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Chapter I

Introduction

American society is gaining weight by the minute. Obesity, a significant public health problem, is defined as a body mass index (BMI)\(^1\) of 30 or above. For example, The Obesity Society states that a 5 foot, 9 inch (69 inches) adult who weighs 203 pounds would have a BMI of 30, thus classifying him/her as obese. The consequences of obesity are hindering health, barrier to mobility, heart disease, some types of cancer, strokes, diabetes, and atherosclerosis (Himes, 2000). Based on the Behavioral Risk Factor Surveillance System 2007 (BRFSS) 25.6 percent of the population is obese. The BRFSS set forth a goal of Healthy People 2010, in which its main objective was to reduce the proportion of adults who are obese to 15 percent by 2010. Not one state met that goal; 30 states were 10 or more percentage points away from that objective. Within the past 20 years, Obesity has dramatically increased in the United States (Wells, 2007).

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\(^1\) BMI is calculated using height and weight. To calculate BMI the following equation is used \(\text{BMI} = \left(\frac{\text{weight in pounds}}{(\text{height in inches}) \times (\text{height in inches})}\right) \times 703.\)
There are many factors that play a role in obesity. Some of the main factors include but are not limited to genetics, behavior, drugs, diseases and the environment. Science shows that a person’s genetic make-up can be a direct cause of obesity and diabetes. However, genes alone are not always a predictor of future health. A person’s behavior, the choices a person makes in eating and physical activity, also contributes to obesity and personal health. However, people make decisions and choices based on the environment and/or community in which they live, work, and play. Haskell states, “The prevalence of leisure-time inactivity remained fairly constant through 1996, but more recently has declined in both genders. In 2005 23.7% of adults reported no leisure time activity” (2007, p.1424). This reported limited leisure activity assumes more time in the workplace. The workplace can vary from sedentary to limited movement.

In the corporate environment activities are generally sedentary in nature. Corporations have taken it upon themselves to care for their employees’ health through various wellness programs. These wellness programs include smoking cessation, health clubs, health physicals, healthy meal choices, and nutritionists. If employees have unhealthy lifestyles it can not only lead to disease and disability but also to decreased productivity, work related injuries, excessive sick leave usage and increased absenteeism in the workplace. “A ten year study by the university of Michigan fitness research center and Steelcase corporation examined 14 non-genetic risk factors (including high blood pressure, high cholesterol, obesity, tobacco use and inactivity among others) found that if
“high-risk employees took action to improve their health habits, healthcare costs were dramatically reduced” (Cohen, 1994, p. 31). If an employee went from high-risk to low-risk their annual claims decreased from $1115 to $537, concluding that Steelcase may gain a three to one return on investment for employee wellness programs in a three to six year period (Cohen, 1194). Other companies who have had a positive return on investment are Aetna, Union Pacific, Motorola, Citibank, DuPont, Caterpillar, Xerox Corporation, Northeast Utilities, and Steelcase. On average, the American Institute for Preventive Medicine Wellness White Paper (2008) states “62% of companies of all sizes are offering some type of wellness program” (p. 4).

American Institute for Preventive Medicine stated in “2008 United States health care costs totaled approximately $2.2 trillion or 16% of the gross domestic product. It is projected that companies will pay $9,312 per employee for health care” (p. 1). The American Institute for Preventive Medicine (2008) developed the Wellness Wizard which is available at no cost. The Wellness Wizard helps companies understand how the government statistics of Risk Factors apply to their employees. For every 100 employees, the Wellness Wizard breakdowns the cost of risk factors and what savings would be based upon a reduction in those risks. The risk factor breakdown from the Department of Health and Human Services 2007, “for every 100 employees: 25 have cardiovascular disease, 12 are asthmatic, 6 are diabetic, 26 have high blood pressure, 30 have high cholesterol, 21 smoke, 31 use alcohol excessively, 20 don’t wear seat belts, 24 don’t
exercise, 44 suffer from stress, and 38 are overweight” (American Institute for Preventive Medicine, 2008, p. 5)

People are overweight not only because of genetics but because in general today’s population is less active. In today’s world almost everything is available right at the fingertips, whether that is technology, transportation or food. An office worker on average is spending eight hours in an artificially lit space with little to no exposure to natural daylight. Sunlight is every bit as central to our health and well-being as proper nutrition, clean water, and exercise. There is strong evidence for a protective effect of Vitamin D (a vitamin in which the body makes when exposed to sunlight) on healthy bone density, muscle weakness, more than a dozen types of internal cancers, multiple sclerosis and Type 1 Diabetes hours a day was found to cause less stress and higher satisfaction in the workplace (Alimoglu et al., 2004). Sunlight affects moods positively and is a natural antidepressant. Exposure to sunlight stimulates the pineal gland to produce melatonin which plays a role in proper sleep and has been shown to fight cancer (Doljansky et al., 2005). A person spending more time outdoors tends to be more active by walking, hiking, and enjoying other physical activities then someone who does not (Wells et al., 2007). Also, being outdoors puts a person in touch with nature and allows them to see and experience the rhythms and cycles of the natural world, reducing stress and increasing their sense of connectedness.

Public health, in general, is in intertwined with all the above. People are not getting enough daylight, causing their circadian rhythm to be out of sync, causing them to
be more stressed. Food is being processed and unnecessary additives are being added, which causes health problems. Technology has made everything at the fingerprints causing the American society to be less active. People’s lives today are more hectic than ever, but somehow American’s population is 25.6% obese. Designers design things to be accessible but with transportation becoming more readily available people are no longer walking outdoors. Urban design has looked at this problem of obesity and has tried to prevent it through parks, access to recreational facilities, and public transportation. Corporations have been addressing this problem of obesity since before the 1980’s making this idea of successful corporate wellness programs not new or innovative however the idea “Can architecture help prevent obesity?” is new with little to no research done on the interior environment. Therefore, does human based design of the built environment have a positive impact on the health of the users?
CHAPTER II

REVIEW OF LITERATURE

The role of human based design in the interior built environment and the positive impact on the health of the users was researched; however there seems to be an absence of empirical evidence in this area. The relationship from processed food to obesity to health to wellness programs to urban design to architecture was reviewed to obtain research on the interior environment and public health. The following literature review attempts to demonstrate and support the relevance of this thesis and the absence of empirical evidence in this field of study.

