THE SEATED INACTIVITY TRIAL (S.I.T.): PHYSICAL ACTIVITY AND DIETARY OUTCOMES ASSOCIATED WITH EIGHT WEEKS OF IMPOSED SEDENTARY BEHAVIOR

by

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Abstract

Background: Time spent in sedentary behaviors, independent of physical activity levels, is a risk factor for chronic diseases and all-cause mortality. It is unknown whether physically active adults alter their dietary and/or physical activity behaviors in response to imposed sedentary time. The aim of this study was to determine whether imposing 10 hours of sedentary time per week for 8 weeks would alter physical activity and/or dietary profiles of physically active adults.

Methods: Sixteen physically active, healthy young adults were randomized into either the no-intervention control (CON) group (n=8) or the sedentary-intervention (SIT) group (n=8). SIT participants attended monitored sedentary sessions for 10 hours per week (4 days; 2.5 hours) for 8 weeks. Assessments occurred at baseline, and weeks 4 and 8. Dietary information was collected through 3-day food records and physical activity was assessed through 7 days of accelerometry (Actical at the wrist).

Results: There were no differences in physical activity profiles in SIT or CON groups when baseline and week-8 average (average weeks) were compared to the week-4 assessment. Differences in step counts comparing the average weeks and week 4 were not significantly different between CON and SIT groups (CON = 615.1 ± 3019.1, SIT= -1158.0 ± 3373.0 steps, p=0.287). There were no differences in sedentary (p=0.366), light (p=0.293), moderate (p=0.656) or vigorous (p=0.701) physical activity when average weeks were compared to one of imposed sedentary behavior. A greater number of SIT (4/8) participants had lower step counts during the imposed sedentary week, when compared to CON (1/8) participants. There was no difference (p>0.05) between CON and SIT groups for total calories consumed at any time-point. Caloric intake decreased significantly in the SIT group compared to the CON group (SIT = -27.9 ± 22.8%, CON = 10.0 ± 37.6%, p=0.028). More SIT (7/8) than CON (3/8) participants decreased caloric intake from baseline to 8 weeks.

Conclusion: Physically active young adults did not alter physical activity profiles, but did decrease their caloric intake, in response to 8 weeks of imposed sedentary time. These findings may indicate a compensatory mechanism to imposed sitting in physically active adults.

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Dedication

For those who so desperately need the services and research that the public health field can offer.

Chapter 1 - Literature Review

Introduction

Research has shown that time spent engaged in sedentary behaviors, independent of physical activity levels, is a risk factor for several chronic diseases and all-cause mortality (Tremblay et al., 2010; Cameron et al., 2003; Katzmarzyk et al., 2009; Hu et al., 2003; Rey-Lopez et al., 2008, Chau et al., 2013). The metabolic processes associated with sedentary behaviors that may influence health outcomes are distinct, and they are not merely the opposite of the processes that occur with physical activity (Tremblay et al., 2010). Therefore, an important distinction must be made between "too much sitting" and "too little physical activity" in regard to public health and individual outcomes. Much of the published literature regarding the association between sedentary time and negative health outcomes has been based upon data collected at a population level; and to date, there is little experimental evidence that explores these associations at an individual level. The cross-sectional level evidence does not give information regarding temporality, nor does it provide sufficient evidence to determine causality. Therefore, it is important that an experimental design is used to better understand the relationship between sedentary time and health outcomes on an individual level. If a person were to increase their amount of time spent engaged in sedentary behavior, the current research suggests that they may be at an increased risk for several negative health outcomes, including obesity, type II diabetes and cardiovascular disease (Tremblay et al., 2010; Cameron et al., 2003; Katzmarzyk et al., 2009; Hu et al., 2003; Rey-Lopez et al., 2008, Chau et al., 2013). Therefore, it is important to better understand whether or not people make lifestyle changes (i.e. increasing MVPA or

decreasing caloric intake) in response to increased sedentary time that would attenuate the potential risks they face.

The current physical activity guidelines for public health recommend that adults accumulate at least 30 minutes of moderate-to-vigorous physical activity [MVPA] on at least five days per week (at least150 minutes MVPA per week). Individuals can also reach the recommendation by completing a minimum of 20 minutes of vigorous physical activity on at least three days per week. It is also recommended that adults incorporate activities that increase their muscular strength on at least two days per week (Haskell et al., 2007). Individuals who meet physical activity guidelines can still have a high amount of sedentary time in their day. Known in the literature as "active couch potatoes", these are individuals who have a spike of physical activity during the day, but are otherwise primarily sedentary (Tremblay et al., 2010). Their risk for disease might be different than an individual who doesn't attain a sufficient amount of MVPA, but instead engages in a high level of light physical activity. When considering the risk for cardiometabolic disease, it is currently unclear if one of these is the better physical activity profile. Another important question to consider is whether or not people change their lifestyle behaviors in response to imposed sedentary time. If individuals make compensatory changes to an increase in sedentary time, either through diet or physical activity, these alterations may attenuate their risk of developing adverse health outcomes.

Sedentary Time and Negative Health Outcomes

The Sedentary Behaviour Research Network has called for a standard definition of sedentary behavior, and this is defined as any waking behavior characterized by an energy expenditure ≤1.5 metabolic equivalents of tasks (METs) while in a seated or reclining posture (Sedentary Behaviour Research Network, 2012). In contrast, researchers use the term "inactive"

to describe those individuals who are not acquiring sufficient amounts of MVPA (i.e., not meeting physical activity guidelines). In addition to other health outcomes, sitting time has also been shown to be inversely associated with a self-report rating of either excellent health or excellent quality of life in a cross-sectional study in Australian adults by Rosenkranz and colleagues (2013). Although physical activity was found to be associated with positive ratings on these domains, it was found that the physical activity and sitting time were independent when considering the impact on health and quality of life. These findings highlight the importance of changes on both ends of the activity spectrum, increasing physical activity and decreasing sedentary time, in order to improve one's perceived rating of health and quality of life (Rosenkranz et al., 2013). As mentioned previously, spending a large amount of time engaged in sedentary behaviors has been shown to be an independent risk factor for many negative health outcomes, including obesity, type II diabetes, cardiovascular disease and all-cause mortality (Tremblay et al., 2010; Cameron et al., 2003; Katzmarzyk et al., 2009; Hu et al., 2003; Rey-Lopez et al., 2008; Chau et al., 2013) The following information from the literature explains these associations and mechanisms in more detail.

Obesity

Obesity is associated with sedentary behaviors, and there are several hypotheses about why this link exists. When energy intake exceeds energy expenditure, weight gain will occur. Energy expenditure occurs in the body through basal metabolism, the thermic effect of food and activity thermogenesis. The activity thermogenesis can be broken down into exercise and non-exercise thermogenesis (Garland et al., 2010). The non-exercise activity thermogenesis (NEAT) includes the energy expenditure from all activities other than sport and exercise, including standing, fidgeting, walking and stair climbing (Levine et al., 2006). In the review paper by

Levine et al., the authors mentioned that the inter-individual variation in NEAT can be partially explained by one's occupation, with those in sedentary jobs experiencing a lower energy expenditure in NEAT than those engaged in more physical jobs. The researchers found that for similar sized individuals in different occupational demands, the variance in NEAT could be as much as 2000 kcal per day. This difference in energy expenditure has the potential to make a significant impact on obesity and weight status. Therefore, sedentary behavior and obesity may be linked due to the replacement of non-activity thermogenesis by sedentary behaviors, which are associated with lower energy expenditure (Levine et al., 2006). There is more information to consider, however, as research has shown the sedentary behavior and obesity link to exist even when accounting for total MVPA levels throughout one's day (Hu et al., 2003; Cameron et al., 2003).

Another line of research that explores the association between sedentary time and obesity status comes from the Nurses' Health Study. In this prospective cohort study, 50,277 women were analyzed, and the researchers found that sedentary time, particularly television viewing, was associated with an increase in the risk of obesity (BMI ≥30). After adjusting for age, total exercise levels, smoking status and diet, the researchers found that a 2-hour increase in reported sedentary television viewing time per day was associated with 23% increase in the risk of obesity (Hu et al., 2003). Data from the Australian Diabetes, Obesity and Lifestyle Study showed, that in 11, 247 healthy adults, television time was more strongly associated with obesity status than total physical activity levels. The odds of being obese were almost three times higher for those who had less than 60 minutes of physical activity per week and more than 900 minutes of television time, compared to those who spent less than 420 minutes watching television and were active for more than 285 minutes per week. Those who were in the highest quintile of physical activity still

had about twice the odds of obesity when they engaged in more than 900 minutes of television viewing per week (Cameron et al., 2003). Overall, this research shows that, despite high levels of physical activity, an independent risk for obesity was seen with a high level of sedentary time (television viewing used as a proxy measurement for sedentary time).

Type II Diabetes Mellitus

Diabetes mellitus is a metabolic condition in which an individual is unable to normally use glucose, due to either an insufficient amount of insulin being present, or through the body's failure to respond to the presence of insulin. In a non-diabetic individual, the pancreas secretes insulin when the glucose blood levels rise. This hormone causes the translocation of the glucose transporter and allows the glucose to be taken up from the blood to other body tissues. In the case of diabetes, this process cannot occur, and the result is that there is an accumulation of glucose in the blood, hyperglycemia, that can cause a serious threat to the body's normal functioning (Joslin Diabetes Center, 2014). Research analyzing continuous sedentary bouts on metabolic risk from the Nurses' Health Study has shown that sedentary time is associated with a reduction in the effectiveness of insulin action (Hu et al, 2003). In this prospective study by Hu and colleagues described previously, it was found that television viewing was significantly associated with the development of type II diabetes in women free of chronic disease at the onset of the study. Those who watched television for more than 40 hours per week exhibited twice the risk for type II diabetes than those who watched one hour or less per week. Those who watched television for 21 to 40 hours per week had approximately 49% higher risk of type II diabetes than those who watched for less than one hour per week. The significance of the relationship was noticed once individuals watched television for at least 6 hours week. They found that for every 2-hour increase in television viewing per day, there was a 14% increase in the risk of type II

diabetes development. For every 2-hour increase in time spent sitting while at work, the risk of type II diabetes was increased by 7%. In contrast, each 2-hour increase in standing time was associated with a 12% reduction in risk (Hu et al., 2003). A study by George and colleagues (2013) examined the association between sitting time the likelihood of diabetes in Australian adult men enrolled in the 45 and Up cohort study. They found that those who reported having higher levels of sitting time were more likely to report having diabetes. When compared to the reference group (sitting less than 4 hours per day), those who reported sitting for six to eight hours per day had 1.19 the odds of reporting diabetes. For those who sat more than 8 hours per day, their odds of diabetes was also significantly greater than the reference group (OR 1.15, 95% CI 1.06 – 1.25, p=0.001). The authors concluded that, independent of physical activity levels and BMI, the presence of diabetes was significantly associated with the amount of time the adult men reported sitting per day. The results are in support of those from Hu and colleagues (2003), although their study used television viewing as a proxy measurement for sedentary time.

Some previous literature has examined extreme examples of sedentary behavior by studying the effects of bed rest on metabolic responses health outcomes. In order to study the effects that five days of bed rest has on insulin resistance and other metabolic responses, Hamburg and colleagues (2007) carried out a randomized controlled trial in 20 healthy adults. Insulin sensitivity was assessed via oral glucose tolerance test at baseline and at the end of the 5-day bed rest period. The researchers found that fasting insulin and glucose levels were increased following the bed rest intervention, when compared to control group, who carried out their normal activity levels. The intervention participants exhibited a 67% increase in insulin response during the glucose test, when their baseline values were compared to the values recorded after the bed rest intervention. No changes in fasting glucose, fasting insulin or insulin

response were seen in the control group. The authors concluded that this relatively short period of sedentary behavior led to a state of insulin resistance in these healthy individuals. This indicates decreased insulin sensitivity, which has been shown to be important in the development of Type II diabetes mellitus (Hamburg et al., 2007).

