas and physical activity revealed stronger relationships at the county-level analysis compared to those found at the larger-scale metropolitan level of analysis in addition to overall findings that ‘urban form’ could be significantly related to some forms of physical activity such as walking (Ewing, Schmid, Killingsworth, Zlot & Raudenbush, 2003). This
finding by Ewing et al. (2003) was considered to be in keeping with the view that a county environment was more representative of the ‘actual day-to-day environment’ residents of an area are exposed to because at the metropolitan level, the overall environmental would consist of multiple counties that may vary in aspects of the built environment such as being a centrally located or outlying county. It was also implied that the ‘explanatory power of variables to predict outcomes’ has the potential to improve as research shifts downwards to the community and neighborhood levels from that of the county and metropolitan levels (Ewing et al., 2003).

This dissertation study examined data based on a five-digit postal zip code to explore the relationship between the variable and HEPA. On account of potential problems in analysis due to small cell sizes, some zip code areas had to be combined making it more difficult to detect differences if any between areas of residence. Along the line of thought offered by Ewing et al. (2003), use of data based on a nine-digit postal zip code may have permitted the detection of differences that were subtle enough to have been missed in analysis of data at the five-digit postal zip code level of analysis. Regarding this dissertation study results on the use of zip code data to explore the relationship between income and physical activity, the relationship between household annual income and meeting physical activity guidelines was reported in the literature, by Martin et al. (2000) as only approaching statistical significance. Librett, Yore, Schmid, and Kohl (2006) also reported that though the literature appears to have established the notion that income is correlated with physical activity levels, no association was found in their study between income and physical activity levels.
Impact of Health Status Variables on HEPA

The co-occurrence of physical activity and other health related variables such as smoking, family history of coronary heart disease, body mass index (BMI), diabetes, hypertension, high blood cholesterol, asthma, general satisfaction with life, personal health evaluation, and level of risk for coronary heart disease were also examined in this dissertation study. Contrary to the stated hypothesis on smoking in this dissertation study, self-reported smokers had higher health enhancing physical activity (HEPA) levels compared to those not identified as smokers. This finding is inconsistent with the conclusion arrived at by Trost et al. (2002) in their review and update of the correlates of physical activity which was that there had been a shift from a repeated demonstration of non-association to repeated documentation of a negative association with physical activity. Another systematic review conducted to better understand the co-occurrence of smoking and physical activity also points in general to levels of smoking having an inverse relationship with physical activity in adult populations though such a generalization was made with caution (Kaczynski, Manske, Mannell & Grewell, 2008).

Kaczynski et al. (2008) had found an inverse relationship between smoking and physical activity to be the case in about 60% of the fifty articles reporting empirical relationships that were reviewed. The studies making up 40% of the articles, when reviewed, had findings on the association between smoking and physical activity that were either ‘positive, mixed or non significant’. A reason offered as to why such contradictory results seem to ‘co-exist’ by Ward et al. (as cited in Kaczynski et al., 2008) is that individuals who, in general, are conscious of their health but however do smoke may tend to use physical activity as a means of reducing the risk to their health that
smoking poses or else smoking may be employed as a means of controlling weight gain. Another study suggests that such contradictory results found in the literature may be due to lack of consideration of the differences due to gender (Akamatsu, Nakamaru & Shirakawa, 2005). Akamatsu et al. (2005) found that among males who exercised regularly, there were more ex-smokers than smokers while in the case of females, smokers exercised more actively than non-smokers even after controlling for confounding factors.

In terms of smokers versus ex-smokers, Kaczynski et al. (2008) also discuss a study by Boyle et al. (as cited in Kaczynski et al., 2008) which used a ‘stages of change’ classification system for smoking as a variable and found that those preparing to give up smoking were significantly more likely to have exercised within the past week compared to those who were in the maintenance stage having quit smoking for six or more months. On the other hand, those who were in a pre-contemplation stage regarding the quitting of smoking were significantly less likely to have exercised within the past week compared to those who were in the maintenance stage (Boyle et al. as cited in Kaczynski et al., 2008). This dissertation study was not able to distinguish between current, former and never-smokers. A more expansive breakdown of smoking status and also more attention paid to the possible influence of gender differences may have helped to elucidate and make the understanding of the association of smoking with physical activity more clear-cut. This is therefore an issue that can be addressed in future research.

Family history of coronary heart disease, diabetes, hypertension, high blood cholesterol, and asthma were not found to be significantly associated with HEPA. These results of analyses are consistent with findings from a study by Frank et al. (2004) in
which bivariate analysis of data demonstrated that personal history of hypertension, of high blood cholesterol, of diabetes or family history of cardiovascular disease were not related to personal exercise habits. Another study also concluded that though physical inactivity is associated with obesity, hypertension and diabetes, this association is not always significant in women (Sobngwi et al., 2002). As far as diabetes is concerned, a study (Thomas, Alder & Leese, 2004) on barriers to physical activity in patients with diabetes in the United Kingdom yielded percentages (23% active) similar to the pattern of physical activity found in this dissertation study. Thomas et al. (2004) observed that this level of inactivity in the United Kingdom diabetes population had not improved since 1990 and was also similar to that observed more recently in the U.S. The dissertation study findings regarding asthma are also consistent with that of Ford, Heath, Mannino, and Redd (2003) in which asthma status did not significantly predict achievement of recommended levels of physical activity.

In the case of the dissertation study findings regarding Body Mass Index (BMI) and personal health evaluation, there is overall consistency with the findings of Frank et al. (2004). Neither of these variables were significantly related to or shown to be predictors of exercise compliance and for ‘self-reported general health status’, specifically, this was so even though the adjusted odds for exercise compliance was higher for those who reported excellent health compared to those reporting very good or good health and those who reported fair or poor health (Frank et al., 2004). Exercise compliance in the study by Frank et al. (2004) had to do with exercise-related behaviors resulting in exercise ‘in the quantity or frequency recommended for promoting good health in Healthy People 2010’ and was dichotomized as ‘achieving or not achieving
compliance with exercise recommendations' (p. 113). A difference between the findings of Frank et al. (2004) and this dissertation study is that some aspects of data analysis of both Body Mass Index and personal evaluation of health in the dissertation study were found to be significant at the bivariate level of analysis but these variables turned out at the multivariate level not to be predictors of HEPA. The findings regarding Body Mass Index in this dissertation study is also at odds with the review of literature on the correlates of physical activity as presented by Trost et al. (2002).

The analysis by level of risk for coronary heart disease also provides some interesting perspectives based on the EPPM. It would appear that the tendency to engage in HEPA by those with a low level of risk was driven by their perception of the response efficacy of HEPA. One could theorize based on the EPPM that since that risk is low, their level of perceived threat does not galvanize them into action. Since they are not challenged to take action, their assertions of self-efficacy are not tested in terms of overestimating their ability to consistently engage in HEPA. Response efficacy thus may have emerged as a significant predictor due to personal values placed on exercise and a belief in what that achieves or because of a desire to ensure that personal risk remains low. In the absence of mediating or moderating effects of the other EPPM variables, the overall significant effects of established variables in the literature such as age and gender are clearly demonstrated. It would also make sense that the odds of engaging in HEPA would be higher (as also observed by Frank et al., 2004) as personal evaluation of health improved from 'poor-to-fair' to 'excellent'.

For those at a moderate level of risk for coronary heart disease, all the EPPM variables except perceived response efficacy achieved significance as predictor variables.
Response efficacy, though attained borderline significance (p=0.68) with an odds ratio of 11.53. From the standpoint of the EPPM, this would be a group that would have reason to perceive a higher level of threat to their health and be more inclined to act (if they have high levels of the EPPM variables). This realization that they are vulnerable especially if they are made aware of the signs or symptoms that indicate their risk for a heart attack is higher compared to those who are at low risk may explain why diabetes status and asthma status also achieved significance as predictors in this group of individuals. The results of analysis may reflect an increase in provider counseling and treatment regimes that encourage adequate physical activity which has been stated as necessary for both of these conditions (Ford & Mannino, 2003; Thomas et al., 2004).