Processed Food in Correlation to Obesity

The documentary, *Food Inc.* explores how eating routines have changed as well as what goes into American food (Kenner, 2008). Micheal Pollan, award winning journalist and world-renown food expert, states in *Food Inc.*, “The way [Americans] eat has changed more in the last 50 years than in the previous 10,000..” (2008). The average supermarket has 30,000 products for sale. Tomatoes are now picked year round green
and ripened with ethylene gas. Meat aisles no longer have carcasses hanging because there is a barrier to conceal where food originates. Kenner states in *Food Inc.*, “it is just not about what we are eating but it is about what we want to know, food processes are deliberately hidden from us” (2008).

Americans are hard wired to go for three things in nature: salt, fat, and glucose, all of which are readily available. The food producing industry according to the documentary, *Food Inc.*, is now affecting diabetes in Americans because the amount of glucose in the food increases insulin levels. 1 in 3 Americans born after 2000 will contract early onset diabetes. 1 in 2 minorities will contract early onset diabetes. The high glucose levels in the food being produced are a big predictor of diabetes. According to Wolin et al. (2009), “Studies have shown that children and adolescents who are overweight produce more insulin…eventually causing the cells in the body to become less sensitive to insulin. This eventually leads to type 2 diabetes. Because overweight and obesity are affecting more and more children and adolescents, there is more type 2 diabetes in this group. This form of diabetes was historically seen only in adults. Now, 45 percent of all diabetes cases currently diagnosed in children are type 2 diabetes” (p. 49).
Body Mass Index

The food producing industry is also affecting obesity in Americans. The biggest predictor of obesity is income level. Those who have lower income buy inexpensive food which is highly subsidized with calories from inexpensive commodity crops making it affordable. Obesity is commonly blamed on an individual’s lifestyle but when Americans consume food that is engineered, evolutionary buttons are being pressed. Food is subsidized because the upfront cost is inexpensive but the environmental costs and health costs that are a result of subsidized food are very expensive. “Food is not processed honestly, nor produced honestly nor priced honestly, nothing about food is honest, and it is all an industry” (Kenner, 2008). Wolin et al. (2009) suggest that amount of food we are eating over time has increased. There has been a large increase in the availability of food in the United States, as well as a corresponding increase in the amount of food that is wasted and or thrown out. Both the Food Inc. and Wolin et al. (2009) agree that the food served at fast food restaurants (high fat, high sugar and energy dense) are strongly correlated with obesity. If food was nutritionally dense and unaltered, those who ate it would be healthier and more productive resulting in less illness.

In 2005, Suzanne Pugh author of the Steelcase Healthcare Report stated, “the percent of adults age 20 and over that are overweight or obese is 65 percent” (p. 1). Of that 65 percent, 30 percent are obese. “It is estimated that between 5 and 10 million of the obese are morbidly obese, meaning that they are at least 100 pounds over their normal
body weight” (Pugh, 2005, p. 1). Wolin et al. traditionally defines obesity in adults using body mass index (BMI), a measure of weight to height. While other researchers, Cawley and Danzinger (2004) define BMI as the standard measure of fatness in epidemiology and medicine; it is used to classify individuals as overweight and obese by the U.S. National Institute of Health, the World Health Organization, and the International Obesity Task Force.

In 2009, Wolin et al. state that in the United States, 66 percent of adults are overweight or obese and 32 percent of adults are obese, and these numbers show a trend of increasing over time. Of particular concern is the rapid increase in the prevalence of morbid obesity in young adults; in 1999 just 4.5 percent of U.S. adults were in this morbid obesity category of having a BMI greater than 40, but this rose to 5.4 percent in just four years. Being overweight or obese can lead to an early death. The estimated number of U.S. adults who die each year from obesity-related cause ranges from 112,000 to 325,000 (Allison et al. 1999; Flegal et al. 2005). The life expectancy of obese adults is lower than for non obese adults.

**Sedentary Behavior**

Wolin et al. (2009) examined the relationship between sedentary behaviors and obesity in 50,277 women who had a BMI less than 30 at baseline over six years. The rate of becoming obese (BMI greater than 30) in multivariate analyses was 1.11, 95 percent of
those who spent greater than 40 hours a week sitting around at home compared with 1.00 in the category who spent 0-1 hours per week sitting around at home. For those sitting at work or away from home or driving more than 40 hours per week the rate of becoming obese was greater, 1.28. This translates to evidence that sedentary activity of more than 40 hours per week can result in raising one's BMI by 1.28. Summerbell et al. (2009) in The International Journal of Obesity slightly contradicts Wolin et al. (2009) with the correlation between physical activity and subsequent excess weight gain and obesity. In U.S. adults of mixed ethnicity 51 to 61 years of age work related physical activity was not found to be a predictor of a four year weight change in men or women. However, Summerbell et al. (2009) study in The International Journal of Obesity indicated a significant inverse relationship between physical work activity and weight gain of a three year weight change in U.S. Caucasian 24 to 42 years of age.

**Physical Activity and Weight Gain**

Physical activity, defined as movement caused by skeletal muscles which increases energy expenditure above rest, is a complex multi dimensional behavior taking place in a wide variety of domains and contexts. Relationships between physical activity exposures and weight gain are so complex that there may be unknown and unmeasured factors. Addy et al. (2004) researched that the beneficial effect of physical activity on reducing chronic diseases are well established, but most of the U.S. population is not regularly active. There may be a relationship between a fit body and improve mental
abilities and to some degree modern research has supported this notion. Educating people about how to have a fit body is sufficient to help them achieve one and that once they are of normal weight, individuals will find it so appealing that there will be minimal regression (Wolin et al. 2009). That has not been the case by any means and research has begun to look beyond the individual to the environmental and societal factors that may contribute to obesity.

A social ecological perspective of health suggests that social and environmental factors play an important role in increasing physical activity (Addy et al. 2004). Supports for physical activity are sidewalks, public recreational facilities, streetlights, pleasant neighborhoods, and physically active neighbors. Addy et al. (2004) however stated, “That there are barriers to physical activity including traffic volume, unattended dogs, crime, and perception of neighbors being untrustworthy” (p.441). However, at this point there is minimal research on the barriers to physical activity within the interior built environment.

**Unemployment in Correlation to Obesity**

As there are several physical barriers to physical activity; obesity is a barrier to several aspects of one’s life. Obesity represents a potential barrier to labor market success because obese females tend to earn less than healthy weight females; this relationship is stronger for Caucasian than African Americans (Cawley et al. 2004). The
goal of Cawley and Danzinger’s paper “Obesity as a Barrier to the Transition from Welfare to Work” was to generate consistent estimates of the relationship between weight and labor market outcomes and between weight and welfare among current and former recipients. Danzinger et al. (2000) examines a variety of such barriers and documents that a range of human capital, physical health, and mental health factors affect the probability of work requirements. Cawley et al. (2004) research resulted in a consistent correlation, “between weight and adverse labor market outcomes among white respondents… For white females, a 10 percent increase in weight from the mean is associated with a 12 percent decrease in the probability of current employment” (p.16) White females who are heavier (whether measured in weight in pounds or BMI) are more likely to report that they are not currently working (Cawley et al., 2004). “Among African American respondents a 10 percent increase in weight in pounds is associated with a 10.9 percent increase in the percent of months of spent on welfare” (Cawley et al., 2004, p.16).