Cardiovascular Disease

Epidemiologic studies have shown a positive association between sedentary or sitting time and risk of cardiovascular disease events in adults (Chomistek et al., 2013). A study by Sequin and colleagues (2013) studied the association between sedentary behaviors and death from coronary heart disease in adult women who were enrolled in the Women's Health Initiative Observational Study. The researchers collected information regarding sedentary time through a questionnaire, and the women were classified as sitting for less than four hours per day, four to eight hours per day, eight to 11 hours per day, or greater than 11 hours per day. They found that there was a positive, linear relationship between sedentary time and death from coronary heart disease, in which those women who sat for more than 11 hours per day had the highest risk of death. When the women who sat for the greatest amount of time were compared with those who sat for less than four hours, it was found that they had a significantly increased risk of death from coronary heart disease and all-cause mortality, independent of physical activity levels (Sequin et al., 2013)

Vascular dysfunction and dyslipidemia have both been shown to be associated with a sedentary lifestyle. There is research available that examines why a link exists between sedentary time and cardiovascular disease risk. A cross-sectional study done by McGavock and colleagues (2006) examined the relationships between activity status and both atrial compliance and endothelium-dependent dilation in 135 healthy, young adults. The participants were classified as

inactive, physically active, or endurance trained based on their physical activity status. Arterial compliance was measured through diastolic pulse contour wave analysis, and flow mediated dilation was measured through the use of an ultrasound transducer. The dilation in the brachial artery was measured after 5 minutes of forearm occlusion. The authors found that arterial compliance was greater for those participants who were endurance trained, when compared to the inactive individuals. No difference was found in flow-mediated dilation when comparing the three groups. These results have significant implications for the risk of cardiovascular disease. Research done by Glasser and colleagues (1997) showed that a reduction in arterial compliance may be an early sign of arterial disease, which is a risk factor for cardiovascular effects. Therefore, these results indicate that the sedentary individuals had a lower arterial compliance than those who were endurance trained and that they may be at an increased risk for cardiovascular disease and death.

One of the possible mechanisms of how sedentary time is associated with cardiovascular disease involves the vascular health of an individual and how this may be affected by prolonged periods of inactivity. In the study by Hamburg et al. (2007) looking at the implications of bed rest, described previously, the researchers also found that changes occurred in regard to blood lipid levels and vascular function that are associated with an increased risk profile for cardiovascular disease. There was a significant increase in total cholesterol, triglycerides and systolic blood pressure following the imposed bed rest intervention. Vascular function was assessed through ultrasound and venous occlusion plethysmography. The researchers were able to measure the flow-mediated dilation of the brachial artery following the occlusion of the upper arm. The researchers found that there was a decrease in the brachial artery diameter after the bed rest intervention, but there was no significant change in the flow-mediated dilation. The authors

concluded that since arterial diameter decreased and systolic blood pressure increased, the participants were experiencing a greater arterial tone and possibly increased vascular resistance (Hamburg, et al., 2007). An increase in the arterial tone and vascular resistance can cause an increase in blood pressure, which is a risk factor for cardiovascular disease (Mayet & Hughes, 2003). In this study, the period of bed rest and sedentary behavior led to a mechanistic change in the body that may have increased the risk of cardiovascular disease in this sample of individuals.

A prospective cohort study by Manson et al. (2002) examined the association between sitting time and cardiovascular disease risk in 73,743 healthy, postmenopausal women. At baseline, physical activity measures were collected through the use of a questionnaire. A weekly MET score was calculated for each participant, in which the physical activities were coded according to the respective energy expenditure. The women estimated the amount of time that they spent sitting in order to account for time spent engaged in sedentary behaviors. The cardiovascular disease end points that were relevant included myocardial infarction, death from a cardiovascular disease event, angina, stroke and congestive heart failure. The authors found that sitting time, independent of recreational physical activity, was a risk factor for cardiovascular disease events. When compared to those who spent less than 4 hours per day sitting, the women who sat for 16 hours per day experienced a 68% increase in their risk for cardiovascular disease. The authors noted that those who sat for less than 16 hours per day did not have a significant increase in their risk for cardiovascular disease (Manson et al., 2002).

Another mechanism that might help to explain the relationship between sedentary behaviors and cardiovascular disease risk is the regulation of the enzyme, lipoprotein lipase (LPL). In a review by Hamilton et al. (2004), this mechanism is studied and explained. The authors explain that LPL is an enzyme present in the endothelial cells of the vascular system that

allows triglycerides to be hydrolyzed from lipoproteins. This enzyme has been linked to cardiovascular and heart disease risk, since a reduced activity of the enzyme indicates that the body is not able to effectively take up the lipoprotein components, which can contribute to the risks of developing disease. There has been research showing that a decrease in the activity of LPL can increase the odds of heart disease by up to five times that of an individual with sufficient LPL activity (Wittrup et al., 1999).

In an animal study by Bey and Hamilton (2003), the researchers used hindlimb unloading (HU) practices in rats to determine the LPL activity difference between conditions of inactivity, low levels of activity and walking on a treadmill following a period of inactivity. In the rats in the HU group (n=8), their hindlimbs were elevated above the ground by lifting the tail and attaching it to a rod by a thin wire. Due to this unloading, these rates had reduced activity in their back legs. In the longer portion of the study, the HU rats were inactive for 10 hours per day for a total of 11 days. The rats in the control group did not undergo any hindlimb unloading. The researchers found that the rats in the HU group had significant reductions in their LPL activity following the 11 days of inactivity, and that the half-life of the LPL was approximately 2 hours. The researchers also performed an acute study, in which 12 hours of HU were followed by a 4-hour phase in which the rats walked on a treadmill for 30 minutes every hour for a total of four hours. Bey and Hamilton found that the LPL activity levels returned to their baseline values after the four hours of walking and standing on all four legs. The authors concluded that the reduction in skeletal muscle LPL following periods of inactivity can be reversed through physical activity, even at low intensities, such as walking (Bey & Hamilton, 2003).

Health Outcomes Associated with Reductions in Sedentary Time

There has been research published regarding the beneficial health outcomes that are associated with interruptions or breaks in prolonged sedentary time (Owen et al., 2010). Thus far, studies have shown that a decrease in sedentary time by approximately one to two hours/day is associated with improvements in several risk factors for chronic disease. For example, in the study by Hu et al., mentioned previously, it was found that for individuals who replaced at least one hour per day of sedentary time with standing or light physical activity, they reduced their risk for obesity and type II diabetes (Hu et al., 2003). It is not clear, however, how much sedentary time is too much, particularly when meeting moderate-to-vigorous physical activity guidelines (Healey et al., 2008). As is shown in the following study, those individuals who break up sedentary behaviors with bouts of light to moderate physical activity can have beneficial effects when it comes to disease and risk factors. A cross-sectional study by Healy and colleagues (2008) objectively measured sedentary time through the use of accelerometry to examine the relationship between breaks in sedentary time and metabolic risk in 168 healthy adults. Although the adults accumulated the same amount of sedentary time throughout the day, there were distinct differences in their patterns, with some individuals breaking up their sedentary times more often than others. The authors found negative associations between the number of breaks in sedentary time and waist circumference, BMI, and fasting glucose, whereas those who took a greater number of sedentary breaks had smaller waist circumferences, lower BMIs and a lower fasting glucose values. These findings were independent of total time spent engaged in either sedentary or moderate-to-vigorous activities.

A randomized crossover study design was used to examine the effects on glucose and insulin levels following uninterrupted versus interrupted sitting in overweight or obese adults. The three treatment interventions were uninterrupted sitting, sitting with light intensity breaks

every 20 minutes and sitting with moderate intensity breaks every 20 minutes. All three trial periods lasted for five hours. At time zero, the participants consumed a beverage that contained 75 g of carbohydrate and blood samples were taken every hour to assess glucose and insulin levels. For the uninterrupted sitting intervention, participants remained seated for the full five hours. In the light-intensity break intervention, participants walked at a 2-minute light intensity bout on a treadmill every 20 minutes. The moderate-intensity break intervention involved a 2-minute walking bout at a moderate intensity every 20 minutes. The researchers found that the glucose and insulin incremental area under the curve (iAUC) was lower for both "break" conditions, when compared to the uninterrupted sitting condition. The authors concluded that the break conditions both lowered post prandial glucose and insulin levels, which can indicate an improvement in glucose sensitivity (Dunstan et al., 2012). Overall, this study showed that breaking up prolonged sedentary time with walking bouts had beneficial impacts on cardiometabolic disease risk factors.

Data from the cross-sectional National Health and Nutrition Examination Survey (NHANES) study was published by Healey et al. (2011) examining the association between sedentary breaks and inflammatory and cardiometabolic risk markers. The analyses were based upon data gathered from 4757 participants. The nationalities of the study participants were mixed and included 73.9% non-Hispanic whites, 7.7% Mexican Americans and 10.3% non-Hispanic blacks. The sample was 50% males and the average age was 46.5 years. Actigraph accelerometers were used to measure physical activity, sedentary time and the number of sedentary breaks throughout the day. The participants wore these devices on their hip for seven days, and a weekly average was calculated. A break was classified as a transition from less than 100 activity counts per minute to more than 100 activity counts per minute. The researchers also

collected data on waist circumference, blood pressure, HDL cholesterol and C-reactive protein. In a subsample, information was also available regarding fasting levels of triglycerides, glucose and insulin. Healy and colleagues found that, on average, participants were spending approximately 8.4 hours per day engaged in sedentary behaviors. After statistically adjusting for confounding factors and total physical activity levels, the researchers found that breaks in sedentary time had significant negative associations with waist circumference and C-reactive protein. For those in the highest quartile of sedentary breaks, waist circumference was, on average, four cm lower than those who took the fewest number of sedentary breaks. Since high levels of C-reactive protein, a marker of inflammation, have been shown to be associated with type II diabetes (Pradhan et al., 2001), high blood pressure (Sesso et al., 2003) and cardiovascular disease (Danesh et al., 2004), those who took the fewest amount of sedentary breaks had an increased risk of these conditions due to their increased levels of C-reactive protein.

The evidence from these studies shows that there are potential improvements in health and chronic disease risk factors when individuals decrease the amount of time that they are engaged in prolonged sedentary behaviors. Since energy expenditure and energy balance are impacted by physical activity and dietary behaviors, it is important to understand both of these components, as they may affect risk profiles differently. It is important to be aware that a change in one area of behavior does not tell us about possible changes in other areas. For example, if someone were to alter their sedentary time, it is also important for researchers to know whether there is a corresponding change to their dietary intake profile. Physical activity and dietary behaviors create a complex system that impacts health, and it is important to understand the

whole set of processes, rather than single components when understanding chronic disease and mortality risk.