Finally, the case of those with high risk for coronary heart disease underscores the complexity of what motivates health behavior change and the need to correct erroneous perceptions. Though the overall model was not significant, it is interesting to note in view of the results already discussed that smoking increased the odds of engaging in HEPA. This may highlight the need for the field of health promotion to explicitly caution the use of smoking as a weight control strategy and stress the efficacy and feasibility of other alternatives such as walking and adopting a more physically active lifestyle in general.

**Overall Implications**

Baranowski et al. (1998) state that in the process of developing programs of research on methods that introduce change in mediating variables, the characteristics of individuals and organizations that make them receptive to change must be looked at. When developing and evaluating intervention programs, they also recommend that data sets from prior interventions be submitted to secondary analyses to assess the role of
mediating variables. A limitation of this dissertation study was that the secondary data permitted a limited number of relationships between physical activity and socio-demographic variables to be examined. The secondary data on Health Enhancing Physical Activity (HEPA) and the Expanded Parallel Process Model (EPPM) measures also came from responses to a cross-sectional survey which only allowed examination of mediators and outcome at the same point in time.

Future research generating data which, is not only more encompassing in terms of characteristics of the sample surveyed but also in terms of a prospective research design, will go a long way in the conduction of cost effective and systematic research investigations focused on better theoretical understanding of the influences on physical activity as proposed by Baranowski et al. (1998). Data gathering on characteristics of the sample that covers a broader spectrum of variables (such as ethnicity, marital status, number of children and their ages, income, history of having ever smoked if currently a non-smoker) would help to fully uncover variables that moderate the effect that hypothesized theoretical variables have as mediators of the outcome variable. The prospective designs would enable optimal research effort as recommended by Lewis et al. (2002) where researchers examine the effect of an intervention on changes in the mediators at a later point in time and then next examine the effect of changes in the mediators on physical activity at yet another later point in time.

In this dissertation study, a multiple linear regression analysis model involving the four EPPM variables when tested also not only failed to explain much of the variance in sufficiency of health enhancing physical activity but also failed to achieve significance as a model. Future research using data from prospective studies rather than from studies
with a cross-sectional design to test the predictive usefulness of the EPPM may help to establish whether or not it is useful for the practice of health promotion by demonstrating, as advocated by Baranowski et al. (1998), 'how much change in physical activity is associated with unit changes in the EPPM mediating variables'. The sample data examined in this dissertation study came from an intact group and this may have contributed to the lack of variability in the perceived efficacy scores. Use of a more diverse sample of working adults in terms of covering a variety of organizational characteristics and occupational groups in future research may yield measures with enough variability to facilitate the determination of whether results are clearly consistent with what the EPPM hypothesizes or not.

Finally, the results of this dissertation study beg the question of what other potential factors or models can be explored if the EPPM as a model is not predictive of health enhancing physical activity. One factor not fully examined in this dissertation study that comes readily to mind is the built environment. According to Palmer (2004), it is essential to understand a person’s willingness or awareness of a need for behavioral change in order to design relevant interventions. Theories that do take into account the effects of external factors assume importance because a person’s ability to adhere to intervention treatments is affected not only by factors that are intrapersonal (Palmer, 2004). The potential for research on the built environment to broaden understanding about physical activity behavior can be achieved if such research also assesses whether the environmental measures examined do ‘add variance to the explanation of behavior’ beyond that yielded from ‘intrapersonal, social and cultural factors’ (Trost et al., 2002).
One way to approach this issue of added variance beyond ‘intrapersonal, social and cultural factors’ is to conduct future research in multiple geographic and cultural domains to increase chances of sufficient variation because the documentation of effects of environmental variables that are widespread in the sample of study (such as the effects of motor vehicles where every adult in a given population owns at least one) may not provide sufficient variation (Trost et al., 2002). An example that brings out this point more clearly is that of a study by Dombois, Fahrlander and Martin-Diener (2007). In examining the physical activity levels of adults in three Swiss alpine communities with environments conducive to physical activity, these researchers found that of the three communities, individuals living in the one without access to motorized transport were significantly more likely to be sufficiently active compared to individuals living in the other two communities with access. The significant differences observed stemmed from the differences in daily moderate activity levels. Though these three alpine community environments were characterized as ‘conducive’ to physical activity, it was also found that overall, the majority of the study participants did not achieve recommended activity levels (Dombois et al., 2007).

The findings by Dombois et al. (2007) on overall insufficient physical activity in a population residing in an environment conducive to physical activity introduces the concept of choice in being physically active. In view of this element of choice, Schmitz (2002) cautions that alterations in the built environment may not necessarily result in changes in behavioral choices. Schmitz further illustrates this point by stating that an individual for whom active transport is important may choose to live in a ‘pedestrian friendly neighborhood’, which, brings up the issue of the influence of self-selection. On
the other hand, another individual who places a low value on active transport could still choose to not walk or use other forms of active transport even if they were to end up living in a pedestrian friendly neighborhood (Schmitz, 2002). Indeed, though the cross-sectional and observational research accruing seems to point to community design as an influence on level of physical activity as applied on a population basis, there are only a few quasi-experimental studies showing that physical activity levels increased following enhancements to the environment (Librett et al., 2006).

One area worthy of contemplation of its merits for use in future research in physical activity, in view of the above discussion on other potential models available and the concept of choosing to be physically active, is that of behavioral choice theory. Epstein (1998) presents this theory as a ‘behavioral economic analyses of physical activity’ and one that can bridge different approaches to physical activity behavior as opposed to other conceptual models that generally target one level of analyses such as the individual, the community or the environment. Through the use of this theory, it is suggested that the facilitative or constraining impact that the environment has on our physical activity choices can be examined at multiple levels of inquiry. At the individual level of inquiry, for example, it could be examined whether increasing the cost of being sedentary (ie. reducing proximity to sedentary behaviors) may prompt the choice to be active in a given situation. Also, it would be important at the level of community or environmental approaches or in policy decision-making to keep in mind how choice could be impacted and thus include assessment of choice and the perception of control that it leads to (Epstein, 1998) in basic research investigations on physical activity or when developing, implementing or evaluating interventions to boost physical activity.
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physicalactivity/index.shtml


Department of Transportation.


health profile of an adult population from the metropolitan region of Sao-Paulo.


APPENDICES

APPENDIX 1a.

PARTICIPANT RECRUITMENT LETTER
Dear [Company name] Member:

You are invited to join [Company name]'s [Quality Improvement Program name] program. [Quality Improvement Program name] is a research project that has been developed to find out if coaching by phone can control medical costs and improve health behaviors and help keep healthy employees healthy. This program is being offered to all [Company name] employees who carry health insurance with [Company name]. There is no cost to participate in this program, and your participation will not affect your health insurance coverage or employment with [Company name] in any way.

There are just a few steps for you to take if you agree to participate in the [Quality Improvement Program Name] project.

- First, read the Consent form, and sign it once all your questions have been answered.
- Second, fill out the Health Risk Assessment enclosed in this packet; it's a quick survey about your health today.
- Third, mail the form in the enclosed, postage paid envelope by DATE______.

Everyone who wants to participate in the program MUST return the completed HRA with signed consent on the form enclosed in this packet. Each person will be RANDOMLY assigned to an intervention group or to a comparison group. None of the [Quality Improvement Program Name] staff have any control over who gets into which group. If you are placed in the intervention group, you must agree to work by phone with a health coach at least once monthly for one year. These calls will take between 15 - 30 minutes of your time, and may be scheduled at your convenience. If you are placed in the comparison group, a health coach will not be contacting you during the study.

Your health is important to us. Please call the [Quality Improvement Program Name] Hotline at ____________, if you have any questions; your call will be returned within 2 business days.

Sincerely,

[Name], PhD, RN, CDE
Director, Disease Management

[Name], MS, CHES
Director, Health & Prevention
APPENDIX 1b.