Obesity is not only correlated to the labor market but to depression as well. The correlation between obesity and depression may be the result of obese individuals becoming depressed about their physical conditions or the result of depression leading to calorie consumption (Williamson et al. 1998). “Obesity is a risk factor for many chronic diseases including, diabetes, hypercholesterolemia, stroke, heart disease, certain cancers and arthritis” (Flegal et al., 2002, p.1726). While some illnesses are the result of obesity,
in other cases illness can limit physical activity and contributes to obesity. Overall, mental and physical health problems indicate that weight is correlated with both mental and physical health problems, but it is unclear in which the causal arrow points. Obesity may increase the likelihood of depression and physical limitations, and vice-versa (Cawley et al., 2004).

If obesity correlates to unemployment and low wages, one strategy for easing the transition from welfare to work may be to expand Medicaid to cover treatments for obesity, nutrition counseling, and weight loss treatments. To the extent that such treatments improve labor market outcomes and reduce welfare use, public savings may offset some of the cost of expansion (Cawley et al., 2004). Roehling (1999) found that weight explains a greater proportion of the variance in hiring decisions than even race or gender. Gallup Consumption Habits Survey (2003) reflects Roehling’s findings in which 20 percent of respondents answered that they would be less likely to hire a job applicant if they learned that the applicant was overweight.

**Health Care Cost**

The Conference Board 2006 CEO challenge survey, cited that almost 14 percent of U.S. CEOs responded that obesity was among the greatest healthcare benefit concern-equivalent to the same level as smoking and greater than drug or alcohol abuse (Rosen et al., 2008). Obesity accounts for a large share of the still-rising costs of employee
healthcare, which U.S. CEOs ranked their 16\textsuperscript{th} greatest challenge in the Conference Board 2007 survey. U.S. health care costs constitute some $1 trillion, about 14 percent, of the gross national product. This cost averages $3,900 per employee (Powell, 2006). Centers for Medicare and Medicaid services (2006) found the rise in U.S. healthcare spending continues to outpace inflation; by 2016, healthcare spending is projected to exceed $4.1 trillion and account for 19.6 percent of gross domestic product (GDP).\textsuperscript{2}

Obesity-related costs account for an estimated five to seven percent of the U.S. national healthcare budget, compared to a little more than two percent for most other industrialized nations (Long et al., 2006, p.245). The business world increasingly recognizes obesity to be a critical and workplace relevant problem. Companies large and small, externally and self-insured, are looking hard at the health and health care costs of current, as well as retired and future, employees. But there is great variation in how this informed awareness translates action (Rosen et al., 2008). “As a nation, we need to renew our commitment to achieving a ‘healthy body weight,’” the Miliken Institute declared in a recent report on the economic costs of chronic disease. “Rising obesity rates threaten to send treatment costs for diabetes and related conditions, such as heart disease and stroke, soaring over the next 20 years. There needs to be a strong, long-term national commitment to promote health and wellness” (DeVol et al., 2007).

\textsuperscript{2} Gross Domestic Product (GDP), refers to the market value of final goods and services produced within a nation’s borders.
Corporate Wellness Programs

Companies are not passively accepting these rising health care costs, and many have reduced benefit levels as a way to deal with them. On the other hand many companies increased health promotions and wellness programs. Companies with workplace wellness programs are improving health, decreasing absenteeism, and saving money. There is data to justify the benefits of health promotions. Series of studies have documented reductions in absenteeism and health care costs when wellness programs have been implemented. There is also research that quantifies the costs associated with employees who exhibit unhealthy lifestyles (Powell, 2006). “A company investment of $100 to $150 per employee each year to participate in an employee wellness program can save companies $300 to $450 for each employee every year”, according to Ron Goetzel, Director at Cornell University Institute for Health and Productivity Studies (Nichols, 2007, para. 2).

Based upon government statistics, from the 1996 William M. Mercer Incorporated Survey (1996), the most common health promotions programs offered at worksites are:

- Disease Prevention 55%
- Medical Self Care 51%
- Fitness 41%
- Smoking Cessation 40%
- Stress Management 37%
Alcohol and Substance Abuse 36%
Back Care 32%
Nutrition Education 24%
Hypertension Education 24%
Mental Health Programs 24%
Weight Control 24%

According to a 2005 survey by the Art of Health Promotion, companies who instituted employee health and wellness programs realized a 30 percent reduction in medical and absenteeism costs in less than four years.

A successful workplace wellness program starts with company leaders. Business owners should lead by example, taking part in their company’s corporate fitness program and working closely with a wellness coach. Company leaders should make sure employees are well aware of their wellness efforts, posting weight loss results or smoking cessation results on company intranet or bulletin board. Johnson & Johnson is an appropriate example of a successful wellness program, “faced with only 26 percent employees participating in their employee health and wellness program; they offered employees a $500 discount on medical insurance if they completed a health risk profile. The number of employees participating in the Johnson & Johnson corporate fitness program jumped after they offered the incentive to more than 93 percent” (Nichols, 2007, para. 4). The American Institute for Preventive Medicine (2008) reviewed scores of
published studies on worksite wellness programs found that the Return on Investment is $3.48:1 due to reduced medical costs and $5.82:1 due to reduced absenteeism.

Studies by the University of Michigan and Johnson & Johnson show more advantages of corporate wellness programs including (“Advantages of Corporate…””, 2010, para. 6):

- “$1,100 a year for every employee who kicks the smoking habit”
- “$269 a year for every employee who progresses from couch potato to fitness enthusiast”
- “$1,200 a year on employees who reduce their cholesterol levels from 240 milligrams to 190 milligrams”
- “$177 a year for every employee who goes from obesity to a healthy weight”

According to separate studies by the University of Michigan and Steelcase, corporate wellness programs can reduce costs for serious illnesses, such as heart disease, by identifying high-risk employees and encouraging them to change their behaviors. Based upon the positive return on investment of companies such as Aetna, Union Pacific, Steelcase, and Johnson & Johnson and the numerous advantages of Corporate Wellness Programs, wellness experts expect that the implementation of Corporate Wellness Programs within businesses will lead to the following: a healthier work force, a higher quality work product, improved employee morale, reduced sick leave usage, absenteeism, lower health care and workers’ compensation costs (Powell 2006).
Companies can offer Corporate Wellness Programs for their employees to improve employee morale and production, as well as the building in which that company also inhabits can help improve employee physical activity. The American Heart Association added a sedentary lifestyle to its list of modifiable risk factors (Fletcher et. al. 1996). There has been a considerable increase in sedentary lifestyles and higher rates of obesity among U.S. residents (Centers for Disease Control and Prevention 1999). U.S. Public Health Reports suggest that only 22 percent of the U.S. adult populations are active enough to derive health benefits from their physical activity and that one in four Americans are completely sedentary.