Dietary and Physical Activity Compensation Following Sedentary Time Alterations

Although there is somewhat limited information available regarding dietary and physical activity compensation following sedentary time alterations, the following research highlights studies that are relevant and currently published in this area. In a randomized crossover trial by Epstein and colleagues (2002), the authors looked at the relationship between sedentary time alterations and energy balance through diet and physical activity in children. Children in the study were between the ages of 8 and 12 years, and were considered healthy. The experiment was nine weeks in total duration and included a 3-week baseline period followed by two separate 3-weeks phases of sedentary time alterations, where sedentary time was either increased or decreased by 25-50% from their baseline values. All participants underwent both sedentary time alteration interventions and served as their own controls. In order to manipulate sedentary time, families and children received a manual with examples of how to increase or decrease sedentary activities. Participants were able to earn up to $50 per week for successfully changing their sedentary time during the respective phase. At baseline, children were educated about what activities were considered sedentary and they kept logs regarding the amount of time they were engaged in these types of behaviors. The children wore accelerometers for three days per week to collect information regarding their physical activity levels. Dietary intake was collected through 24-hour dietary recalls that were administered over the phone. This information was collected for three days during each separate intervention phase. The researchers found that during the 3-week period of increased sedentary time behaviors, the participants increased these behaviors by an

average of 50.2%, and that during this time, there was a significant increase in positive energy balance. The authors did not see a change in energy balance during the period of decreased sedentary time. It was shown that during this time of increased sedentary time, there was an increase in energy intake (mean=250.9 Calories) and decrease in total energy expenditure (mean=99.8 Calories). The authors concluded that this average positive energy balance of 350 Calories per day could lead to an increase in body weight of 0.7 pounds per week. Overall, in this sample of children, the evidence suggested that participants did not make compensatory changes (through physical activity or diet) in response to an increase in time spent engaged in sedentary behaviors.

A study published by Dale, Corbin and Dale (2000) looked at the relationship between sedentary time alterations and energy balance in children. The authors wanted to see if children would increase their physical activity levels outside of school if they underwent a school day of "restricted" physical activity. The analyses for this study were based on 78 elementary-aged participants. The children wore accelerometers on four separate school days. On two of these days, the children had restricted physical activity levels, where the recess and physical education class was replaced by sitting in the school library. On the other two days, the children had their normal school schedule, which included the recess and physical education class. On each of the four days, the children wore the accelerometer from 9am until they went to bed at night. The researchers found that the children did not make compensatory changes (i.e. increase their physical activity levels) outside of the school day during the restricted days. It was shown that on the active days, total physical activity levels were higher than during the restricted physical activity days. Overall, the researchers concluded that the children did not make compensatory

changes in response to restricted physical activity throughout the school day (Dale, Corbin & Dale, 2000).

A randomized crossover trial by Saunders and colleagues looked at the physical activity and dietary intake responses following a bout of imposed sedentary behavior in children. Twenty healthy children (ages 10-14 years) were recruited for this study and they were randomized to begin with one of three experimental conditions. The first condition was a day of uninterrupted sitting. In the second intervention, the children were sedentary for the day, but they had 2-minute light intensity walks every 20 minutes. The final condition was identical to the second, except the children also added two bouts of moderate physical activity (20 minutes each). The researchers kept track of ad libitum food intake at a buffet meal following the intervention and total physical activity (through accelerometry) over the course of 24 hours at each of the intervention periods. The researchers found no significant differences in either total physical activity levels following the intervention period or ad libitum food intake at the buffet meal when comparing the day of prolonged sitting to a day with breaks and/or physical activity. The authors concluded that these children did not compensate for a day of imposed, prolonged sitting by decreasing their dietary intake or increasing their physical activity levels (Saunders et al., 2014).

Conclusion

There is limited information available in the literature about individual dietary or physical activity responses to imposed sedentary time in adults meeting physical activity guidelines. Typically, inactive participants have been studied, and in order to determine independence of sedentary time and physical activity, using active individuals in the research is important. Since much of the previous literature is based upon shorter-term studies, this time frame may not be long enough to really understand what is happening on an individual level, since it has been

suggested that it can take several weeks, or even months, for behavioral compensation to become apparent in individuals (Gomersall et al., 2013). Additionally, much of the current literature is based upon data involving children, and it is unclear whether or not adults would respond differently.

An important population to study is young adults who frequently transition from active lifestyles in high school or college to a more sedentary lifestyle when entering a largely sedentary workforce. There are large numbers of adults employed in sedentary jobs, and environmental and technological advances have lowered the daily requirement for energy expenditure during non-exercise time at work, home, and daily routines (Hill et al., 2003; Philipson and Posner, 2008; Beers et al., 2008). As shown throughout this introduction, meeting physical activity (MVPA) guidelines may not offer sufficient protection against obesity and obesity-related chronic diseases, depending on one's sedentary behavior levels. Changes in environments can impact changes in the amount of physical activity or sedentary behavior for adults. Examples include: the transition from being a high school athlete to a college student; from being an active college student to working a 50-hour per week desk job; during times of illness or injury; holiday vacations; and having children. A study completed by Zsolt et al. (2007) examined changes over four years in body composition and aerobic capacity of young adult males after university graduation. The researchers found that BMI was increased, minute ventilation was lowered, aerobic power was lower during a max treadmill test, and running distance was reduced. These participants were extensively interviewed and participants attributed the negative physiological consequences to lifestyle changes due to their work environment, as compared to the previous freedoms they had as university students.

It is not currently clear how much sedentary time is too much, particularly when meeting MVPA guidelines. Although the United States does not currently have a set of sedentary behavior guidelines, the Australian Department of Health published a set of guidelines regarding the recommendations for sedentary behaviors. For adults, aged 18-64, the recommendations are to minimize the amount of time that an individual spends in prolonged sitting behaviors, and if one must be sedentary, to break up the sitting periods as much as possible (Australian Department of Health, 2014). Previous epidemiological literature suggests that two hours per day of additional sitting time (both through television watching and sitting at work) could potentially negatively impact health outcomes (Hu et al., 2003). If this amount of increased sedentary time has the potential to cause detrimental effects, then we need to understand whether or not individuals will make compensatory changes, either through dietary intake or total physical activity, that might minimize their risk of developing disease. Therefore, the aim of this thesis was to determine whether or not imposing 10 hours of sedentary time per week for 8 weeks would significantly alter the physical activity and/or dietary profiles of physically active adults.

Chapter 2 - Methods

Participants

The participants for this study were sixteen healthy, young adults (age 21.6 years ± 1.4, 10 males). They were all physically active, as they met the physical activity recommendation of accumulating at least 150 minutes of moderate-to-vigorous physical activity per week (Physical Activity Guidelines, 2008). Before entering the study, a medical history was obtained from each participant to collect information regarding cardiovascular disease risk factors and general health status. All participants were free of known chronic disease. Written and oral informed consent was obtained from all those who participated, and the experimental protocol was approved by the Institutional Review Board at Kansas State University in Manhattan, KS.

Experimental Design

At baseline, participants came to the Physical Activity and Nutrition Clinical Research Consortium (PAN-CRC) for their initial appointment. At this session, the participants underwent a general health assessment, and data were collected regarding their anthropometrics and cardiovascular disease risk factors. Anthropometric measurements included height, weight, waist circumference and body fat percentage. Cardiovascular disease risk factor assessments included the analysis of total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides and fasting glucose. The impact of sedentary time on cardiometabolic risk factors is part of the larger study, and the specific protocols and results will not be presented in this paper. As described in the following sections, dietary intake was collected through a 3-day food record and physical activity was measured objectively through accelerometry, as the participants wore an accelerometer on their wrist for seven days at each of the assessment periods.

Following the initial week of accelerometer wear, the participants were randomly assigned into one of two groups, the no-intervention control (CON) group or the sedentary intervention (SIT) group. The intervention for the SIT group was an imposition of 10 hours of sedentary time per week for eight weeks. Those in the SIT group came into the lab for monitored sedentary sessions on four days each week, for 2.5 hours at each session. Those in the CON group were not given an intervention and were told to continue their usual behaviors. All participants returned to the laboratory for health assessments at 4 weeks (halfway through the intervention) and again at 8 weeks (end of the intervention period).

Tests and Measurements

Anthropometric Measurements

At each of the three assessment periods, the following tests were conducted and measurements were taken by a trained research assistant. The individuals were asked to remove their shoes and any outer clothing or heavy garments. Height was measured to the nearest 0.1 cm with a portable stadiometer (Invicta Plastics, Leicester, England), and weight was measured to the nearest 0.1 kg with a digital scale (Pelstar LLC, Alsip, IL, USA). Body mass index (BMI) was calculated as weight (kg) divided by height (m) squared. Waist circumference was measured with a non-elastic Gulick tape measure at the horizontal plane at the iliac crest. Participants were asked to cross their arms across their chest and breathe normally. The measurement was made by a trained research at the end of a normal exhalation. All measurements were taken in duplicate, and a third measurement was taken if the values differed by more than 0.5 cm or 0.5 kg. The two values that were within the acceptable difference range were then averaged and subsequently used in the analyses. Body composition was measured with total body dual-energy x-ray absorptiometry (DEXA) scan (GE Lunar Prodigy, Madison, WI, USA).

Physical Activity and Sedentary Behavior

Physical activity was measured objectively by using Actical physical activity monitors (Respironics Inc., Bend, OR, USA). These are small devices that the participants wore on their wrist for seven continuous days at each assessment period. A nylon band was used to secure the device to their non-dominant wrist. The accelerometers were set to record data in a 30-sec epoch. After the one week of wear, participants returned to the laboratory to have their wrist band removed, and the data was downloaded and analyzed. The accelerometer output included daily information regarding total steps, total time spent engaged in sedentary, light, moderate and vigorous physical activity, as well as the percentage of time that the participants spent engaged in each of these levels of intensity.

For those in the SIT group, the imposed sedentary sessions took place in the laboratory, and all sessions were monitored by research assistants to ensure that the participants were engaged in sedentary behaviors during the 2.5 hour block. They were able to study, watch TV, work on a computer, read, etc. as long as they stayed sitting and awake. They accumulated 10 hours of imposed sitting per week for eight weeks.

Dietary Intake

Dietary intake, including total calories and macronutrient distribution, was measured through a 3-day food record that the participants kept at each of the assessment periods. They recorded their diet on two week days and one weekend day. The participants were given instruction about how to fill out the log, as well as suggestions about how to estimate the portion sizes that they were consuming. Upon return of the dietary logs, the research staff looked them over and asked questions where information was missing. Dietary intake was analyzed with the

use of Nutritionist Pro nutrition analysis software (Axxya Systems-Nutritionist Pro, Stafford, TX) by a trained research assistant.

Statistical Analysis

Statistical analyses were performed using SPSS version 19.0. Repeated measures mixed analysis of variance (ANOVA) was used to determine changes between and within groups across the assessment periods, regarding physical activity and dietary intake variables. Fischer's exact tests were run to determine associations between group membership and physical activity and dietary changes. Parametric assumptions were tested and non-parametric tests were used when appropriate. Where total caloric intake and macronutrient distribution were analyzed, the values represent the average intake across the 3 days included in the respective assessment period. For physical activity values, such as total steps and time spent engaged in each level of physical activity intensity, the values used in the calculations are the average of the physical activity across the 7 days included in the respective assessment period. Data are shown as the mean ± standard deviation. For all tests, statistical significance was set at $p<0.05$.

Chapter 3 - Results

Participant Characteristics

Baseline group characteristics are shown in Table 3.1, and no significant differences were seen when comparing groups. At baseline, the participants spent 736.8 ± 235.2 minutes engaged in sedentary behavior and 170.8 ± 87.9 minutes engaged in MVPA per day. The average caloric intake for the participants was 2617 ± 969 kcal, and macronutrient distribution was 46.8 ± 8.0% carbohydrates, 18.4 ± 5.7% protein, 32.1 ± 6.3% fat, with no differences between SIT and CON groups (p>0.05).