HEALTH RISK ASSESSMENT
[Quality Improvement Program name]- HEALTH RISK ASSESSMENT
SIGN AND RETURN IN ENCLOSED ENVELOPE

Today’s Date: ________________

**Fill in the following questions with your clinical measurements:**

1. Total Cholesterol: ______ HDL Cholesterol: _____ Lab Test Date: ______

2. Blood pressure: __________________ Test Date: ___________

3. Weight: ______ pounds  Height: _____feet ______ inches

4. Do you smoke?  
   Never Smoked ______ (skip to question #5)
   Used to Smoke __________
      a. How many years has it been since you smoked cigarettes regularly?
         _____Less than a year ago  _____1-4 years ago  _____5-9 years ago  _____10 or more years ago
      b. What was the average number of cigarettes per day that you smoked before you quit?
         _____10 or less  _____11-20 (1/2 to pack)  _____21-40 (1 to 2 packs)  _____41 or more (2 packs+)

   Still Smoke __________
      a. What is the average number of cigarettes per day that you smoke?
         _____10 or less  _____11-20 (1/2 to pack)  _____21-40 (1 to 2 packs)  _____41 or more (2 packs+)

5. In an average week, how many times do you engage in physical activity or work that lasts at least 20 minutes without stopping and is hard enough to make you breathe heavily and your heart beat faster?
   _____ Less than 1 time a week
   _____ 1 to 2 times per week
   _____ At least 3 times a week

6. In general, how satisfied are you with your life?
   _____ Mostly  _____ Partly  _____ Not

7. How would you describe your overall health?
   _____ Excellent  _____ Good  _____ Fair  _____ Poor

8. Do you have Asthma? _____ Yes _____ No

9. Do you have Diabetes? _____ Yes _____ No  A1c level: ______ Date tested: ______

TURN PAGE OVER
Questions for Women Only

10. How long has it been since a physician or nurse examined your breasts? _____ Never
    _____ Less than a year ago _____ 1 year ago _____ 2 years ago _____ 3+years ago

11. When was your last pap smear? _____ Never
    _____ Less than a year ago _____ 1 year ago _____ 2 years ago _____ 3+years ago

12. How long has it been since your last breast X-ray (mammography)? _____ Never
    _____ Less than a year ago _____ 1 year ago _____ 2 years ago _____ 3+years ago

13. Are you currently pregnant? ________________________________

Question for Men Only

14. How long has it been since your last your last prostate or digital rectal exam? _____ Never
    _____ Less than a year ago _____ 1 year ago _____ 2 years ago _____ 3+years ago

CONSENT

I certify that my decision to take part in this research project is voluntary and that I consent to participate in the research project. I have read the consent form and I understand that:

- The purpose of this study is to determine if motivational coaching and improved health behaviors reduce health risk factors and control medical costs, and keep healthy employees healthy.
- I will be randomly assigned into either the Intervention or Comparison group.
- By signing this consent I agree to complete the Health Risk Appraisal (HRA) that includes twelve questions about my health habits. As a ______ employee, I will be automatically enrolled into the Healthy Edge program, and awarded Flex Credits based on these answers.
- If I am randomly assigned into the comparison group, I agree to complete the HRA again at the end of the study.
- If I am randomized into the intervention group, I agree to participate in monthly contacts with my Patient Service Coordinator by phone and will consent to having the following clinical measures: body weight, blood pressure (B/P), cholesterol (HDL and total), and A1c testing (if I have diabetes).
• My decision to participate or not participate in this research will not change my employment status, my medical care or my benefits as described under my health insurance policy.

Best phone number to reach me: ________________  Best time of day to reach me: ____________

Best day of the week to reach me: Monday  Tuesday  Wednesday  Thursday  Friday

You may email me at: ____________________________

_______________________________________________  ________________________________  __________
Signature of Participant  Typed or Printed Name  Date
APPENDIX 1c.

HEALTH RISK ASSESSMENT SUMMARY REPORT SAMPLE
Assigned ID: 3124 JD
Age: 40
Gender: M
Date: 08/18/2006

Health Risk Appraisal Results

Your Health Summary:

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<th>Your Response</th>
<th>Recommended Health Guidelines</th>
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<tr>
<td>Blood Pressure</td>
<td>Less than 120/80 mmHg is normal</td>
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<tr>
<td>Cholesterol, Total</td>
<td>Less than 200 mg/dl is desirable</td>
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<tr>
<td>Cholesterol, HDL</td>
<td>More than 40 mg/dl is desirable</td>
</tr>
<tr>
<td>Exercise</td>
<td>Exercise at least 3 times weekly</td>
</tr>
<tr>
<td>Tobacco</td>
<td>No tobacco use</td>
</tr>
<tr>
<td>Weight</td>
<td>Body Mass Index ideal range is 18.5 - 24.9</td>
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</table>

This report is a summary of the information you gave us on your health risk assessment. There are some factors affecting your health that you cannot change like your gender, your genetic make-up and your age. However, there are other factors that are under your control. This report stresses the things YOU CAN DO to protect your health, like exercising regularly, making healthy food choices, and avoiding tobacco use. However, this information should not replace the advice of your doctor. We encourage you to review this information with your physician at your next visit.

Your Health Risk Assessment

Blood Pressure
You reported that your blood pressure was **140/90 mmHg**.

You reported that your blood pressure was high. High blood pressure is one of the risk factors for developing heart disease as well as other chronic diseases. You can decrease your risk by not using tobacco, eating a low fat diet with five or more fruits and vegetables every day, increasing your physical activity to 30 minutes a day most days of the week, and either not using alcohol or moderate use of alcohol. If you are already working with your physician to lower your blood pressure, remember to take the medications as prescribed. [Company Name] Healthcare has programs to help you lower your blood pressure numbers. You may call 1-800-[Phone #] to find out more about and register for [Program Name], an education and exercise program that teaches you how to make healthy food choices, to develop regular exercise habits, to cope with stress and to quit smoking.
Cholesterol
You reported that your total cholesterol was 215 mg/dl
and that your HDL cholesterol was 35 mg/dl.

You reported that your total cholesterol level was higher than 199 mg/dl and that your HDL cholesterol was 39 mg/dl or lower. These are outside of the normal range and are a risk factor for heart disease. You can lower your risk by not using tobacco, eating a low-fat diet with plenty of fruits and vegetables every day, and increasing your physical activity to 30 minutes a day most days of the week. If you are already working with your physician to lower your cholesterol, remember to take the medications as prescribed. [Company Name] Healthcare has programs that can help you lower your cholesterol. Call 1-800-[Phone #] to find out more about [Program Name], an education and exercise program that teaches you how to eat healthy, to develop regular exercise habits, to cope with stress and to quit smoking.

You reported that you use tobacco.
Using tobacco damages the heart. It decreases HDL levels and increases the likelihood of heart disease, heart attack and stroke. [Company Name] Healthcare has free programs that can help you stop using tobacco for good. You may call 1-800-[Phone #] to find out more and register for this program.

You reported that you exercise 1 - 2 times per week.
According to CDC, regular physical activity reduces your risk of coronary heart disease, stroke, colon cancer, diabetes and high blood pressure. It also helps to control weight, contributes to healthy bones, and reduces symptoms of anxiety and depression. Increase your physical activity to 30 minutes five or more times a week. Walking is an excellent way to start. Remember to consult with your physician before starting an exercise program.

You reported that your height was 6 ft 1 in and your weight was 210 lbs.
That equals a body mass index of 27.8.
Your weight is higher than the recommended weight for a person your height. Healthy eating habits and regular exercise can help you lose extra pounds and avoid weight-related problems like high blood pressure, diabetes and heart disease. You may call 1-800-[Phone #] for more information.
You reported that you have had a prostate exam 1 year ago.
Congratulations on taking care of yourself by having your prostate exam. You should have this test repeated at your annual physical or as recommended by your physician.

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APPENDIX 2.