**Physical Activity Recommendations**

The Center for Disease Control and Prevention and the American College of Sports Medicine revised back in 1995 their recommendations regarding exercise to suggest that all Americans should accumulate 30 minutes or more of moderate to intense physical activity on most or all days of the week (Pate et al., 1995). Walking and taking the stairs instead of escalators or elevators may be two easy ways for seemingly healthy sedentary adults to become more moderately active (Anderson et al., 1995). Ross Anderson et al. (1998) tested the effectiveness of signs to encourage use of stairs instead of escalators. The signs (22” x 28”) promoting the health and weight-control benefits of stair use were placed beside escalators with adjacent stairs. Overall, in older persons (≥40 years of age) stair use increased from 5.1% to 8.1% when a health sign was placed
but increased to 8.7% with the weight-control sign. Lean persons used the stairs more often than overweight persons (5.4% and 3.8%). The health sign increased stair use to 7.2% among normal-weight persons; the weight control sign prompted stair use to increase to 6.9% among persons of normal weight and to 7.8% among overweight persons (Anderson et al., 1998). Stairs located within 25 feet of an entrance and encountered prior to the elevator are more likely to be used for everyday travel (Nicoll, 2007). Stair use not only burns calories, but research has linked stair use to other health benefits such as better cardiovascular health (Zimring et al., 2005 and Bloomberg, 2010).

**Environmental Approaches**

Traditionally, research on disease prevention has target individuals to effect behavioral change, this includes modifying physical education and health classes, counseling, promotional materials, and self-monitoring. This approach of effecting behavioral change alone has not made sufficient progress in increasing physical activity, in the past there have been calls for interventions that include environmental approaches as well (Pate, 1995). Such environments include facilities for leisure activity, such as trails, public swimming pools, and parks. Parks are common community features that provide opportunities for physical activity (Bedimo-Rung et al., 2005). There is a strong relationship between parks and physical activity. The park characteristics create park visitations, which therefore create behavior of physical activity within park which has its
benefits of physical health, psychological health, social, economic, and environmental (Bedimo-Rung et al., 2005).

Physical activity can be measured using the 2001 Behavioral Risk Factor Surveillance System physical activity module. Moderate physical active is 30 minutes 5 days a week, or vigorous physical activity is 20 minutes 3 days per week. Someone who is insufficiently active does not engage in moderate or vigorous physical activity (Addy et. al. 2004). “In the past 20 years, walking in the United States has been decreasing steadily, both as a means of transportation and as a form of recreation,” (Alfonzo, 2005, p.808). There are many variables that are determinants of physical activity and walking.

Addy et. al. (2004) tested the associations of perceived social and physical environmental supports with physical activity and walking behavior. This test resulted in a multivariable model demonstrating that younger age, better street lighting, trust of neighbors, and use of recreational facilities were associated with increased physical activity. Younger age, more education, having physically active neighbors, having sidewalks available in their neighborhood, and using a mall for walking were associated with increasing walking behaviors. Few investigators have used multivariable analysis to assess the influence of environmental supports on physical activity (Sallis et al., 1997) and less is known about the impact of such supports on walking behavior. Future research on community-based interventions should focus on expanding awareness, safety,
and access to and use of places where people can engage in physical activity and walking (Addy et al., 2004).

Most researchers have focused on access to exercise or recreational facilities, built form, urban design, and land uses. Additionally, studies investigating the relationship between the built environment and physical activity have usually examined the effects of only one or two characteristics of the physical environment, without a broader elaboration of the multiple and complex ways in which the built environment may influence walking for diverse populations and settings (Alfonzo, 2005, p.809). Mariela Alfonzo (2005) developed the hierarchy of walking needs. The hierarchy of walking needs model points out that there are five levels of needs that are considered within the walking decision making process. These needs progress from the most basic need, feasibility (related to personal limits), to higher-order needs (related to urban-form) that include accessibility, safety, comfort, and pleasurability, respectively. Within this hierarchical structure, an individual would not typically consider a higher-order need in his or her decision to walk if a more basic need was not already satisfied (p.818).

Distances to destinations also affect the choice to walk. For example, although 70 percent of people will walk 500 ft for errands, only 40 percent will walk 1/5 mile and only 10 percent of people will walk half a mile (Southworth, 1997). Although it is assumed that mobility issues affect whether a person decides to walk; only one study has investigated this relationship directly (Alfonzo, 2005). Both a person’s weight and a
person’s perception of his or her own weight have been found to be a significant barrier to physical activity (Ball et al., 2000). More studies examining the effect of mobility on the need for feasibility and ultimately on the decision to walk would be beneficial (Alfonzo, 2005).

**Seasonal Variation Effects**

However, there are things that are out of human control, such as the seasons of nature, which affect one's physical activity. Matthew et al. (2001) studied the seasonal variation in household, occupational, and leisure time physical activity. During summer in comparison to winter, moderate non-occupational activity increased by 51 minutes per day in men and by 16 minutes per day in women. Seasonal variation in physical activity has been reported to coincide with seasonal changes in blood lipid levels, blood pressure, body mass, bone density, and affective disorders (Mundall, 1997). “A large percentage (20%-30%) of the population suffers from problems such as depression, sleep disorders, lack of concentration, loss of interest, and loss of libido,” (Begemann et al., 1997, p.239).

Environmental changes in ambient temperature, daylight, and monthly precipitation are thought to induce seasonal changes in physical activity, and recent public health recommendations have noted the importance of environmental factors (i.e. daylight and weather) as potential barriers to regular participation in healthful levels of such activity. Consistent participation in high levels of physical activity appears to be
required for optimal health; thus, environmental factors related to seasonal variations in physical activity behaviors must be considered in intervention and health promotion efforts designed to increase activity levels in the general population (Matthew et al., 2001). Preplanned strategies for overcoming these apparent environmental barriers to physical activity under unfavorable environmental conditions will be needed to encourage year-long participation in healthful levels of physical activity.