Table 3.1 Baseline participant characteristics

	CON Group (n=8)		**SIT Group (n=8)**		
	mean ± SD	range	mean ± SD	range	*p*-value
Age (yr)	21.6 ± 1.4	19 – 24	22.4 ± 3.4	18 – 29	0.575
Body Mass (kg)	69.6 ± 12.4	55.3 – 86.6	73.5 ± 13.3	50.2 – 87.7	0.547
Height (cm)	171.5 ± 12.9	152.0 – 187.6	173.6 ± 12.3	155.5 – 188.5	0.743
Body Fat %	20.6 ± 10.3	8.8 – 35.6	17.5 ± 7.4	7.9 – 32.8	0.490
MVPA (min/day)	155.8 ± 111.0	10.0 – 333.0	185.9 ± 60.9	119.1 – 284.4	0.512
Average Steps (per day)	18,526 ± 3,714	14,853 – 26,222	17,816 ± 5,117	11,238 – 27,902	0.755
Sedentary Time (min/day)	789.5 ± 322.3	469.4 – 1,309.4	684.1± 91.0	542.6 – 837.9	0.388
Kilocalories (per day)	2,501± 1,087	1,098 – 4,459	2,734 ± 894	1,593 – 4,381	0.648
% Carbohydrate	47.2 ± 6.0	38.7 – 56.4	46.5± 10.0	30.9 – 63.9	0.858
% Protein	17.1 ± 3.0	13.0 – 21.1	19.7 ± 7.5	12.1 – 32.3	0.371
% Fat	34.5 ± 6.0	27.4 – 46.0	29.7 ± 6.0	20.8 – 38.1	0.129

MVPA, moderate-to-vigorous physical activity

Physical Activity

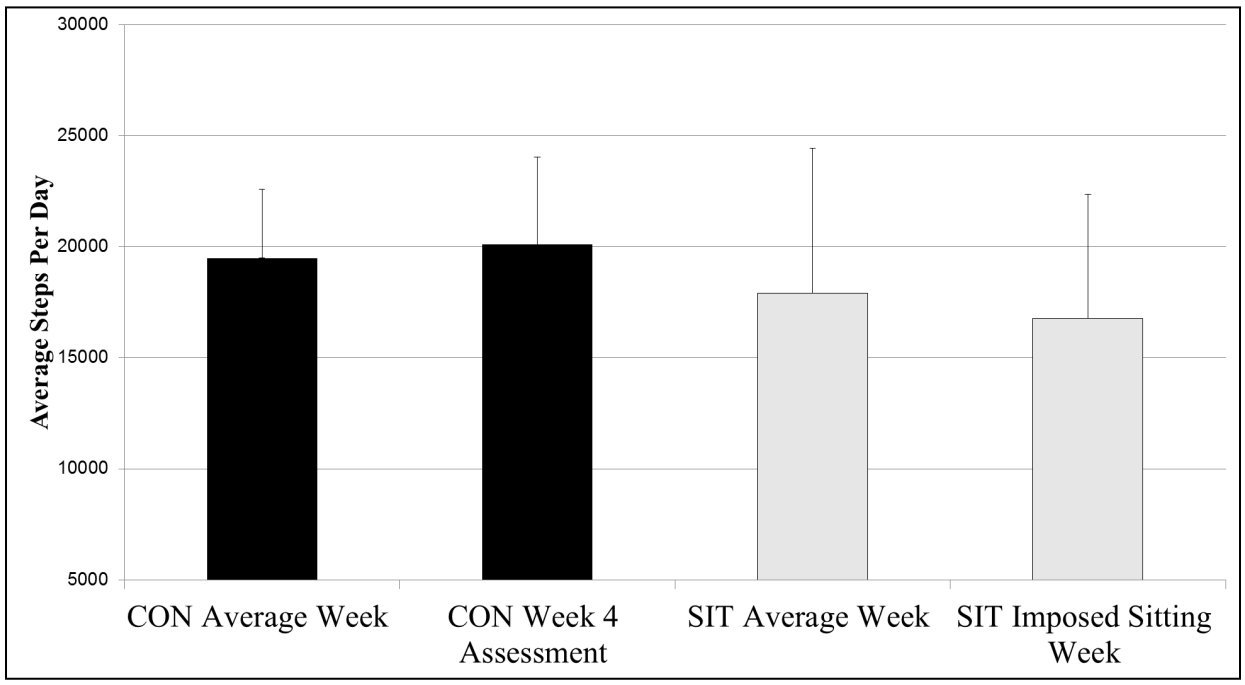
Absolute changes in total steps, as well as time spent engaged in sedentary, light, moderate and vigorous physical activity are shown in Table 3.2. In order to assess differences between average weeks and a week that occurred during the intervention period, weeks 1 and 8 were averaged for the physical activity data in order to compare the weeks that were not during the intervention to the week 4 data, which did occur during the intervention period. The difference in step counts between these time periods were not significantly different when comparing the SIT and CON groups (p=0.287). There were no significant differences in time spent in sedentary (p=0.366), light (p=0.293), moderate (p=0.656) or vigorous (p=0.701) physical activity when comparing the average weeks to the week 4 assessment period. Group data for step counts are shown in Figure 3.1. Individual data for time spent engaged in the various physical activity intensities are shown in Figure 3.2.

In order to determine whether or not group membership was associated with a lower total step count (by at least 10%) when comparing the average weeks to a sitting week, a Fischer's exact test was performed. When compared to the average weeks, a greater number of SIT (4/8) participants had lower total steps during the imposed sedentary week, when compared to CON (1/8) participants, although this difference between groups was not significant (p>0.05).

Table 3.2 Comparison of physical activity behaviors at three assessment periods

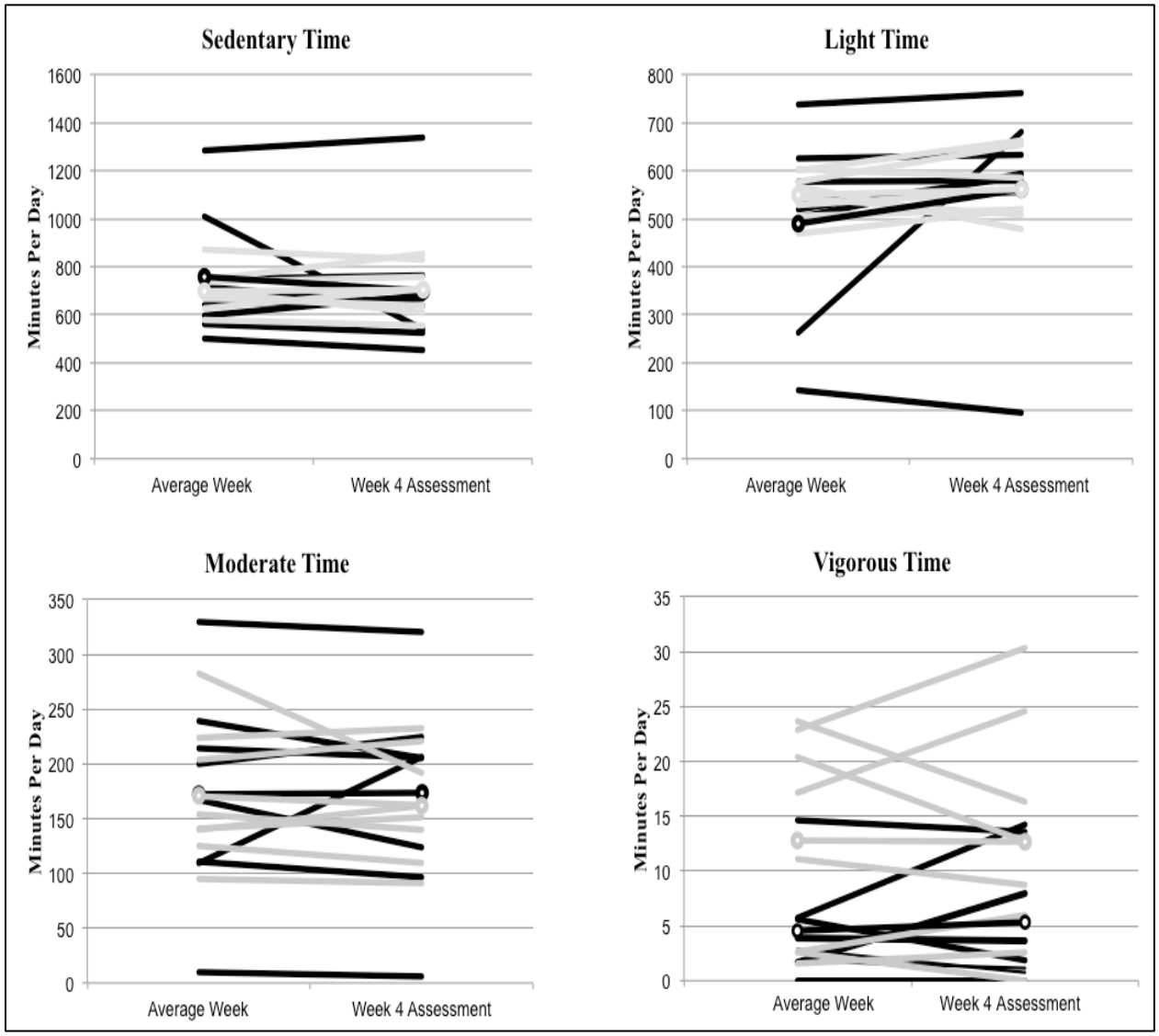
	CON Group (n=8)	SIT Group (n=8)
Average Steps Per Day		
Baseline	17,816 ± 5,117	18,526 ± 3,714
Week 4	20,103 ± 3,930	16,763 ± 5,603
Week 8	20,450 ± 3,531	18,027 ± 8,092
Pre-Post Average Steps Difference	1,925 ± 3,753	211.4 ± 3,705
Average Weeks vs. Week 4 Assessment	615 ± 3,019	-1,158 ± 3,373
Sedentary Time (min/day)		
Baseline	789.5 ± 322.3	684.1± 91.0
Week 4	700.5 ± 276.2	703.9 ± 104.2
Week 8	725.5 ± 246.1	713.0 ± 97.0
Pre-Post Sedentary Time Difference	-64.0 ± 221.1	28.8 ± 58.4
Average Weeks vs. Week 4 Assessment	-57.0 ± 176.6	5.3 ± 66.3
Light Time (min/day)		
Baseline	472.4 ± 216.4	553.2 ± 49.5
Week 4	560.7 ± 199.2	560.8 ± 68.5
Week 8	505.9 ± 185.3	546.2 ± 51.0
Pre-Post Light Time Difference	33.5 ± 110.9	-7.1 ± 35.5
Average Weeks vs. Week 4 Assessment	71.5 ± 146.0	11.1 ± 56.2
Moderate Time (min/day)		
Baseline	153.4 ± 110.1	171.8 ± 52.2
Week 4	173.5 ± 95.4	162.4 ± 50.4
Week 8	191.4 ± 96.2	169.2 ± 73.3
Pre-Post Moderate Time Difference	38.0 ± 71.5	-2.6 ± 32.5
Average Weeks vs. Week 4 Assessment	1.1 ± 43.9	-8.1 ± 36.1
Vigorous Time (min/day)		
Baseline	2.3 ± 3.0	14.1± 10.9
Week 4	5.4 ± 5.8	12.6 ± 10.6
Week 8	6.7 ± 9.6	11.4 ± 9.3
Pre-Post Vigorous Time Difference	4.3 ± 11.0	-2.8 ± 6.7
Average Weeks vs. Week 4 Assessment	0.9 ± 4.3	-0.1 ± 6.0

Figure 3.1 Group step data during average weeks and during a week of imposed sedentary behavior



CON group shown in black. SIT group shown in gray. Heights of bars indicate the average steps per week, comparing average weeks to the week that occurred during the imposed sedentary period (week 4 assessment). There were no differences between or within groups when comparing an average week to a week of imposed sitting.