STUDY QUESTIONNAIRE
PHYSICAL ACTIVITY, HEALTH RISK PERCEPTION AND CORONARY ARTERY DISEASE RISK STRATIFICATION QUESTIONNAIRE

I will be administering a questionnaire that may take up to 20 or 30 minutes of your time today. Please remember that one of the goals of this research is to study health related behaviors and determine if motivational coaching and improved health behaviors help or not in reducing health risk factors and keeping healthy people healthy. There are therefore no right or wrong responses to the questions. Your honest responses to questions are needed to achieve this research goal.

Even though you consented to monthly telephone contacts as a requirement for participation in the study, you will be offered a small incentive of $50.00 for agreeing to today’s 20-30 minute telephone time commitment. This incentive is also a token recognition of the contribution of your responses to this aspect of the research.

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. This set of questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   ___ days per week

   □ No vigorous physical activities → Skip to question 3

2. How much time did you usually spend doing vigorous physical activities on one of those days?

   ___ hours per day

   ___ minutes per day

   □ Don’t know/Not sure
Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

____ days per week

☐ No moderate physical activities → Skip to question 5

4. How much time did you usually spend doing moderate physical activities on one of those days?

_____ hours per day

_____ minutes per day

☐ Don’t know/Not sure

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

_____ days per week

☐ No walking → Skip to question 7

6. How much time did you usually spend walking on one of those days?

_____ hours per day

_____ minutes per day

☐ Don’t know/Not sure
The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the last 7 days, how much time did you spend sitting on a week day?

____ hours per day

____ minutes per day

☐ Don’t know/Not sure

The purpose of the next set of questions in this questionnaire is to determine your perceptions or beliefs about a heart attack as a threat to your health and engaging in physical activity as a recommended response to avoid this health threat.

Please indicate the degree to which you agree or disagree with each of the following statements with a number from 1 to 7. Indicating ‘7’ means ‘strongly agree’, ‘4’ means ‘neutral’, and ‘1’ means ‘strongly disagree’.

8. Accumulating 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week is effective in preventing a heart attack:

1 2 3 4 5 6 7

Strongly Disagree

Strongly Agree

9. Accumulating 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week works in preventing a heart attack:

1 2 3 4 5 6 7

Strongly Disagree

Strongly Agree
10. If I accumulate 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week, I am less likely to experience a heart attack:

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree

11. I am able to accumulate 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week to prevent experiencing a heart attack:

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree

12. It is easy to accumulate 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week to prevent experiencing a heart attack:

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree

13. I can accumulate 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week to prevent experiencing a heart attack:

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree
14. I believe that a heart attack is a severe threat to my health:

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Strongly Disagree

Strongly Agree

15. I believe that a heart attack has serious negative consequences:

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Strongly Disagree

Strongly Agree

16. I believe that a heart attack is extremely harmful:

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Strongly Disagree

Strongly Agree

17. It is likely that I will experience a heart attack:

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</tr>
</tbody>
</table>

Strongly Disagree

Strongly Agree

18. I am at risk for experiencing a heart attack:

<table>
<thead>
<tr>
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<td>7</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Strongly Disagree

Strongly Agree
19. It is possible that I will experience a heart attack:

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree

20. **Gender:** Male _____ Female _____

21. **Age:** ______

22. **Major signs and symptoms suggestive of Cardiovascular and Pulmonary Disease**

Have you been told by your healthcare provider or do you have

_____ Pain or discomfort in the chest, neck, jaw, or arms [Pain, discomfort (or other anginal equivalent) in the chest, neck, jaw, arms, or other areas that many be due to ischemia]

_____ Shortness of breath at rest or with mild effort [Shortness of breath at rest or with mild exertion]

_____ Dizziness, fainting or blackouts [Dizziness or syncope (fainting, blackouts)]

_____ Breathing discomfort while lying on the back or waking up at night gasping for breath [Orthopnea or paroxysmal nocturnal dyspnea]

_____ Swelling of the ankles [Ankle edema]

_____ Awareness or feeling that your heart is beating more strongly or more rapidly than normal [Palpitations or tachycardia]

_____ Pain, ache, cramp or tired feeling in the calf, foot, thigh, hips or buttocks that occurs on walking [Intermittent claudication]

_____ A heart sound not heard in the normal heart [Known heart murmur]

_____ Feeling unusually tired or out of breath with usual activities [Unusual fatigue or shortness of breath with usual activities]
## 23. Coronary Artery Disease Risk Factors Thresholds

<table>
<thead>
<tr>
<th>Risk Factors: (Positive)</th>
<th>Defining Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family History ____</td>
<td>Heart attack [myocardial infarction], heart surgery [coronary revascularization], or sudden death before 55 years of age in father or other male first-degree relative (i.e., brother or son), or before 65 years of age in mother or other female first-degree relative (i.e., sister or daughter)</td>
</tr>
<tr>
<td>Cigarette Smoking ____</td>
<td>Current cigarette smoker or those who quit within the previous 6 months.</td>
</tr>
<tr>
<td>High Blood Pressure [Hypertension] ____</td>
<td>Systolic blood pressure of ≥140 mm Hg or diastolic ≥90 mm Hg, confirmed by measurements on at least 2 separate occasions, or on medication for high blood pressure [antihypertensive medication].</td>
</tr>
<tr>
<td>High Blood Cholesterol [Hypercholesterolemia] ____</td>
<td>Total serum cholesterol of &gt;200 mg/dl (5.2 mmol/L) or HDL [high-density lipoprotein] cholesterol of &lt;35 mg/dL (0.9 mmol/L), or on medication for high blood cholesterol [lipid-lowering medication].</td>
</tr>
<tr>
<td>Diabetic or takes medicine to control blood sugar [Impaired Fasting Glucose] ____</td>
<td>A1c blood level measurement for diabetics [or Fasting blood glucose of ≥110 mg/dL (6.1 mmol/L) confirmed by measurements on at least 2 separate occasions]</td>
</tr>
<tr>
<td>Obesity ____</td>
<td>Body Mass Index of greater than or equal to 30 [mg/m2]</td>
</tr>
<tr>
<td>Height ___ ft ___ in. Weight ___ lbs</td>
<td>Persons not participating in a regular exercise program or meeting the minimal physical activity recommendations from the U.S. Surgeon Generals' Report.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk Factors: (Negative)</th>
<th>Defining Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Serum HDL Cholesterol ____</td>
<td>&gt;60 mg/dL (1.6 mmol/L)</td>
</tr>
</tbody>
</table>

This is the end of the questionnaire. Thank you for participating.
PHYSICAL ACTIVITY, HEALTH RISK PERCEPTION AND CORONARY ARTERY DISEASE RISK STRATIFICATION QUESTIONNAIRE

This questionnaire may take up to 20 or 30 minutes of your time today. Please remember that the goal of this research is to study health related behaviors and determine if motivational coaching and improved health behaviors help or not in reducing health risk factors and keeping healthy people healthy. There are no right or wrong responses to the questions. Your honest responses to questions are needed to achieve this research goal.

Even though you consented to participation in the study, you will be offered a small incentive of $50.00 for your time to complete this survey. This incentive is also a token recognition of the contribution of your responses to this research.

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The first set of questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   ___ days per week

   [ ] No vigorous physical activities ➔ Skip to question 3

2. How much time did you usually spend doing vigorous physical activities on one of those days?

   ___ hours per day

   ___ minutes per day

   [ ] Don’t know/Not sure
Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

____ days per week

☐ No moderate physical activities  ➔ Skip to question 5

4. How much time did you usually spend doing moderate physical activities on one of those days?

_____ hours per day

_____ minutes per day

☐ Don’t know/Not sure

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

____ days per week

☐ No walking  ➔ Skip to question 7

6. How much time did you usually spend walking on one of those days?

_____ hours per day

_____ minutes per day

☐ Don’t know/Not sure
The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the last 7 days, how much time did you spend sitting on a week day?

   _____ hours per day
   _____ minutes per day

   [ ] Don’t know/Not sure

The purpose of the next set of questions in this questionnaire is to determine your beliefs about heart attacks and about physical activity.

Please indicate the degree to which you agree or disagree with each of the following statements with a number from 1 to 7. Indicating '7' means 'strongly agree', '4' means 'neutral', and '1' means 'strongly disagree'.