**Built Environment**

The Active Design Guidelines resulted from a collaborative, multidisciplinary effort among City agencies; New York’s health, planning, design, and architecture communities; and academic institutions from across the country (Bloomberg et al., 2010). These guidelines promote physical activity and health in design that is directly related to New York City. This document indicates that there is a lack of research on how the built environment (particularly the interior environment) affects the public health of the user. It focuses on the interior stair location and usage. However, its’ primary focus is the built environment in context to urban design providing a guideline for Architects and Urban Designers that is grounded in the idea that the design of the built environment can have a crucial and positive influence on improving public health. Comprehensively guidelines state: architects need to encourage the use of stairs through signage and location. The building core itself should also include a recreational facility within. Like most interior spaces, incorporate as much natural daylight into the stairs environment. “Illumination
levels of 75 percent should equal that of adjacent corridors, with a minimum of 10 foot candles illumination within the stairs,” (Bloomberg et al., 2010, p.77).

**Daylight Effects**

Daylight exposure not only encourages stair use but exposure to daylight at least 3 hours a day was found to cause less stress and higher satisfaction in the workplace (Alimoglu et al., 2004, p.553). Burnout, a term that was first used in the medical field by Herbert Freudenberger (1974) is known to be a prolonged psychological response to chronic emotional and interpersonal stressors on the job, and is defined by the three dimensions of emotional exhaustion, depersonalization, and low personal accomplishment. Daylight exposure showed no direct effect on burnout but it was indirectly effective (i.e. night shifts may lead to burnout via work related strain and dissatisfaction with annual income) (Alimoglu et al., 2004, p.554). Veitch et al. (1996) tested human beliefs about lighting on a Likert scale from 0 to 4. 65 percent of the respondents reported that the quality of light is important to their well being. A larger majority (80.5 percent) agreed or strongly agreed that natural daylight indoors improves their mood. 70% reported that the type of lighting in a room makes a difference to them. However, there were some contradictions in the result, 32.7 percent agreed or strongly agreed that bright lights are stimulating and make them feel more energetic. Only 14.8 percent agreed or strongly agreed that they accomplish more under bright light. When asked to rate the statement, “Fluorescent lighting is bad for your health,” only 14.8
percent reported any degree of agreement. Almost twice that number agreed or strongly agreed that fluorescent light can give them headaches (p.454-456).

In commercial and institutional settings the one who makes decision about the lighting is not always the end user. Evidence suggests that in some cases, decision makers avoid innovative, energy-efficient products to avoid problems with end user acceptance of a new lighting system (Conway et al., 1992). In the absence of empirical evidence about how end users perceive lighting, an institutional lighting decision maker can rely only on informal knowledge to predict end user response (Veitch et al., 1996, p.466). Results from research by Begemann et al. (1997) supported the results of Veitch (1996) in an office environment. The results show that most people prefer to follow a daylight cycle instead of a constant level.

Preferred lighting levels are significantly higher than today’s indoor lighting standards and correspond to levels where biological stimulation can occur. Medical research has shown that a prolonged lack of “light vitamin” can cause health problems ranging from minor sleep and performance difficulties to major depressions. “At low daylight levels (500 lux) the average preferred colour temperature is around 3300 Kelvin (K)3 which increases to 4300 Kelvin at levels above 1500 lux,” (Begemann et al., 1997, p.236). By forcing people to work in biologically ‘dark’ indoor environments, during the

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3 Kelvin is the measurement of the color temperature of a light source.
day we may well have deprived them of their daily light dose necessary to regulate and optimize their circadian rhythm. “Creating healthy luminous indoor environments may turn out to be a simple form of preventive medicine that provides a new challenge for the lighting community” (Begemann et al., 1997, p. 239).

**Summary**

Begemann, Vietch, Alimoglu, and etc. focus on how lighting, daylight and artificial, affects human circadian rhythm, work strain, and productivity. The Active Design Guideline refers to case studies and research on how stair placement and use can affect one’s choice in physical activity. However the guideline, like most research, is geared to the urban context of a built environment as well as urban design. Along, with urban design how one interacts in parks, trails, and sidewalks has also been substantially researched by Matthew, Alfonzo, Southworth, Black, etc. It can be assumed from this literature review that there is a need for future research on the interior built environment and how it affects public health. This would help to determine what factors need to be present in an interior environment that subconsciously encourages the user to be physically active.
CHAPTER III

METHODOLOGY

The objective of this study is to understand how the physical interior environment influences employee’s mobility throughout the space by examining the possible effects of stair, elevator, restroom, copy/work room, café, workstations, and reception location. To accomplish this study objective, a field experiment was conducted at two local corporate offices. This chapter presents research methods by specifically addressing the participants, the observation setting, the dependent measures and the observation procedure.

Participants

A total of 20 individuals were observed at Firm A. A total of 17 individuals were observed at Firm B. Totaling, 37 individuals over the age of 18 were observed for this study. Due to the nature of this study, Participants were unaware that they were part of a study investigating physical activity patterns.

Prior to observing, the office administration of each location granted permission to engage their employees in this observation study. Before the researcher proceeded
with the study, the background and process for this study was discussed and approved by administration.

Field Observations Setting

Firm A

Firm A, an architecture and design firm located in Cleveland, Ohio, was observed to obtain data. This office is two stories, about 10,000 square feet, with a ceiling height of 20 feet on the first floor and 20 feet on the second floor. The walls are painted, wallpapered, and/or some other type of application (Figure 3.1). Both floors are exposed to ample daylight. The ceilings are exposed ductwork (Figure 3.2).

Figure 3.1 Wall Applications

Figure 3.2 Exposed Ductwork Ceiling
The floor plan (Appendix 1) consists of 3 staircases; 1 open (located within 25 feet of main entrance) (Figure 3.3) and 2 closed fire stairs (access to employee parking lots) (Figure 3.4). Restroom and café facilities are located on each floor.

Copy and print room is also on each floor, however large format plotter is only located on second floor (Figure 3.5). The first floor consists of 29 studio seats (Figure 3.6) and the second floor consists of 49 studio seats (Figure 3.7). One small elevator is
located at the front of the building adjacent to entry door and (Figure 3.8) a freight elevator is located at rear of building.