Figure 3.2 Difference in individual physical activity intensity between an average week and a week of imposed sitting



CON group shown in black. SIT group shown in gray. Open circles depict group means. There were no significant differences in time spent in sedentary (p=0.366), light (p=0.293). moderate (p=0.656) or vigorous (p=0.701) physical activity when comparing an average week to a week of imposed sedentary behavior.

Dietary Intake

Changes in total kilocalories and macronutrient distribution across the three assessment periods are shown in Table 3.4. The change in caloric intake from baseline to 8 weeks was different between groups (SIT: Calorie % Δ = -27.9± 22.8%, CON: Calorie % Δ = 10.0 ± 13.3%, $p = 0.028$), but macronutrient distribution was not different within or between groups ($p > 0.05$). Average caloric intake decreased significantly in the SIT group by approximately 28%, compared to the CON group, in which average caloric intake increased by approximately 10%. Average caloric intakes for each group at each time point are shown in Figure 3.3. Group mean changes for total calories are shown in Figure 3.4.

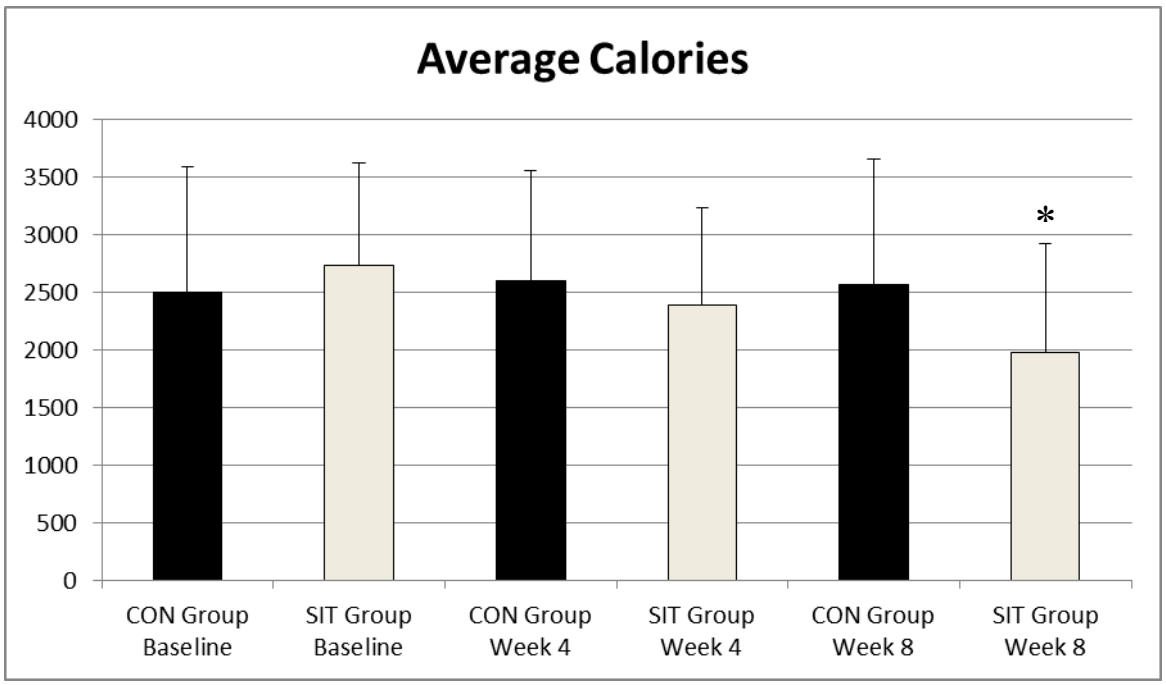
A Fischer's exact test was performed in order to determine whether or not group membership was associated with a decrease in total calories (by at least 10%), when comparing baseline intake to caloric intake during week 8. A greater number of SIT (7/8) than CON (3/8) participants decreased caloric intake from baseline to 8 weeks, although this difference between groups was not significant ($p>0.05$).

Table 3.3 Comparison of group dietary intake during three assessment periods

	CON Group	SIT Group
Average Calories Per Day		
Baseline	2,501 ± 1,086	2,733 ± 894
Week 4	2,603 ± 954	2,385 ± 849
Week 8	2,567 ± 1,091	1,978 ± 950
Pre-Post Calorie Change	65.5 ± 1073.9	-756.0 ± 640.6 *
Average Weeks vs. Week 4 Assessment	32.7 ± 536.9	-378.0 ± 320.3
% Carbohydrate		
Baseline	47.2 ± 6.0	46.5 ± 10.0
Week 4	47.7 ± 5.6	45.2 ± 10.6
Week 8	47.5 ± 4.4	47.5 ± 14.9
Pre-Post % Carbohydrate Change	0.3 ± 5.0	1.1 ± 10.2
Average Weeks vs. Week 4 Assessment	0.1 ± 2.5	0.5 ± 5.1
% Fat		
Baseline	34.5 ± 6.0	29.7 ± 6.0
Week 4	34.4 ± 5.8	30.1 ± 7.0
Week 8	35.0 ± 3.9	29.1 ± 9.5
Pre-Post % Fat Change	0.5 ± 3.7	-0.6 ± 7.5
Average Weeks vs. Imposed Sitting Week	0.2 ± 1.8	-0.3 ± 3.7
% Protein		
Baseline	17.0 ± 3.0	19.7 ± 7.5
Week 4	17.9 ± 1.6	21.4 ± 12.2
Week 8	16.5 ± 3.4	21.9 ± 9.7
Pre-Post % Protein Change	-0.6 ± 5.2	2.2 ± 3.7
Average Weeks vs. Imposed Sitting Week	-0.3 ± 2.6	1.1 ± 1.8

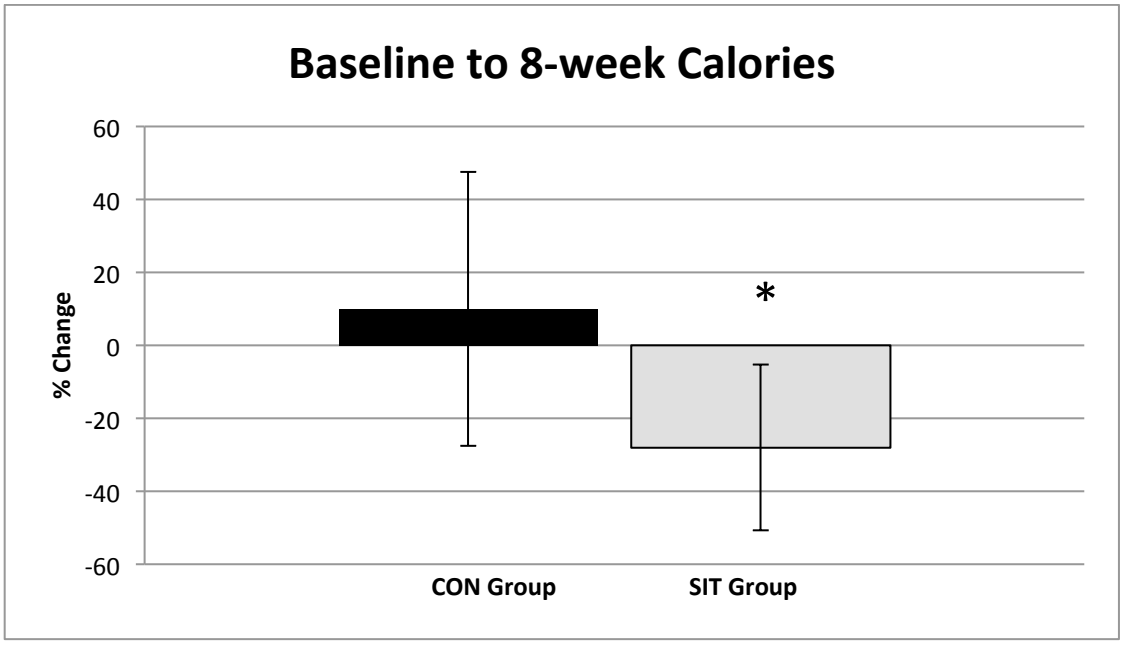
*** Statistically significant decrease in total calories from baseline to week 8 in SIT only (p=0.012)**

Figure 3.3 Group caloric intake during three assessment periods



***Statistically significant decrease in total calories from baseline to week 8 in SIT only (*p*=0.012)**

Figure 3.4 Caloric intake percentage change from baseline to week 8



Average caloric intake decreased significantly in the SIT group by approximately 28% compared to the CON group, where average caloric intake increased by approximately 10%. Error bars indicate standard deviation. *CON vs SIT were statistically different at $p<0.05$ level.

Chapter 4 - Discussion

Major Findings

The purpose of this study was to determine whether or not physically active, healthy, young adults would make physical activity or dietary behavior changes in response to eight weeks of imposed sedentary time. Based on previous literature, the null hypothesis was that these individuals would not make physical activity or dietary behavior changes, and this was partially supported. Our results show that in this sample, physically active, healthy young adults did not significantly alter their physical activity profiles, but did decrease their caloric intake in response to eight weeks of imposed sedentary time.

Physical Activity Findings

Objectively measured data from the NHANES survey (2008 and 2011) found that American adults spend, on average, 54.9% of their day engaged in sedentary behaviors (Matthews et al., 2008) or about 8.44 hours per day (Healy et al., 2011). At baseline, our study participants spent 789.5 minutes (54.8%) of their day engaged in sedentary behaviors. There were no significant differences in average sedentary time, either between or within groups, when comparing an average week to one of imposed sedentary behavior. While these active individuals were spending the majority of their day being sedentary, they were also exceeding the physical activity guidelines of 150 minutes of moderate-to-vigorous physical activity per week. On average, the study participants were accumulating 170.8 minutes of objectively measured, moderate-to-vigorous intensity physical activity per day. Therefore, we recruited and studied the group that we were targeting, as they spent a significant amount of time being sedentary, but were also meeting or exceeding physical activity guidelines. Based upon the information presented previously, we knew that, although they were adequately physically

active, the participants' sedentary time may have been a risk for future chronic diseases and all-cause mortality.

There is currently limited information available in the research examining the relationship between sedentary time and compensatory behaviors in active adults, especially when considering a prolonged study period. The evidence that is available was highlighted previously in this paper, and was based upon data from children in primarily acute intervention settings. In the study by Epstein and colleagues (2002), it was found that children increased caloric intake and reduced energy expenditure during a 3-week period in which their sedentary behaviors were increased by approximately 50%. This study suggested that the young participants in this study did not make compensatory changes (through increased physical activity or reduced energy intake) in response to an increase in time spent engaged in sedentary behaviors (Epstein et al., 2002). In their study, Epstein and colleagues found that energy expenditure in children decreased during the weeks of targeted increased sedentary behavior. This is in contrast to our findings, as we did not see any significant changes in energy expenditure ($p>0.05$) or physical activity in healthy college aged adults. In the Epstein study, the researchers told the participants to increase their sedentary time throughout the day and they were given monetary incentives, so this may contribute to the results that they found, as individuals were being asked to consciously change their physical activity behaviors. We utilized a different study design, in which we would be able to see organic or natural changes in these compensatory behaviors. Our results have similar findings to the study by Dale et al. (2000), but there are also areas of disagreement. In their study, they found that children did not make compensatory changes to their physical activity outside of a primarily sedentary school day. Our results concur, in that we did not see any compensatory physical activity behavior changes,

although we did not study the scope of a single day. These authors also found that, on the "active" days at school, the children accumulated more physical activity throughout the day than on the "restricted" activity days. If we consider our midpoint assessment to be comparable to a restricted period, we found that study participants did not accumulate significantly less physical activity on those days than compared to their average day without the imposed sedentary session. When compared to the study by Saunders and colleagues (2014), our results are consistent with their findings. They saw that children did not significantly change their physical activity profiles when they compared a full day of sitting to two separate conditions of intermittent breaks that occurred on separate days. Although we did not impose a full day of sitting and we had a more prolonged study period, our findings also showed that the imposition of sedentary time did not alter the physical activity behaviors of individuals.