8. Accumulating 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week is effective in preventing a heart attack:

   1  2  3  4  5  6  7

   Strongly Disagree
   Strongly Agree

9. Accumulating 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week works in preventing a heart attack:

   1  2  3  4  5  6  7

   Strongly Disagree
   Strongly Agree
10. If I accumulate 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week, I am less likely to experience a heart attack:

<table>
<thead>
<tr>
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<th>1</th>
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<tr>
<td>Strongly Disagree</td>
<td>Strongly Agree</td>
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</table>

11. I am able to accumulate 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week to prevent experiencing a heart attack:

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<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Strongly Agree</td>
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</tbody>
</table>

12. It is easy to accumulate 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week to prevent experiencing a heart attack:

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<tr>
<td>Strongly Disagree</td>
<td>Strongly Agree</td>
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</table>

13. I can accumulate 30 minutes or more each day of moderate intensity physical activity for 5 or more days of the week or 20 minutes or more of vigorous activity each day for three or more days of the week to prevent experiencing a heart attack:

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<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Strongly Agree</td>
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</tbody>
</table>
14. I believe that a heart attack is a severe threat to my health:

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree

15. I believe that a heart attack has serious negative consequences:

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree

16. I believe that a heart attack is extremely harmful:

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree

17. It is likely that I will experience a heart attack:

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree

18. I am at risk for experiencing a heart attack:

1 2 3 4 5 6 7

Strongly Disagree
Strongly Agree
19. It is possible that I will experience a heart attack:

1 2 3 4 5 6 7

Strongly Disagree  Strongly Agree

20. What is your Gender? Male _______ Female _______

21. What is your Age? _______

22. Major signs and symptoms suggestive of Cardiovascular and Pulmonary Disease

Have you been told by your healthcare provider or do you have

Yes No __ Pain or discomfort in the chest, neck, jaw, or arms [Pain, discomfort (or other anginal equivalent) in the chest, neck, jaw, arms, or other areas that may be due to ischemia]

Yes No __ Shortness of breath at rest or with mild effort [Shortness of breath at rest or with mild exertion]

Yes No __ Dizziness, fainting or blackouts [Dizziness or syncope (fainting, blackouts)]

Yes No __ Breathing discomfort while lying on the back or waking up at night gasping for breath [Orthopnea or paroxysmal nocturnal dyspnea]

Yes No __ Swelling of the ankles [Ankle edema]

Yes No __ Awareness or feeling that your heart is beating more strongly or more rapidly than normal [Palpitations or tachycardia]

Yes No __ Pain, ache, cramp or tired feeling in the calf, foot, thigh, hips or buttocks that occurs on walking [Intermittent claudication]

Yes No __ A heart sound not heard in the normal heart [Known heart murmur]

Yes No __ Feeling unusually tired or out of breath with usual activities [Unusual fatigue or shortness of breath with usual activities]
# 23. Coronary Artery Disease Risk Factors Thresholds

## Risk Factors: (Positive)

### Defining Criteria

- **Family History** = Heart attack [myocardial infarction], heart surgery [coronary revascularization], or sudden death before 55 years of age in father or other male first-degree relative (i.e., brother or son), or before 65 years of age in mother or other female first-degree relative (i.e., sister or daughter).

- **Cigarette Smoking** = Current cigarette smoker or those who quit within the previous 6 months.

- **High Blood Pressure/Hypertension** = Systolic blood pressure of ≥140 mm Hg or diastolic ≥90 mm Hg, confirmed by measurements on at least 2 separate occasions, or on medication for high blood pressure [antihypertensive medication].

- **High Blood Cholesterol/ Hypercholesterolemia** = Total serum cholesterol of >200 mg/dl (5.2mmol/L) or HDL [high-density lipoprotein] cholesterol of <35 mg/dL (0.9 mmol/L), or on medication for high blood cholesterol [lipid-lowering].

- **Impaired Fasting Glucose** = A1c blood level measurement for diabetics [or Fasting blood glucose of >110 mg/dL (6.1 mmol/L) confirmed by measurements on at least 2 separate occasions]

- **Obesity** = Body Mass Index of greater than or equal to 30 [mg/m2]

- **Sedentary Lifestyle** = Persons not participating in a regular exercise program or meeting the minimal physical activity recommendations from the U.S. Surgeon Generals’ Report.

### Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Defining Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did your father, brother or son or your mother, sister or daughter have a heart attack, heart surgery or die suddenly before 55 years of age if they were male or before 65 years of age if they were female?</td>
<td>Yes No</td>
</tr>
<tr>
<td>Do you currently smoke cigarettes or if you have quit, did you quit within the last six months?</td>
<td>Yes No</td>
</tr>
<tr>
<td>Do you have high blood pressure or do you take medicine to control your blood pressure?</td>
<td>Yes No</td>
</tr>
<tr>
<td>Current Blood Pressure? ______</td>
<td></td>
</tr>
<tr>
<td>Do you have high blood cholesterol or do you take medicine to control your blood cholesterol level?</td>
<td>Yes No</td>
</tr>
<tr>
<td>Total Blood Cholesterol Level? ______</td>
<td></td>
</tr>
<tr>
<td>Are you a diabetic or do you take medicine to control your blood sugar?</td>
<td>Yes No</td>
</tr>
<tr>
<td>If Yes, what is your A1c blood level? ______</td>
<td></td>
</tr>
<tr>
<td>What is your height and weight? Height ______ ft ______ in. Weight ______ lbs</td>
<td>[Obesity] = Body Mass Index of greater than or equal to 30 [mg/m2]</td>
</tr>
<tr>
<td>Do you engage in less than 30 minutes of physical activity on at least 3 days per week?</td>
<td>Yes No</td>
</tr>
</tbody>
</table>

## Risk Factors: (Negative)

- **High Serum HDL Cholesterol** = >60 mg/dL (1.6 mmol/L)

This is the end of the questionnaire. Thank you for participating.
APPENDIX 3:

SURVEY QUESTIONNAIRE COMPLETION INCENTIVE COVER LETTER
Dear __________,

Congratulations! You successfully completed the [Quality Improvement Program name] survey. Enclosed is your $50.00 gift card to [Gift Card Company name]. We hope that you enjoy this gift and use it toward products that will help you achieve your personal best health goals.

Preventive health screenings, good nutritional decisions and plenty of exercise, are the best gifts you can give to yourself. Keep up the good work!

Be well,

[Name], MS
Director
[Quality Improvement Program name] Program
APPENDIX 4:
DESCRIPTION OF THE INTERVENTION
The intervention to be administered involves monthly telephone contacts initiated by two Patient Service Coordinators who will work with participants as a healthy lifestyle coach. As coaches, the Patient Service Coordinators will be offering individualized and tailored education with the aim of enhancing motivation for behavior change during the phone contact. Participants will also have access to other health promotion resources. They will, for example, be offered the opportunity to receive health promotion education such as the ‘Eating for Life’ viewing program and a free ‘Weight Watchers at Work’ program. If they choose, they can receive a referral to other organizational resources including ‘Explore Health’, Registered Dietician services, a ‘Healthy Heart’ program, tobacco cessation programs, a ‘Walkabout with Healthy Edge’ program, a Jazzercise program, and a Yoga program. Participants, in addition, will receive quarterly incentives for participation as a token of their contribution.

The intervention will focus on information contained in the health appraisal summary report generated from analysis of the Health Risk Assessment that was completed by participants during the initial data collection phase (See Appendix 1c. for report samples). Each participant as well as the Patient Service Coordinator contacting them will receive a copy of this report. The report touches on factors affecting health that can be controlled and stresses things that the individual in question can do to protect their health such as increasing physical activity to 30 minutes most days of the week and developing regular exercise habits. The aspects of the summary report that are related to the ‘cardiovascular disease risk’ and/or ‘physical activity’ context of this study are blood pressure, blood cholesterol level, tobacco use, exercise pattern and weight for height (See Appendix 1c).
Responses to the RBDS and IPAQ portions of the questionnaire collected during the pre-intervention data phase may serve as a guide for the Patient Service Coordinators who, as motivational coaches, will tailor their health risk communication messages about cardiovascular risk to an individual in light of the individual’s health risk assessment results. (See Appendices 1b, 1c & Appendix 2, Questions #1-#19). This will be done in order to promote danger control actions, which, according to the EPPM are self-protective actions taken by people who adopt a recommended response to protect themselves from a specified health threat.