Figure 3.5 Copy/Work Room  Figure 3.6 First Floor Studio Seats

Figure 3.7 Second Floor Studio Seats  Figure 3.8 Front Entrance Elevator
Firm B

The office a Firm B, an architecture and design firm is located in Ohio City of Cleveland, Ohio. This office occupies the third and fourth floor of a four story building, approximate total of 5,000 square feet, with a ceiling height of 12 feet third floor and 14 feet fourth floor. The walls are painted, exposed brick, and/or some other type of application (Figure 3.9). Both floors are exposed to ample daylight. The ceilings are exposed ductwork (Figure 3.10).

The main entrance to this office is from the back of the building (Appendix 2). The floor plan consists of 3 staircases; 1 spiral staircase (Figure 3.11) and 2 closed fire stairs (access to employee parking lot and front of building) (Figure 3.12). Restroom and café facilities are located on first floor. Copy room is also on first floor (Figure 3.13), however fourth floor has access to its own black and white printer. The first floor
consists of 20 studio seats (Figure 3.14) and the second floor consists of 5 studio seats (Figure 3.15). One medium size elevator is located towards the main entrance of the building (Figure 3.16).
Observational Instruments

The data-collection instrument (Appendix 3) for this study was an observation form divided in two sections, designed to obtain demographics of each participant. Since the nature of this study was observation, all data collected was determined by subject’s personal appearance. No exact data/measurements were taken in this study. Information gathered included gender and approximates of age, height, and weight. A subject’s height was estimated in comparison to the workstation’s panel height of four feet. For observation reasons a brief description of the participant was given, however this is not an exact measure but a reference for the researcher during observation. The second measure of the research was designed to obtain their physical activity/mobility patterns within a two hour time slot. This observation gathered information within the space the
participant walked, how long they were sedentary and the number of times an individual used the stairs in either direction.

**Procedure**

The study was conducted over a two day period for both firms: one day for the second level and second day for the first level, both observations were conducted 9:00am until 3:00pm. All of the participants were employees of the firm. The participants were unaware that they were part of a study investigating their mobility. The researcher sat in an inconspicuous location therefore not interrupting daily physical activities but able to monitor subject.
CHAPTER IV

RESULTS

This chapter presents the findings, including demographics and descriptive statistics on participant demographic characteristics. Then quantitative findings based on the participant’s physical activities and the interior environment is analyzed.

Subject Characteristics

Firm A

A total of 20 (N=20) subjects aged 18 and over were observed in this study. Table 4-1 presents the percentage distributions for the participant demographic characteristics. Ten subjects were male (50%) and the other ten subjects were females (50%). The age range of subjects included: six subjects (30%) were 20 to 30 years old, nine subjects (45%) were 30 to 40 years old, three subjects (15%) were 40 to 50 years old, and two subjects (10%) were 50 to 60 years old. One subject (5%) was 5 feet 11 inches; three subjects (15%) were 5 feet 10 inches; two subjects (10%) were 5 feet 9 inches; two subjects (10%) were 5 feet 8 inches; two subjects (10%) were 5 feet 7 inches;
three subjects (15%) were 5 feet 6 inches; one subject (5%) was 5 feet 5 inches; four
subjects (20%) were 5 feet 4 inches; two subjects (10%) were 5 feet 3 inches. Fourteen
subjects (70%) were of normal weight; one subject (5%) was underweight; and five
subjects (25%) were overweight. No subject, by observation, was determined to be
obese.

<table>
<thead>
<tr>
<th>Sex</th>
<th>n (%)</th>
<th>Age Group</th>
<th>n (%)</th>
<th>Height</th>
<th>n (%)</th>
<th>Weight</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
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<td>10 (50%)</td>
<td>20-30</td>
<td>6 (30%)</td>
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<td>1 (5%)</td>
<td>Underweight</td>
<td>1 (5%)</td>
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<tr>
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<td>9 (45%)</td>
<td>5'10”</td>
<td>3 (15%)</td>
<td>Normal</td>
<td>14 (70%)</td>
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<td></td>
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<td>3 (15%)</td>
<td>5'9”</td>
<td>2 (10%)</td>
<td>Overweight</td>
<td>5 (25%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50-60</td>
<td>2 (10%)</td>
<td>5'8”</td>
<td>2 (10%)</td>
<td>Obese</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Female</td>
<td>10 (50%)</td>
<td>20-30</td>
<td>6 (30%)</td>
<td>5'7”</td>
<td>2 (10%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30-40</td>
<td>9 (45%)</td>
<td>5'6”</td>
<td>3 (15%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>40-50</td>
<td>3 (15%)</td>
<td>5'5”</td>
<td>1 (5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50-60</td>
<td>2 (10%)</td>
<td>5'4”</td>
<td>4 (20%)</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5'3”</td>
<td>2 (10%)</td>
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<td></td>
</tr>
</tbody>
</table>

¹ n= number of subjects (N=20)

**Firm B**

A total of 17 (N=17) subjects aged 18 and over were observed in this study. Table
4-2 presents the percentage distributions for the participant demographic characteristics. 13
subjects were male (76.47%) and the other 7 subjects were females (41.18%). The age
range of subjects included: two subjects (11.76%) were 20 to 30 years old, six subjects
(35.29%) were 30 to 40 years old, four subjects (23.53%) were 40 to 50 years old, two
subjects (11.76%) were 50 to 60 years old, two subjects (11.76%) were 60-70 years old,
and one subject (5.88%) was 70-80 years old. Two subjects (11.76%) were 5 feet 10 inches; three subjects (17.65%) were 5 feet 9 inches; three subjects (17.65%) were 5 feet 8 inches; three subjects (17.65%) were 5 feet 7 inches; three subjects (17.65%) were 5 feet 6 inches; one subject (5.88%) was 5 feet 5 inches; two subjects (11.76%) were 5 feet 4 inches; two subjects (11.76%) were 5 feet 3 inches. Fourteen subjects (82.35%) were of normal weight and three subjects (17.65%) were overweight. No subjects, by observation, was determined to be obese.