Although group differences were not seen in the physical activity profiles in our current study, four of the individuals in the SIT group had lower average daily step counts during the intervention period. If those individuals were to continue to have a reduction in their step counts, this could potentially lead to negative outcomes regarding their health. If the steps were replaced by sedentary behaviors, although their MVPA levels remained unchanged, the individual may be at an increased risk for obesity, type II diabetes, cardiovascular disease and all-cause mortality (Tremblay et al., 2010; Cameron et al., 2003; Katzmarzyk et al., 2009; Hu et al., 2003; Rey-Lopez et al., 2008, Chau et al., 2013).

Dietary Intake Findings

When we considered the dietary intake behaviors following the sedentary intervention period, we found that the total caloric intake decreased significantly in the SIT group. The decrease in energy intake was not significant when comparing baseline to the midpoint

assessment, but became significant at the week eight assessment period. Average caloric intake decreased significantly in the SIT group by approximately 28%, compared to the CON group, in which average caloric intake increased by approximately 10%. These findings are in contrast to the findings by Epstein et al. (2002), described previously, in which the children increased their caloric intake following the three week period of increased sedentary behavior. Since the children in their study were given sedentary activity suggestions, including watching movies or playing video games, it is possible that their increased caloric intake occurred primarily during these activities, rather than spread throughout the day. In that study, dietary intake was measured through a 24-hour recall, which may not represent a typical eating pattern and there is the potential for recall bias. Overall, our current study in active adults did not find results that support Epstein's findings in children. It is possible that, since our study used active individuals, they may have been more mindful of eating behaviors in general, as compared to Epstein's sample. Additionally, children do not often have complete control over their food choices as adults do, which may also impact the results that were found. In the study by Saunders et al. (2008), the researchers found that children did not significantly change their total caloric intake when comparing a full day of sedentary behavior to days of sedentary behavior with breaks. They measured caloric intake at a buffet following the intervention period. There are certainly limitations to this method, as researchers were only analyzing one meal rather than a full day of intake, which may not reflect usual eating habits. Buffet consumption may also be impacted by personal preference in food choices being offered, and as people do not typically dine at a buffet, this might not reflect their usual eating patterns. However, this was balanced across the three experimental conditions. As with the Epstein study, our findings of a decreased caloric intake are in contrast to their results. Both of these studies were in children, so it is possible that the

difference in results is due to a different sample. However, we may also see contrasting results due to the methodology of our study or the activity level and general awareness of health in our sample.

Relevant to the topic of physical activity and dietary intake behavior changes is the ActivityStat hypothesis. This hypothesis states that if an individual were to increase or decrease their physical activity or energy expenditure, they will make a change in either their physical activity level or dietary intake in order to compensate for the alteration in energy expenditure. The goal of these changes, regulated by an internal or biological control, would be a state of energy balance (Rowland, 1998). There are conflicting results in the research regarding whether or not this hypothesis is supported. In his review paper, Gomersall and colleagues (2013) examined the role of the ActivityStat hypothesis in studies involving the manipulation of energy expenditure in individuals, through either physical activity changes or alterations in sedentary time. They explained that there is an amount of time needed for the compensatory behaviors to take effect, and it may not be seen when comparing day to day. They suggested that longer amounts of time, such as weeks or months, are needed for the compensatory behaviors to fully occur. The conclusion for this area in question was that one to three months was an adequate amount of time to see the compensatory actions (Gomersall, 2013). Based upon these findings, our current study fit the criteria for length of intervention, where previous studies have largely been shorter term. The authors also state that there is a tolerance threshold that must be surpassed in order for compensatory behaviors to begin. If the energy expenditure alteration is minimal, an individual may not alter their typical physical activity or dietary habits. Overall, the researchers stated that while there are several strong studies that support the presence of this mechanism, there is inconclusive evidence about whether it is apparent in the compensation research

(Gomersall, 2013). Based upon the information presented in this review, we cannot be fully sure if an internal control would be driving potential compensation, or whether these actions may be a more conscious and external decision. In our sample of individuals, the stimulus of imposed sedentary time may not have been large enough to cause alterations in the body's internal control system, as would by hypothesized by the ActivityStat view. However, research does suggest that in general, more physically active people are better able to achieve energy balance, as compared to their less active counterparts (Hill, Wyatt & Peters, 2012). Caloric reduction is one method of achieving energy balance following an increase in sedentary time, but further research is needed to determine whether or not their decreased intake would be long-term. If this reduction continues, this might affect their weight change, but it is unknown whether this would attenuate the risks of the imposed sedentary behavior on other cardiovascular disease risk factors and overall health.

As stated previously, this was an important demographic to study, as early adulthood comprises the ages where individuals can make the transition from an active young adulthood to a more sedentary occupational setting. When we imposed the sedentary time, as a group, the physical activity profiles were not significantly different, although there were some individuals who did alter their total steps. Based upon our findings, it is possible that this group of active individuals may have behavior patterns and/or the mentality that may offer protection against an increase in an accumulation of sedentary time. We chose the imposed sedentary load of 10 hours per week, as this amount has been associated the negative health outcomes in groups in cross-sectional studies. Although we did not study a load of imposed sedentary time that would be seen with the initiation of a desk-type job, it is possible that these individuals would be naturally be active enough throughout their day to offset the potential risks. More research is needed in this

area for us to understand the behavior patterns of active individuals who are asked to incorporate a novel amount of sedentary time into their day.

Experimental Considerations

Strengths of Current Study

There are several strengths of the current study, which add to the current body of literature. To our knowledge, this is the first study to examine the relationship between sedentary time and behavior changes in physically active adults for a long-term intervention period. The imposition of sedentary time was consistent over the course of eight weeks, which is longer term than the other studies that are currently published. The sedentary sessions were monitored by research staff and were not based upon self-report, so we can be confident that those in the experimental condition fully complied with the intervention protocol. We were able to account for potential seasonal differences in physical activity profiles, as this study was run in two phases, one in the fall and the other in the spring. Dietary intake was collected at the time of consumption for three days at a time, and participants were not asked to recall their diet, so there is less chance of recall bias. As explained previously, physical activity was measured objectively for seven full days at each assessment period, so our objective measurements are considered more accurate than those achieved through self-report and questionnaires. A descriptive study on 20 different countries from Bauman et al. (2011) indicated that analysis of objectively assessed (not self-reported) sedentary time from the U.S. showed that adults averaged 7-8 hours per day in sedentary time. This is consistent with the study by Healy and colleagues (2011) that found Americans engaged in approximately 8.4 hours of sedentary behaviors per day. These objective estimates are about 20% higher than self-reported measure estimates calling attention to potential

underestimation of self-reported sitting time. Further, light physical activity is not well captured with survey instruments, such as questionnaires. With the measurement tools used in this study, we are able to bypass the potential problems associated with self-report methods. Finally, we were able to retain all study participants and experienced no dropout.

Limitations of Current Study

Although the physical activity and dietary collection tools were strengths of our study, there are also some limitations to consider. We were able to collect three sets of 3-day food records from each individual, as well as three sets of weeklong physical activity profiles. There are potential biases to consider, as participants may have changed their behaviors when they knew that this information was being collected. This potential bias would apply to both the CON and SIT groups equally. The study design required the participants to be actively engaged for eight weeks, and those in the SIT group made the commitment to schedule their sedentary sessions every week during this time. There was a relatively large participant burden, so we cannot be sure if this affected the participants' responses on dietary logs or other questionnaires. Although we kept records of the days in which the participants had their sedentary sessions, we did not keep track of the specific time frame for each day, as they were sometimes different between weeks. Therefore, we do not know if their physical activity behaviors would have been different if they would have done their sessions in the mornings versus in the evenings. We were not able to examine specific differences in physical activity behaviors for days where sedentary time was imposed as compared to days when it was not, as we did not have good records of which day of week 4 were spend in sedentary sessions, and energy balance could, therefore, not be determined.

Proposed Reasoning for Physical Activity Results

Given our study design, there are several reasons why we may not have seen changes in physical activity behaviors. It is possible that the imposed sedentary sessions were too short in duration. Although our intervention period was longer than the majority of the studies available in the literature, it is possible that a longer duration would be required to be a strong enough stimulus to initiate behavior change. Since the total sedentary time for those in the SIT group did not significantly change over the course of the intervention (p=0.161), we cannot be sure that we were imposing "new" sedentary behaviors, although this was not the original goal of the study. They may have been being sedentary during this time anyway, regardless of whether or not they were in our lab at the time. Another possible reason why physical activity changes were not seen may be due to the participants that we recruited. Since they were all physically active and healthy, they represent a small proportion of the population. Their usual routines and lifestyles may offer some type of resistance to an imposition of sedentary time. They may have been active enough throughout the rest of the day that this relatively small stimulus was not enough for them to change their normal physical activity routines, as a group. With this small sample, a lot of individual variability can washout a group mean. Based upon the individual level changes, it is evidence that there were some people who were experiencing some negatives from the imposed sedentary time. Their usual routines may be protective against physical activity changes, however, in some cases, any reduction in physical activity may have been "offset" by a reduction in total caloric intake. This may be part of the protection afforded to them by their active lifestyle. There is some research to suggest that people who expend a lot of calories through physical activity are better at achieving energy balance over the long-term as compared to people who are not physically active (Hill, Wyatt & Peters, 2012).

Future Directions

The findings of this current study highlight the need for future research in this area. Overall, our small sample size and large variability in the data show that larger studies are needed to determine the potential for compensatory physical activity and dietary changes following an imposition of sedentary time. It is unknown whether or not ten hours per week of imposed sedentary time is enough of a stimulus to cause behavior change. Future research should examine the potential for a dose-response in this relationship to determine whether or not there is a threshold where behavior change will occur. It would also be valuable to obtain a fuller picture of the day, so that researchers can understand sleep patterns, appetite changes, mood and other outcomes that can impact health and quality of life. Additionally, it would be important to know if there is a level of sedentary time where behavior change becomes a conscious action, and if so, where this level occurs. Since only active individuals were studied in this research, future directions should include other cohort of individuals, including those who are inactive, in order to determine whether or not they respond differently to imposed sedentary time. The extent to which an imposition of sedentary time leads to compensatory behavior changes in physically active adults is still in need of future research before we can fully understand this complex relationship and the effects on health.

Conclusion

This study adds important information to the sedentary behavior research. We found that physically active, healthy young adults do not significantly alter their physical activity profiles, but do significantly decrease their caloric intake, in response to 8 weeks of (10 hours/week) of imposed sedentary time. Due to their high level of physical activity, it is possible that these individuals may have some protection against an increase in sedentary time and the subsequent

health outcomes. On the individual level, half of those in the intervention group decreased their steps by at least 10% from their average baseline values. If this reduction in steps were to translate into an increase in sedentary time, these individuals may increase their risk for cardiovascular disease, type II diabetes mellitus, obesity and all-cause mortality. However, a reduction in caloric intake may also be protective against potential negative effects of reduced physical activity.