In connection with this study topic of health enhancing physical activity, the motivational telephone-assisted coaching sessions may cover issues such as the nature and impact of coronary heart disease; increased cardiovascular disease risk on account of personal risk factors such as high blood pressure or cholesterol levels, family history, weight or sedentary lifestyle; the importance and relevance of adopting, achieving or maintaining a more physically active lifestyle; and personally effective ways for an individual to decrease risk according to recommended physical activity guidelines. These motivational coaching session issues can thus be seen to have a bearing on the study variables of perceptions of severity, susceptibility, response efficacy and self-efficacy in terms of actions being promoted through the intervention.
APPENDIX 5:

GENERAL PHYSICAL ACTIVITIES DEFINED BY LEVEL OF INTENSITY TABLE
General Physical Activities Defined by Level of Intensity
The following is in accordance with CDC and ACSM guidelines.

**Moderate activity**

3.0 to 6.0 METs*

<table>
<thead>
<tr>
<th>3.5 to 7 kcal/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking at a moderate or brisk pace of 3 to 4.5 mph on a level surface inside or outside, such as</td>
</tr>
<tr>
<td>• Walking to class, work, or the store;</td>
</tr>
<tr>
<td>• Walking for pleasure;</td>
</tr>
<tr>
<td>• Walking the dog; or</td>
</tr>
<tr>
<td>• Walking as a break from work.</td>
</tr>
<tr>
<td>Walking downstairs or down a hill</td>
</tr>
<tr>
<td>Racewalking—less than 5 mph</td>
</tr>
<tr>
<td>Using crutches</td>
</tr>
<tr>
<td>Hiking</td>
</tr>
<tr>
<td>Roller skating or in-line skating at a leisurely pace</td>
</tr>
<tr>
<td>Bicycling 5 to 9 mph, level terrain, or with few hills</td>
</tr>
<tr>
<td>Stationary bicycling—using moderate effort</td>
</tr>
<tr>
<td>Aerobic dancing—high impact</td>
</tr>
<tr>
<td>Water aerobics</td>
</tr>
<tr>
<td>Calisthenics—light</td>
</tr>
<tr>
<td>Yoga</td>
</tr>
<tr>
<td>Gymnastics</td>
</tr>
<tr>
<td>General home exercises, light or moderate effort, getting up and down from the floor</td>
</tr>
<tr>
<td>Jumping on a trampoline</td>
</tr>
<tr>
<td>Using a stair climber machine at a light-to-moderate pace</td>
</tr>
<tr>
<td>Using a rowing machine—with moderate effort</td>
</tr>
<tr>
<td>Weight training and bodybuilding using free weights, Nautilus- or Universal-type weights</td>
</tr>
<tr>
<td>Boxing—punching bag</td>
</tr>
<tr>
<td>Ballroom dancing</td>
</tr>
<tr>
<td>Line dancing</td>
</tr>
<tr>
<td>Square dancing</td>
</tr>
<tr>
<td>Folk dancing</td>
</tr>
<tr>
<td>Modern dancing, disco</td>
</tr>
</tbody>
</table>

**Vigorous activity**

Greater than 6.0 METs*

<table>
<thead>
<tr>
<th>(more than 7 kcal/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Racewalking and aerobic walking—5 mph or faster</td>
</tr>
<tr>
<td>Jogging or running</td>
</tr>
<tr>
<td>Wheeling your wheelchair</td>
</tr>
<tr>
<td>Walking and climbing briskly up a hill</td>
</tr>
<tr>
<td>Backpacking</td>
</tr>
<tr>
<td>Mountain climbing, rock climbing, rapelling</td>
</tr>
<tr>
<td>Roller skating or in-line skating at a brisk pace</td>
</tr>
<tr>
<td>Bicycling more than 10 mph or bicycling on steep uphill terrain</td>
</tr>
<tr>
<td>Stationary bicycling—using vigorous effort</td>
</tr>
<tr>
<td>Aerobic dancing—using high impact</td>
</tr>
<tr>
<td>Step aerobics</td>
</tr>
<tr>
<td>Water jogging</td>
</tr>
<tr>
<td>Teaching an aerobic dance class</td>
</tr>
<tr>
<td>Calisthenics—push-ups, pull-ups, vigorous effort</td>
</tr>
<tr>
<td>Karate, judo, tae kwon do, jujitsu</td>
</tr>
<tr>
<td>Jumping rope</td>
</tr>
<tr>
<td>Performing jumping jacks</td>
</tr>
<tr>
<td>Using a stair climber machine at a fast pace</td>
</tr>
<tr>
<td>Using a rowing machine—with vigorous effort</td>
</tr>
<tr>
<td>Using an arm cycling machine—with vigorous effort</td>
</tr>
<tr>
<td>Circuit weight training</td>
</tr>
<tr>
<td>Boxing—in the ring, sparring</td>
</tr>
<tr>
<td>Wrestling—competitive</td>
</tr>
<tr>
<td>Professional ballroom dancing—energetically</td>
</tr>
<tr>
<td>Square dancing—energetically</td>
</tr>
<tr>
<td>Folk dancing—energetically</td>
</tr>
<tr>
<td>Clogging</td>
</tr>
</tbody>
</table>
Ballet

Table tennis—competitive
Tennis—doubles
Golf, wheeling or carrying clubs
Softball—fast pitch or slow pitch
Basketball—shooting baskets
Coaching children’s or adults’ sports

Tennis—singles
Wheelchair tennis

Most competitive sports
Football game
Basketball game
Wheelchair basketball
Soccer
Rugby
Kickball
Field or rollerblade hockey
Lacrosse

Volleyball—competitive
Playing Frisbee
Juggling
Curling
Cricket—batting and bowling
Badminton
Archery (nonhunting)
Fencing
Downhill skiing—with light effort
Ice skating at a leisurely pace (9 mph or less)
Snowmobiling
Ice sailing

Beach volleyball—on sand court
Handball—general or team
Racquetball
Squash

Downhill skiing—racing or with vigorous effort
Ice-skating—fast pace or speedskating
Cross-country skiing
Sledding
Tobogganing
Playing ice hockey
Swimming—steady paced laps
Synchronized swimming
Treading water—fast, vigorous effort
Water jogging
Water polo
Water basketball
Scuba diving

Swimming—recreational
Treading water—slowly, moderate effort
Diving—springboard or platform
Aquatic aerobics
Waterskiing
Snorkeling
Surfing, board or body
Canoeing or rowing a boat at less than 4 mph
Rafting—whitewater
Sailing—recreational or competition
Paddle boating
Kayaking on a lake, calm water
Washing or waxing a powerboat or the hull of a sailboat
Fishing while walking along a riverbank or while wading in a stream—wearing waders
Hunting deer, large or small game
Pheasant and grouse hunting
Hunting with a bow and arrow or crossbow—walking
Horseback riding—general
Saddling or grooming a horse

Playing on school playground equipment, moving about, swinging, or climbing
Playing hopscotch, 4-square, dodgeball, T-ball, or tetherball
Skateboarding
Roller-skating or in-line skating—leisurely pace
Playing instruments while actively moving; playing in a marching band; playing guitar or drums in a rock band
Twirling a baton in a marching band
Singing while actively moving about—as on stage or in church
Gardening and yard work: raking the lawn, bagging grass or leaves, digging, hoeing, light shoveling (less than 10 lbs per minute), or weeding while standing or bending
Planting trees, trimming shrubs and trees, hauling branches, stacking wood
Pushing a power lawn mower or tiller

Canoeing or rowing—4 or more mph
Kayaking in whitewater rapids
Horseback riding—trotting, galloping, jumping, or in competition
Playing polo
Running
Skipping
Jumping rope
Performing jumping jacks
Roller-skating or in-line skating—fast pace
Playing a heavy musical instrument while actively running in a marching band
Gardening and yard work: heavy or rapid shoveling (more than 10 lbs per minute), digging ditches, or carrying heavy loads
Felling trees, carrying large logs, swinging an ax, hand-splitting logs, or climbing and trimming trees
Pushing a nonmotorized lawn mower
Shoveling heavy snow
Moderate housework: scrubbing the floor or bathtub while on hands and knees, hanging laundry on a clothesline, sweeping an outdoor area, cleaning out the garage, washing windows, moving light furniture, packing or unpacking boxes, walking and putting household items away, carrying out heavy bags of trash or recyclables (e.g., glass, newspapers, and plastics), or carrying water or firewood

General household tasks requiring considerable effort

Putting groceries away—walking and carrying especially large or heavy items less than 50 lbs.