### Table 4-2 Place B Subject Characteristics

<table>
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<tr>
<th>Sex</th>
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<th>Weight</th>
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</thead>
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<td>5’11”</td>
<td>Underweight</td>
</tr>
<tr>
<td>Female</td>
<td>30-40</td>
<td>5’10”</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>40-50</td>
<td>5’9”</td>
<td>Overweight</td>
</tr>
<tr>
<td></td>
<td>50-60</td>
<td>5’8”</td>
<td>Obese</td>
</tr>
<tr>
<td></td>
<td>60-70</td>
<td>5’7”</td>
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</tr>
<tr>
<td></td>
<td>50-60</td>
<td>5’6”</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5’5”</td>
<td>0 (0%)</td>
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<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5’3”</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

¹ n= number of subjects (N=17)

**Quantitative Findings based on Physical Activity**

**Firm A**

Table 4-3 shows how long the subjects were sedentary, how many feet they walked, and the number of times an individual used the stairs in either direction, for a two hour time period. The average sedentary time for all subjects regardless of subject characteristics was 97.55 minutes. On average male subjects were sedentary for 100.70
minutes and female subjects were sedentary for 94.40 minutes. The subject who was perceived to be underweight was sedentary for 80 minutes while those whose weight perceived to be normal were sedentary for 97.36 minutes and those whose weight perceived to be overweight were sedentary for 101.60 minutes. The average feet walked in a two hour time period, regardless of subject characteristics, was 1243.70 feet. Male subjects on average walked 513.38 feet while female subjects walked 1047.86 feet in a two hour time period. The subject who was perceived to be underweight walked 1347 feet in two hours while the subjects who were perceived to be of normal weight walked 1445.57 feet and those subjects perceived to be overweight walked 657.80 feet. The male subjects on average took 1.3 trips one way up/down the stairs. The female subjects on average took 1.7 trips one way up/down the stairs. The subject who perceived to be underweight took 2 trips one way up/down the stairs. The subjects who perceived to be of normal weight took 1.86 trips one way up/down the stairs while those subjects perceived to be overweight took 0.8 trips one way up/down the stairs.
<table>
<thead>
<tr>
<th>Sex</th>
<th>Age</th>
<th>Height</th>
<th>Weight</th>
<th>Sedentary (minutes)</th>
<th>Walked (feet)</th>
<th>Stairs (1 way)</th>
</tr>
</thead>
<tbody>
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<td>Subject B</td>
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<tr>
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<td>Subject I</td>
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<td>1326</td>
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<tr>
<td>Subject J</td>
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<td>Normal</td>
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<td>1195</td>
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<tr>
<td>Subject K</td>
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</tr>
<tr>
<td>Subject L</td>
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<td>Subject M</td>
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<td>Overweight</td>
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<td>503</td>
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<table>
<thead>
<tr>
<th>Sex</th>
<th>Age</th>
<th>Height</th>
<th>Weight</th>
<th>Sedentary (minutes)</th>
<th>Walked (feet)</th>
<th>Stairs (1 way)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>5’-7”</td>
<td>Normal</td>
<td>91</td>
<td>2172</td>
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<td>5’-4”</td>
<td>Overweight</td>
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<td>456</td>
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<tr>
<td>Subject C</td>
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<td>Normal</td>
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<td>351</td>
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<td>Subject D</td>
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<td>Normal</td>
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<td>1245</td>
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<td>Subject G</td>
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<td>Normal</td>
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</tr>
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</table>
Firm B

Table 4-4 shows how long the subjects were sedentary for, how many feet they walked, and the number of times an individual used the stairs in either direction, for a two hour time period. The average sedentary time for all subjects regardless of subject characteristics was 100.05 minutes. On average male subjects were sedentary for 80.30 minutes and female subjects were sedentary for 93.86 minutes. Those whose weight perceived to be normal were sedentary for 99.64 minutes and those whose weight perceived to be overweight were sedentary for 102 minutes. The average feet walked in a two hour time period, regardless of subject characteristics, was 744.76 feet. Male subjects on average walked 437 feet while female subjects walked 953.15 feet in a two hour time period. Subjects who were perceived to be of normal weight walked 802.57 feet while those subjects perceived to be overweight walked 475 feet. The male subjects on average took .615 trip one way up/down the stairs. The female subjects on average took 1.28 trips one way up/down the stairs. The subjects who perceived to be of normal weight took .78 trips one way up/down the stairs while those subjects perceived to be overweight took 2 trips one way up/down the stairs.
<table>
<thead>
<tr>
<th>Subject</th>
<th>Sex</th>
<th>Age</th>
<th>Height</th>
<th>Weight</th>
<th>Sedentary (minutes)</th>
<th>Walked (feet)</th>
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</thead>
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<th>Walked (feet)</th>
<th>Stairs (1 way)</th>
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CHAPTER V
DISCUSSION

This chapter provides a discussion of findings framed by the review of literature and the observational study. A comparative analysis of Firm A to Firm B is discussed based on the study’s finding for each place and subjects, and why the findings of this study either support or contradict previous research. Also to be discussed are the limitations, conclusions, and suggestions for future research.

Comparative Analysis of Firm A to Place B

During observation of Firm A the environment seemed to be sedentary. The subjects only walked to restricted places. For example, subjects would walk to a co-workers desk multiple times for a distance of 80 feet; however the visit would be short causing them still to be sedentary for most of the two hours. Firm A had almost every accommodation on each floor. Once a subject arrived at work seldom was there a need to travel up and down the stairs. However, there are some exceptions; the library was on the first floor so if a subject needed to access the library they would have to travel downstairs. As well as the only large format plotter is on the second floor, indicating that
if a subject needed to plot they would have to travel upstairs. Each floor had access to a restroom and a café. The only café that had a microwave was on the second floor causing many subjects to travel upstairs during lunch hour. An interesting observation to point out is that there was one café downstairs that a majority of the subjects would travel to, resulting on average an extra 100 feet walked, because the ice maker “supposedly” is the best one in the office. After lunch hour the subjects were excessively sedentary and were not physical active for at least three quarters of the two hour time period. On average the subjects on the second floor walked 1338.3 feet while those subjects on the first floor on average walked 1068 feet. The distances traveled were similar, whether the subject resides on the first or second floor, to the subject’s destination.

Firm B, unlike Firm A, did not have all the accommodations on one floor. The restrooms, café, copy/work room, and large format plotter were all on the third floor (i.e. Firm B occupies third and fourth floor of a four story building). On the fourth floor however there is a black and white printer. To travel from fourth floor to third floor there were two options, spiral staircase or elevator. One way on the spiral staircase adds 51 feet to the distance traveled. All subjects once they arrived to the fourth floor all took the spiral staircase to the third floor, observation noted that the elevator is relatively slow causing subjects to be impatient, resulting in taking the staircases’. Since all accommodations are on the third floor those subjects who reside on the third floor are relatively sedentary for they do not have to travel far to reach their destination unless they
need to communicate in person with another subject on the fourth floor. For example those subjects on the fourth floor on average walked 1112.5 feet in two hours. Whereas on the third floor on average walked 631.6 feet in two hours. Therefore, indicating those on the fourth floor are more physically active than those on the third floor because they have to travel longer distances to their destinations.

**Limitations**

There were some key limitations within this observation relating to measurement and/or the environment. Since this was an observation study and did not involve surveying or interaction with the human subjects, the research was limited by the researcher’s ability to perceive the subject’s characteristics. Also, limited was the researchers inability to observe the subjects while out of sight.