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Chapter 5 - Field Experience Report

Introduction

My public health field experience was completed at the Riley County Research and Extension office at 110 Courthouse Plaza in Manhattan, KS. One hundred eighty hours were completed between January 4, 2014 and May 16, 2014. The goal of research and extension is to extend Kansas State University's education and research into the community where the general population can benefit and improve their worksites and personal lives. Resources and training materials are available for use regarding agriculture, economics, family life, youth development, community leadership and business. The Cooperative Extension was established in 1914, and the county extension programs are funded through various levels of government and land-grant universities. The organizational chart for Kansas State University Research and Extension is shown in Figure 5-1. In Riley County, the land-grant university that supports the department is Kansas State University. The Riley County office is directed by a county extension director, and there are four extension agents, one receptionist and two assistants. The agents specialize in the areas of family and consumer sciences, 4-H, horticulture and agriculture (Riley County, 2014).

I completed my field experience under the direction and supervision of Virginia (Ginny) Barnard, MPH. She is the Family and Consumer Sciences Agent for Riley County and specializes in the areas of nutrition, food safety, health and indoor environments. In addition to her many other responsibilities, Ginny organizes and runs the Riley County Walk Kansas program and the nutrition education classes for local elementary schools. During my time with her, these were the two areas where I was most involved. These programs were a great fit for my interests and education, and I was excited to be involved with the community and schools in order to extend my experience and offer my skills.

Walk Kansas Background Evidence

Walk Kansas is an eight-week community-wide health promotion program that encourages physical activity and healthy eating. The program was created with the goal of increasing physical activity levels in Kansas residents, and the effectiveness of this community-lead, group-based physical activity promotion program has been studied and documented in the research. In a systemic review completed by the Task Force on Community Preventive Services, it was found that community-wide programs and social support campaigns show strong evidence for overall effectiveness in increasing the physical activity levels of individuals (Kahn et al., 2002). These two components, group membership and social support, are ones that the Walk Kansas program uses in its model, and there is evidence backing the effectiveness of this program, specifically. In a study completed by Estabrooks and colleagues (2008), the effectiveness of the Walk Kansas program in increasing minutes of MVPA was evaluated. Fifteen counties in Kansas participating in the program were randomly selected to be included in the research. Pre-tests were sent to the qualified participants with questionnaires regarding the amount of moderate and vigorous physical activity that they accumulated per week. At the end of the eight-week program, a post-test was mailed to the individuals. A smaller, random sample was also selected to complete a follow-up questionnaire six months after the program concluded. The researchers mentioned that the majority of Walk Kansas members were older adult women who tended to be more active than the general population in their county of residence. When looking at the participants all together, the authors found that Walk Kansas was an effective program for increasing the physical activity levels of the individuals. When they studied these results on a stratified level, they found that the increase in physical activity was dependent upon the physical activity levels at baseline. For those who were inactive and insufficiently active at baseline, they showed a significant increase in both their moderate ($p<0.001$) and vigorous ($p<0.001$) levels of

physical activity per week. For those who were meeting physical activity guidelines at baseline, however, the researchers did not find significant increases in their moderate or vigorous levels of physical activity following the eight-week program (Estabrooks, 2008). As this research shows, Walk Kansas is a useful program for the Kansas counties to implement in order to increase the activity levels of those who choose to participate. The results also suggest that those who are not meeting physical activity levels, a targeted group, at baseline can show the most improvement when they are involved with the program.

School-Based Nutrition Education Background Evidence

As mentioned previously, another responsibility that I had was working with the local elementary schools to each nutrition-education with a gardening component. School-based nutrition education has been studied previously, and there is evidence to suggest that it can be effective tool for increasing the nutrition knowledgebase of students (Contento, Manning & Shannon, 1992). Contento and colleagues published a review piece in which they studied the effectiveness of school-based nutrition education on improving the dietary intakes of school-aged children. They found that general nutrition education studies with short-term instruction or education components (10-15 hours) were effective in increasing the knowledge, skills and self-efficacy of the students towards nutrition, but that this did not significantly lead to a change in their food choice behaviors. For the programs that were more geared toward behavioral modifications and decision making, the outcomes on subsequent behavior changes were more favorable, but the authors concluded that the outcomes were inconsistent. In comparison to short nutrition education series, those programs that lasted for several years resulted in significant dietary intake behavior changes in the students (Contento et al., 1992). This research suggests

that if we were to see favorable outcomes following our nutrition education, they would be seen in the knowledge or self-efficacy components, rather than behavior changes.

During my experience in the schools, we started the nutrition education series with lessons regarding gardening, followed by the planting and harvesting of the vegetables that we grew. In addition to the research that shows that garden-enhanced nutrition increases children's preference for some vegetables (Morris & Zindenberg-Cherr, 2002), there is evidence to suggest that it is also an effective tool for increasing the fruit and vegetable consumption in school-aged children. In a study by McAleese and Rankin (2007), the effectiveness of nutrition education, based on school gardens, on increasing fruit and vegetable consumption was determined. They wanted to know whether nutrition education, combined with a gardening component, was more effective than the nutrition education lessons alone. The sample consisted of 122 sixth-grade students from three separate elementary schools. To assess dietary intake, 24-hour dietary recalls were given at baseline and at the conclusion of the 12-week intervention program. The students were given three days' worth of consecutive dietary recalls at both of the assessment periods. There were two separate intervention programs, and one site served as the control group. At the first school, students used the book, *Nutrition in the Garden,* for their lessons that covered topics in nutrition and gardening. The second school received the nutrition education materials, but they also planted and tended to their own garden. In addition to learning about gardening basics, they prepared snacks, dried herbs and made cookbooks. The researchers found that students in the nutrition education plus gardening increased their intake of fruits, vegetables, vitamins A and C, and fiber. The students in this group more than doubled their intake of combined fruits and vegetables (1.9 to 4.5 servings per day). When comparing baseline and post-intervention, there were no significant changes in these nutrition variables for either the nutrition education only

group or the control group. The authors suggested that the gardening activities increased the self-efficacy of the students to change their dietary behavior patterns (McAleese & Rankin, 2007). Although the nutrition education series carried out during my time with the research and extension office were shorter in duration than this study, the findings suggest that the gardening component could serve as an important factor in the effectiveness of our education series to improve self-efficacy and, potentially, lead to a change in the students' food choice behaviors.

Focus and Scope of Work

When I first started with Ginny, I was educated about the Walk Kansas Program and was given the responsibilities related to getting the program started up for another year. This year (2014), the Walk Kansas program ran from March 16 to May 10. Participants joined the program as a team of six to eight people and logged their total minutes of physical activity and number of fruits and vegetables consumed every day for eight weeks. When the teams registered for the program, they were asked to select a physical activity challenge for themselves. The first challenge is based on the 2008 Physical Activity Guidelines and requires team members to accumulate 150 minutes of physical activity per week for the duration of the program. If all team members meet this goal for the eight weeks, their total walking would be approximately 423 miles and would represent the distance across the state of Kansas. The second challenge represents the distance that it would take to walk across the state of Kansas and back. To meet this challenge, team members need to each accumulate five hours of physical activity per week, which is approximately 846 miles. The third challenge requires each team member to reach the goal of six hours of physical activity per week, which would be approximately equivalent to walking around the perimeter of the state of Kansas, or about 1200 miles. During the program, the team captain reported their team miles and fruit/vegetable servings, either through the online

reporting system or through e-mail at the conclusion of every week. Part of my job was keeping track of team progress and ensuring that all the teams were moving forward towards their goals.

I was also involved with the gardening and nutrition education lessons at several elementary schools in Manhattan. The ages of the children ranged from first grade to fourth grade. I assisted with the gardening component as part of the Junior Master Gardener series. Through this program, the elementary classes were educated about gardening, and they planted their own class gardens. We selected plants that were relatively easy to grow and that would be ready for harvest within our time frame of about two months. We chose to plant spinach, onions, radishes and lettuce in the gardens. The students were taught about selecting an appropriate plot, the nutrients required for growth and how plants grow and function. We also taught the students about weeding, watering and harvesting the plants. At the conclusion of the program, we harvested the gardens and made salads from the plants that they grew. Following the gardening section, I took over the education classes and we switched the focus to nutrition and healthy eating. I assisted Ginny with the first few lessons at local elementary schools, and then I was given the responsibility of teaching all lessons at Flint Hills Christian School by myself. Following the workbook and Ginny's instruction, I began each lesson by introducing the concept of MyPlate (Figure 5-2) and interacting with the students about how they could make good decisions for their own personal plates. We had a total of five lessons, spread over five weeks. I led discussions over the five food groups (fruits, vegetables, grains, dairy, meat/beans) and the children completed activities focused on each section. During the class lessons, I would spend about 20 minutes teaching, followed by an interactive activity, and we would conclude the session with the preparation of a healthy snack.

Overall, the scope of work for this field experience fit with my education and interests very well. I was able to learn how to implement a successful community-wide health promotion program, as well as teach children about the importance of nutrition and healthy eating.