Actively playing with children—walking, running, or climbing while playing with children

Walking while carrying a child weighing less than 50 lbs

Walking while pushing or pulling a child in a stroller or an adult in a wheelchair

Carrying a child weighing less than 25 lbs up a flight of stairs

Child care: handling uncooperative young children (e.g., chasing, dressing, lifting into car seat), or handling several young children at one time

Bathing and dressing an adult

Animal care: shoveling grain, feeding farm animals, or grooming animals

Playing with or training animals

Manually milking cows or hooking cows up to milking machines

Home repair: cleaning gutters, caulking, refinishing furniture, sanding floors with a power sander, or laying or removing carpet or tiles

General home construction work: roofing, painting inside or outside of the house, wall papering, scraping, plastering, or remodeling Outdoor carpentry, sawing wood with a power saw

Heavy housework: moving or pushing heavy furniture (75 lbs or more), carrying household items weighing 25 lbs or more up a flight or stairs, or shoveling coal into a stove

Standing, walking, or walking down a flight of stairs while carrying objects weighing 50 lbs or more

Carrying several heavy bags (25 lbs or more) of groceries at one time up a flight of stairs

Grocery shopping while carrying young children and pushing a full grocery cart, or pushing two full grocery carts at once

Vigorously playing with children—running longer distances or playing strenuous games with children

Racewalking or jogging while pushing a stroller designed for sport use

Carrying an adult or a child weighing 25 lbs or more up a flight of stairs

Standing or walking while carrying an adult or a child weighing 50 lbs or more

Animal care: forking bales of hay or straw, cleaning a barn or stables, or carrying animals weighing over 50 lbs

Handling or carrying heavy animal-related equipment or tack

Home repair or construction: very hard physical labor, standing or walking while carrying heavy loads of 50 lbs or more, taking loads of 25 lbs or more up a flight of stairs or ladder (e.g., carrying roofing materials onto the roof), or concrete or masonry work

Hand-sawing hardwoods
Automobile bodywork
Hand washing and waxing a car

Pushing a disabled car

Occupations that require extended periods of walking, pushing or pulling objects weighing less than 75 lbs, standing while lifting objects weighing less than 50 lbs, or carrying objects of less than 25 lbs up a flight of stairs
Tasks frequently requiring moderate effort and considerable use of arms, legs, or occasional total body movements.
For example:
• Briskly walking on a level surface while carrying a suitcase or load weighing up to 50 lbs
• Maid service or cleaning services

• Waiting tables or institutional dishwashing
• Driving or maneuvering heavy vehicles (e.g., semi-truck, school bus, tractor, or harvester)—not fully automated and requiring extensive use of arms and legs
• Operating heavy power tools (e.g., drills and jackhammers)
• Many homebuilding tasks (e.g. electrical work, plumbing, carpentry, dry wall, and painting)
• Farming—feeding and grooming animals, milking cows, shoveling grain; picking fruit from trees, or picking vegetables
• Packing boxes for shipping or moving
• Assembly-line work—tasks requiring movement of the entire body, arms or legs with moderate effort
• Mail carriers—walking while carrying a mailbag
• Patient care—bathing, dressing, and moving patients or physical therapy

Occupations that require extensive periods of running, rapid movement, pushing or pulling objects weighing 75 lbs or more, standing while lifting heavy objects of 50 lbs or more, walking while carrying heavy objects of 25 lbs or more
Tasks frequently requiring strenuous effort and extensive total body movements.
For example:
• Running up a flight of stairs while carrying a suitcase or load weighing 25 lbs or more
• Teaching a class or skill requiring active and strenuous participation, such as aerobics or physical education instructor
• Firefighting
• Masonry and heavy construction work
• Coal mining
• Manually shoveling or digging ditches
• Using heavy non-powered tools
• Most forestry work
• Farming—forking straw, baling hay, cleaning barn, or poultry work
• Moving items professionally
• Loading and unloading a truck

* The ratio of exercise metabolic rate. One MET is defined as the energy expenditure for sitting quietly, which, for the average adult, approximates 3.5 ml of oxygen uptake per kilogram of body weight per minute (1.2 kcal/min for a 70-kg individual). For example, a 2-MET activity requires two times the metabolic energy expenditure of sitting quietly.

+ For an average person, defined here as 70 kilograms or 154 pounds. The activity intensity levels portrayed in this chart are most applicable to men aged 30 to 50 years and women aged 20 to 40 years. For older individuals, the classification of activity intensity might be higher. For example, what is moderate intensity to a 40-year-old man might be vigorous for a man in his 70s. Intensity is a subjective classification. Data for this chart were available only for adults. Therefore, when children’s games are listed, the estimated intensity level is for adults participating in children’s activities.

To compute the amount of time needed to accumulate 150 kcal, do the following calculation: 150 kcal divided by the MET level of the activity equals the minutes needed to expend 150 kcal. For example, 150 ÷ 3 METS = 50 minutes of participation. Generally, activities in the moderate-intensity range require 25-50 minutes to expend a moderate amount of activity, and activities in the vigorous-intensity range would require less than 25 minutes to achieve a moderate amount of activity. Each activity listed is categorized as light, moderate, or vigorous on the basis of current knowledge of the overall level of intensity required for the average person to engage in it, taking into account brief periods when the level of intensity required for the activity might increase or decrease considerably.

Persons with disabilities, including motor function limitations (e.g., quadriplegia) may wish to consult with an exercise physiologist or physical therapist to properly classify the types of physical activities in which they might participate, including assisted exercise. Certain activities classified in this listing as moderate might be vigorous for persons who must overcome physical challenges or disabilities.
~Note: Almost every occupation requires some mix of light, moderate, or vigorous activities, depending on the task at hand. To categorize the activity level of your own position, ask yourself: How many minutes each working day do I spend doing the types of activities described as light, moderate, or vigorous? To arrive at a total workday caloric expenditure, multiply the minutes spent doing activities within each intensity level by the kilocalories corresponding to each level of intensity. Then, add together the total kilocalories spent doing light, moderate, and vigorous activities to arrive at your total energy expenditure in a typical day.
APPENDIX 6a.

IRB APPROVAL DOCUMENTS
Dear Dr. Walker and Ashlea D-L Sar:

Your proposal, "Modeling physical activity in working adults: How Suitable is the Expanded Parellel Process Model?" has been accepted as exempt since the data collection used is from a pre-existing data set and individual responses cannot be traced to the subjects included in the original data collection. You may begin data analysis effective May 31, 2004.

Respectfully,

George Maltzaler, Chair
School of Physical Therapy
Old Dominion University
Dr. [Name], Chair  
College Committee for Review of Human Subjects Research  
College of Health Sciences  
Old Dominion University  
Norfolk, Virginia  

Dear Dr. [Name]:

Notice of change to Exempt Proposal # 06-0-02

I am writing on behalf of Dr. [Name], my dissertation committee chair, and on my own behalf, to inform you as the chair and point of contact for the College Committee of an alteration in the study design for the approved proposal #06-0-02:- “Modeling physical activity in working adults: How suitable is the Expanded Parallel Process Model?” which we had submitted to the committee and approved 5/31/06.