The sample size of the subjects during observation may have caused some limitation and significant drawbacks. Each place had a different number of subjects located on each floor therefore making a valid comparison between floors difficult. Furthermore each place had a different number of subjects making a valid comparison between places difficult. It is difficult also to make a comparison because there was only one researcher meaning each place, floor, and subject had to be observed on different days at different times.

Field observation, in context to this study, was suppose to provide a glimpse into the actual behavior of the subjects on a ‘typical’ work day. However, in both of these
environments and places studied the researcher believes there is no typical work day, meaning that some days a subject may be out of office, may need to be in meetings, may need to finish up a project, etc. Indicating that one day a subject may be overly active and minimally sedentary while other days they be sedentary 90 percent of the day.

A larger sample of places and subjects observed with more researchers may reveal a much more significant insight into how a subject is physically active throughout their work day as well as a supplemental type of study (e.g. Survey) that may provide further information to why a subject is sedentary for long periods of time or what causes them to travel to their destination, based on task and/or distance needed to travel. Maria Alfonzo (2005) researched the hierarchy of walking but in context to urban planning and design not in correlation to the interior built environment.

**Conclusion and Suggestions**

The quality of health of employees should be and/or is important to employers as they try to produce a more active and healthier environment for their employees to work and thrive in. Although, many studies have taken a look at understanding the benefits of wellness programs and their return on investment; the standards of physical activity for a human to benefit health wise; the location of buildings and parks in correlation to urban design and accessibility, there is still a lack of research on how one can be more physically active, subconsciously, within their work environment. The design industry is
well aware of making things accessible and efficient but what is perceived as accessible and efficient could be deterring ones health and increasing sedentary time.

Productivity, in correlation to economics, is usually the foremost thing with which an employer is concerned. How can they as an employer make their employees more productive? Some employers may say longer hours, lesser or shorter breaks are necessary because if employee is sedentary at their desk then they must be more productive then an employee who is walking around or visiting other coworkers. This observational study was not inclusive of the productivity of employees. A study on how more productive an employee would be if they increase their physical activity but decrease the sedentary time, would be beneficial not only to the design industry but to the corporate industry as well.

This observational study indicated that there are many barriers to subconsciously increase human physical activity in the interior environment. The above barrier of an economical view point is that if an employee is not sedentary at their desk for long periods of time they may not be as productive. The other view point, also economical, is financial reasons. Wellness programs are proven to have a high return on investment. If an employer makes their work environment better for their employee’s health there should be a high return on investment, not only because healthcare costs will be reduced but in turn the employee will be more productive.
The American Institute for Preventive Medicine stated in “2008 United States health care costs totaled approximately $2.2 trillion or 16% of the gross domestic product. It is projected that companies will pay $9,312 per employee for health care” (p.1). Obesity-related costs account for an estimated five to seven percent of the U.S. national healthcare budget, compared to a little more than two percent for most other industrialized nations (Long et al., 2006, p.245). The office environment should encourage physical activity, increasing the amount of steps an employee takes in a typical business week. The American Institute for Preventive Medicine (2008) reviewed scores of published studies on worksite wellness programs found that the Return on Investment is $3.48:1 due to reduced medical costs and $5.82:1 due to reduced absenteeism.

The complexity of the interior environment and how it affects its users has been researched in many aspects, whether it is color theory, indoor air quality, accessibility, and/or functionality. The complexity of the urban environment and how it affects human beings has been research also in many aspects, whether it is park location, trails, transportation, recreation, and/or built environment. The complexity of the human beings functions and how important physical activity to one’s health has been highly researched in many aspects such as hierarchy of walking needs, recommended amount of physical activity, recommended amount of steps to take in a day, circadian rhythm, etc. Where there is a lack of research is where all the above intersect, a point that has not been researched. This point is how the interior environment, human based design, can impact the health of users, positively.
Some guidelines the researcher has produced based on the review of literature and observation are as follows. These guidelines are purely suggestions, an indication that further research should assess this topic, and quantify the reasons why it is important to the health of the users as well the importance from an economic view point.

**Suggested Guidelines:**

1. Within the interior, divide up and/or separate everyday accommodations’ such as the general office tasks (e.g. Put copy/print room on one level and the restrooms or café on another).
2. A well lit, inviting open staircase for main circulation purposes between levels. A staircase within 25 feet of the entrance in user’s direct sight line is preferred (Bloomberg et al., 2010).
3. In order to access the elevator the user should turn at least one corner, passing the staircase.
4. Plenty of windows letting natural daylight filter in as well as an outside space for users to take a break, keeping in sync with their circadian rhythm.
5. Café or vending machines that offer healthy, organic food options. Perhaps, local market vendor sets up a stand during lunch hours. This way decreasing the after lunch sedentary time because user’s bodies are no longer pumped with sugar and fats.

The design of any space needs to be versatile enough to satisfy a wide range of users. Further research needs to focus on that point where all aspects stated above intersect where no researcher has primarily studied before. The barriers of economic, financial reasons and accessibility need to be addressed and research needs to provide evidence based on all the multivariable’s that were reviewed through the review of
literature. Employers are under greater pressure to lower costs and increase productivity, human based design and how it can positively impact the health of the users may just be the answer.
WORKS CITED


Cohen, M. J. (1994). The cost of wellness; the evidence is trickling in: worksite wellness programs not only help improve employees health, but also have a positive impact n the bottom line. *Management Review, 83*(7), 29-34.


LIST OF REFERENCES


Predictors of obesity, weight gain, diet, and physical activity workshop, Bethesda, MD, August 4-5, 2004.


APPENDIX 1

FIRM A FLOOR PLAN

First Floor Plan
APPENDIX 1

FIRM A FLOOR PLAN

Second Floor Plan
APPENDIX 2

FIRM B FLOOR PLAN

Third Floor Plan
APPENDIX 2

FIRM B FLOOR PLAN

Fourth Floor Plan
APPENDIX 3

OBSERVATIONAL INSTRUMENT

Honor's Thesis Observation Form

Location:

Date:

Time:

Sex:  Female

       Male

Brief Description of physical traits/ workspace:

The following are approximately based on appearance judgment.

   Age (approx.):

   Height:

       Measure to a fix point on wall or cubicle height (giving myself a point of reference)

   Weight:  Underweight

       Circle One  Normal

       Overweight

       Obesity

       Morbidly Obesity

Physical Activity:

   Walked (to and from):

   Sedentary (time):

   Stairs (up and down):