The scope of the study has been scaled back from that of an observational cross-sectional assessment and a three-month longitudinal assessment design as at the time of approval to that of only an observational cross-sectional assessment design. Analysis of the longitudinal data assessment will no longer be carried out.

The study was accepted as exempt by the committee since the data collection was to be from a pre-existing data set and individual responses cannot be traced to the subjects included in the original data collection. With the specified change made to the study design, the data collection will still remain data extraction from a pre-existing data set where individual responses cannot be traced to the subjects included in the original data collection.

Respectfully,

Adwoa B-H-Sam,  
Student, PhD Program in Health Services Research  
College of Health Sciences  
Old Dominion University  
Norfolk, Virginia
June 18, 2007

Adwoa B-H Sam  
Student, PhD Program in Health Services Research  
College of Health Sciences  
Old Dominion University  
Norfolk, VA 23529

Dear Ms. Sam:

Thank you for submitting an alteration of your study design for the approved exempt proposal, # 06-0-02 “Modeling physical activity in working adults: How suitable is the Expanded Parallel Process Model?” The change of the study to an observational cross-sectional assessment design without the analysis of longitudinal data was approved by the College of Health Sciences Human Subjects Committee on June 15th, 2007 via electronic communication between members.

I am sending a signed copy of this letter to your committee chairperson, Dr. [Name] since this document will need to be included in your dissertation thesis. Please feel free to contact me if you have any further questions or concerns.

Respectfully,

[Name], PT, PhD  
Chairperson, Human Subjects Committee  
School of Health Sciences
APPENDIX 6b.

COPY OF DATASET USE AGREEMENT DOCUMENT
[Health Plan Quality Improvement Program Name] Research Project Agreement

This [Health Plan Quality Improvement Program Name] Research Project Agreement (the “Agreement”), effective ___, 2007 (the “Effective Date”), is entered into by and between [Name] and Adwoa Sam, an Old Dominion University doctoral student (“Student”).

WHEREAS, (“Company Name”) and Student are working on a research project designed to explore the behaviors of people working with a Lifecoach to improve their health (the “Project”); and

WHEREAS, (“Company Name”) possesses data that would assist Student in the research of the Project and wishes to assist Student in the Project;

NOW, THEREFORE, the parties agree as follows:

1. (“Company Name”) agrees to assist Student in the Project by providing data relevant to the Project, which data will specifically include information on physical activity (the “Data”). Student acknowledges that the Project has received approval from the ODU Investigational Review Board (the “Board”). Upon (“Company Name”)’s request, Student will provide (“Company Name”) with a copy of such approval from the Board.

2. (“Company Name”) shall provide the Data to Student at no charge. Upon completion of the Project, Student agrees to share her results with (“Company Name”) for possible publication of the results.

3. (“Company Name”) owns the Data. Student retains the right to use the Data for the purpose of the Project.

4. Student agrees that she will use Data only for purposes related to the Project, including a final analysis report and/or manuscript for possible publication. Student will not at any time, without the prior written consent of (“Company Name”), either during the Project or thereafter, publish Data or disclose Data to another person or entity, except to individuals working directly on the Project and only on a “need to know” basis. Student’s duty of non-disclosure does not apply to Data which:

1. Student can demonstrate was known to it prior to (“Company Name”) sharing Data with Student;

2. Is lawfully acquired from third parties that have a right to disclose such information; or

3. Student is required by law to release; provided, however, that Student shall first notify (“Company Name”) of such request so that (“Company Name”) may take any action it deems necessary to protect the information sought.
5. ("Company Name") and Student agree that ("Company Name") will provide to Student only de-identified-patient level Data. ("Company Name") will not provide to Student Protected Health Information ("PHI"), as defined in the Health Insurance Portability and Accountability Act ("HIPAA"), and will not provide Student with the key to the random identifier such that Student could identify an individual patient.

6. The term of this Agreement shall commence as of the Effective Date and shall continue until the Project is complete, unless sooner terminated as set forth in this Agreement. Either party may terminate this Agreement at any time for any reason by providing fifteen (15) calendar days prior written notice to the other party.

7. The parties agree to negotiate in good faith to amend this Agreement to comport with changes in federal law that materially alter either or both parties’ obligations under this Agreement.

8. Nothing in this Agreement shall confer upon any person other than the parties and their respective successors or assigns, any rights, remedies, obligations, or liabilities whatsoever.

9. This Agreement constitutes the entire understanding of the parties regarding the subject matter of this Agreement. The Agreement may only be amended in a writing signed by authorized representatives of each party.

10. This Agreement shall be governed and construed in all respects in accordance with the laws of the (US Mid-Atlantic State).

11. ("Company Name") and Student hereby agree to indemnify and hold harmless each other from and against any and all claims, demands, and actions, and any liabilities, damages, or expenses resulting there from, including court costs and reasonable attorney fees, arising out of any negligent act or misconduct of either Student or ("Company Name"), or Student’s or ("Company Name")’s breach of this Agreement.

12. Student acknowledges that pursuant to this Agreement it may receive from ("Company Name") confidential proprietary plans, programs, formulae, methods and other products and information ("Proprietary Material") relating to the business services and activities of ("Company Name"), the disclosure of which may seriously damage ("Company Name"). All Proprietary Material of any kind provided by ("Company Name") that has been or may hereafter be provided to Student shall be treated as strictly confidential. Student agrees that Proprietary Material received by it will remain absolutely confidential regardless of whether or not there occurs any change in the relationship between ("Company Name") and Student after this Agreement is executed. Student also agrees that she will not use any Proprietary Material provided to it by ("Company Name") for any reason or purpose which is in any way detrimental to ("Company Name"). This section shall survive termination of this Agreement.
IN WITNESS WHEREOF, each of the undersigned has caused this Agreement to be duly executed in its name and on its behalf.

ADWOA SAM

(COMPANY NAME) HEALTH PLAN

Signature of Authorized Representative

Signature of Authorized Representative

Name of Authorized Representative

Title of Authorized Representative

Date

Date
VITA
Adwoa B-H-Sam

Education:

2008 Doctor of Philosophy, Health Services Research
Old Dominion University, Norfolk, Virginia 23529
2004 Master of Science, Critical Care Nursing
Northeastern University, Boston, Massachusetts 02115
1987 Bachelor of Arts (Honors), Nursing with Psychology
University of Ghana, Legon, Ghana, West Africa

Professional Work Experience:

Current Adjunct Instructor, Department of Health Sciences,
Tidewater Community College, Norfolk, Virginia
Responsibilities: Teaching HLT 143-Medical Terminology course
with a focus on basic anatomy and physiology.

2000-2003 Health Promotions Manager, Health Promotion Department
U.S. Naval Hospital, Naples, Italy
Responsibilities: Responsibility for oversight and coordination of
clinical preventive screening and counseling components of the
department’s ‘Put Prevention into Practice /Wellness Program for
active duty and dependent Tricare beneficiaries.

1994-1995 Staff Nurse, Neuroscience Unit
Boston University Medical Center, Boston, Massachusetts
Responsibilities: Providing nursing care for clients requiring neuro-
medical/surgical monitoring and intervention therapies within the
context of the primary nursing model and a multi-disciplinary
healthcare team.
Korle-Bu Teaching Hospital, Accra, Ghana

**Responsibilities:** Providing nursing care for clients in hands-on experience rotation through these units.

Ministry of Health/University of Ghana Medical School, Legon, Ghana

**Responsibilities:** Maintaining department vital statistics records, assisting with the operation of department sickle-cell anemia pre/post natal clinics, assisting with research data collection in joint studies with organizations such as World Health Organization and Carnegie Corporation as well as with other ‘Visiting Professor’ faculty.

**Other Professional Experience:**


11/2006 Guest Lecturer, College of Health Sciences
Old Dominion University, Norfolk, Virginia

**Responsibilities:** Teaching a HLSC –Public and Community Health Management class on administrative processes and strategies for public and community health organizations with a focus on building constituencies for public health and leadership in public health.