Figure 5.1 K-State research and extension organizational chart

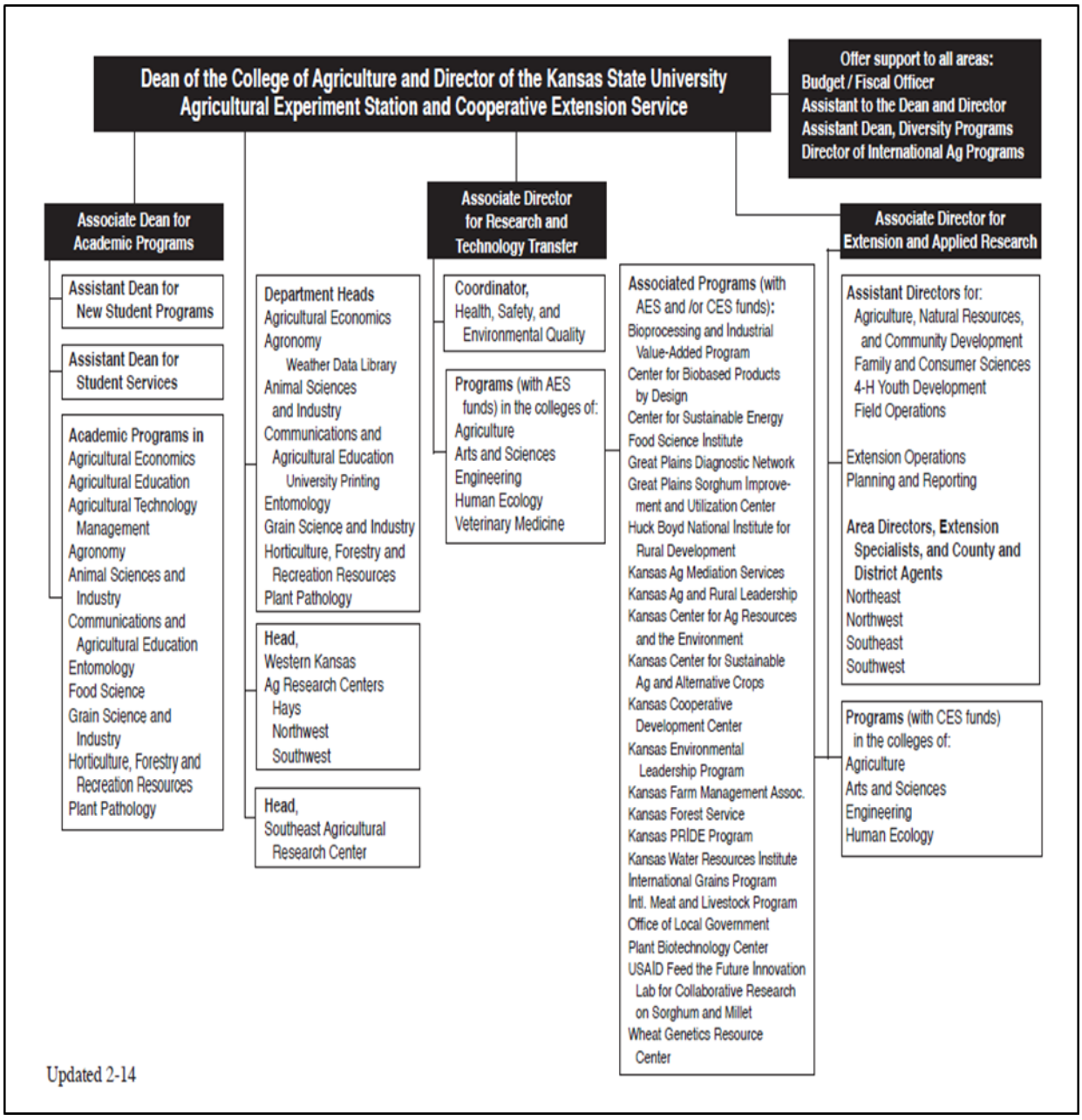
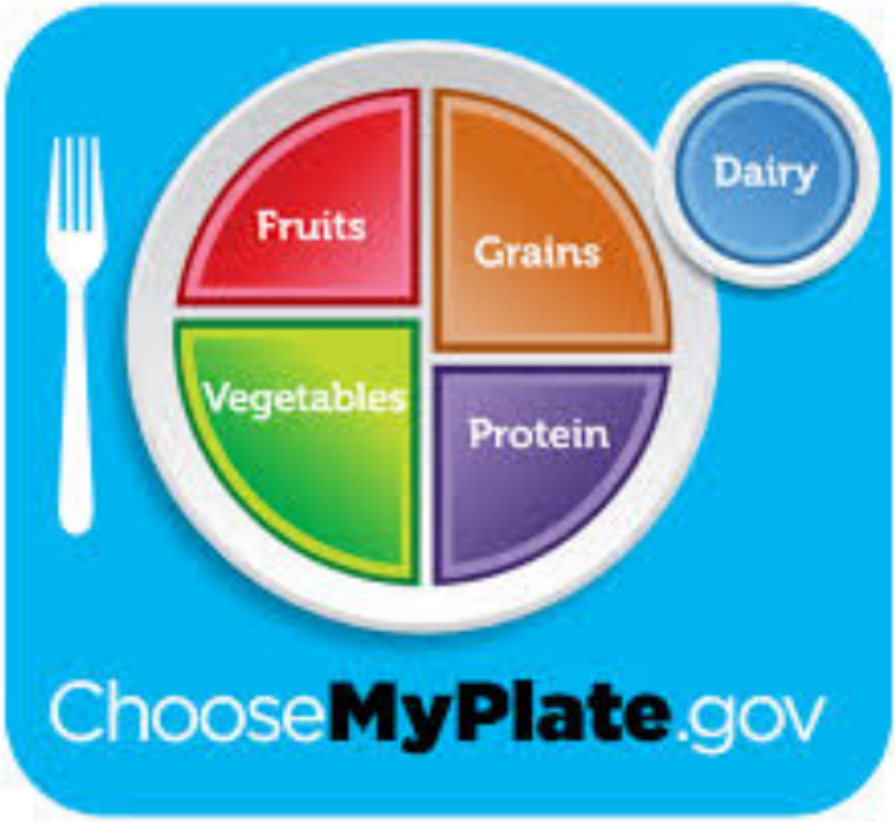


Figure 5.2 MyPlate Visual Aid



Learning Objectives

Prior to beginning my field experience, I had developed the learning objectives that I hoped to accomplish throughout my time with Ginny at the research and extension office. These objectives were related to the relevant areas from my public health nutrition education. My first objective was to understand how to organize and implement a community-wide physical activity program. This objective was accomplished on several different levels. Ginny was a great teacher and she helped me understand the challenges and tasks that arise with an intervention in a community setting. Since the Walk Kansas program had already been established for several years, I was able to look at feedback from previous years in order to help improve the experience

for our participants. From designing promotional materials to recruiting to planning and organizing group events, I was able to be very involved with the entire process of the health promotion campaign.

I also had the goal of identifying successful recruitment methods and ways to reach diverse groups in the Riley County population. The majority of Walk Kansas participants are middle aged women, and we wanted to recruit as diverse a population as possible for our program this year. In order to do this, I knew that we needed to recruit through several different avenues. I first contacted all of the participants who had participated in previous years, and encouraged them to recruit other family members, coworkers and friends. Since I had close ties with Kansas State University, I was able to put an article in K-State Today, as well as several email lists on campus. The research and extension office has a Facebook account, so we were also able to use this page for recruiting potential participants. I printed off and delivered about 50 flyers and informational handouts for businesses, schools, parks and other community areas around the Manhattan area. We were able to develop a press release and radio clip for Riley County, and these were available to the public for a few weeks prior to the start of the Walk Kansas program. Another method of recruitment was having conversations with people who had questions and encouraging them to participate. Overall, I felt that I learned a lot about ways to recruit in a community setting and we were able to reach people from diverse demographics in Riley County.

My third objective was to recognize and implement ways to keep participants motivated in their physical activity and nutrition efforts. I was able to accomplish this objective through contact with the participants through email and telephone, as well as the group events that I organized. I sent out a newsletter each week to all Walk Kansas participants that gave

information about physical activity and nutrition, as well as encouragement and a weekly recipe for them to try. In addition to the weekly newsletters, the team captains also received a captain's letter each week. When I sent these newsletters, I also sent a short letter or email with upcoming events or reminders for that week. If I noticed that a team had not been submitting their totals or if their numbers were going down, I would personally contact them to see if there was anything that I could help them with in order for them to reach their goals.

Finally, I wanted to gain an understanding of how public health works in a community-wide setting. This objective was the primary focus of my field experience, and I felt that I truly did gain an understanding and appreciation for the need for public health programs. I learned that sometimes the best ideas on paper do not translate in the community setting well. It is much more important to listen to your community and understand what needs they have for a program and how you can tailor it to be most effective and useful for them. Since we were working on a budget, I had to learn how to make events and motivational tools most cost-effective, while still being enjoyable for everyone. The survey results, shown in Appendix 1, show that the majority of participants found the program helpful in improving their physical activity and nutrition behaviors. I would consider Walk Kansas to be a successful public health program for our state and community, and it was a pleasure and honor to work so closely and learn from the staff and participants.

Activities Performed

Walk Kansas Activities

I was given the opportunity to perform many activities related to physical activity, nutrition and public health during my time at the Riley County Research and Extension office. In the months leading up to the start of Walk Kansas, I created new and original documents that were used in the recruitment of participants for the program, and I modified existing participant packet information so that they met the needs of the current year and goals. An early responsibility that I was given was to set up the website system for online registration. Although individuals are given the option of registering in person or by filling out the paper forms, we wanted them to have the opportunity to register online, in order to appeal to the younger and working generation. We created a link that we could attach to emails, webpages and flyers that directed people to the registration website. In addition to online registration, we also set up a website for online Walk Kansas apparel orders this year. Although I did not start in my position with a lot of experience in webpage set up and design, I was given the opportunity to enhance my skills in this area. When team registrations started coming, I created a file to keep all participant records and releases organized. During these first couple of months, I quickly learned about the extent of work that it takes on the front end of a public health program to get it started and for it to be successful.

I wanted to kick off the program with a special event this year, in order to get people motivated and excited about working on their health journey. After considering many different venue options and the potential weather factors, I chose to hold the event in the commons area of Manhattan Town Center Mall. The kick off celebration included a mall walk, door prizes, apparel sales and opportunities for team building. Ginny and I set up several tables with

promotional materials and other information from the research and extension department. I created cards so that the walkers could keep track of the laps that they made around the mall. For every two laps (approximately one mile) that they walked, their name was entered into the drawing for one of two prizes. The prizes for this event were an iPod shuffle and a $50 Manhattan Running Company gift card. Not only did our walkers have a great time and physical activity bonding session, but Ginny and I were able to talk to many community members who had never heard about Walk Kansas. We were able to interact and recruit people who we would not have been able to otherwise. Overall, it was a great event and something that could definitely be incorporated into future years of the program.

Once the program was kicked off, there were many different activities and responsibilities that I undertook. We wanted to implement the use of an online reporting system for the participants to utilize. Although other counties have used this system in their programs for a few years, I was able to help with the initiation of Riley County to the system. In previous years, the team captains have always called, emailed or faxed their team totals to the extension office. This year, In hopes of appealing to many of the participants and their busy schedules, I set up usernames and passwords for all team captains and directed them to a website where they could securely enter their totals and monitor their progress. The majority of team captains used this method to enter their totals and we had very few complications that arose. I tried to maintain a presence with the participants, and I served as a point of contact and answered any questions that they had during the program. Through my emails and newsletters, I was in contact with the participants on a weekly basis to serve as a source of encouragement and to keep track of their progress.

One of my final responsibilities for the Walk Kansas program was to plan, organize and host the finale celebration event. In past years, there have been about 100 participants who attended this event to celebrate the end of the program. I chose to hold the event at Pottorf Hall in Cico Park. I was given free reign to decide how the party would happen for this year, and I started my planning by deciding on the food menu and the prizes that we wanted to have donated. After considering time of preparation, appeal and cost, I chose the menu items that included cheese and crackers, black bean salsa and chips, fresh fruit, fresh vegetables and spinach strawberry salad. For the two days before the event, I did the shopping and food preparation in order to have everything ready. In addition to preparing the food, I also contacted community groups and local businesses to see if they would be interested in donating a prize for our raffle. We asked for donations that were approximately $30 to $50 in value. Thanks to our generous donors, we were able to offer Yoga for Life classes and apparel, yoga mats, Knotty Body massages, Dick's Sporting Goods gift card, Manhattan Running Company gift card and apparel and Walk Kansas merchandise. When participants come to the event, they were given a raffle card and they could put it in the basket of the prize that they wanted to win. Towards the end of the event, Ginny and I did the drawings and the prizes were claimed. I was also given the opportunity to address the crowd and thank them for their participation. At the end of the event, I handed out program evaluations that they could fill out anonymously to give us feedback about how we could improve Walk Kansas. I also sent the survey out through email so that those who weren't at the celebration event would still have a chance to provide input. I collected information regarding adherence to the program, outcomes and qualitative information about how participants felt the program impacted their health and wellness. The survey results are shown as appendix 1.

Gardening and Nutrition Education Activities

During the eight weeks that the program was running, my responsibilities lessened in the office and my attention was more focused on the nutrition education lessons in the schools. As was explained previously, I lead the lessons at Flint Hills Christian school and covered several sessions at other local schools when help was needed. We started with the gardening sessions, and I helped the Master Gardener, Jaquee, teach the classes and ultimately plant the gardens. At the beginning of the course, the students were taught about which types of foods were plants and how these foods go from the garden to the stores and to their plates. We taught them about different types of seeds and bulbs and what it takes to successfully grow the plants. Interactive activities and discussions occurred, in which the children decided where the best place to plant their garden would be. We helped them accomplish this task with the help of the worksheet shown as Figure 5-3. Once the location of the garden plot was agreed upon, the vegetables were selected for the gardens. We needed to select vegetables that could withstand the heat and that would grow enough for harvest in approximately 2 months. The students learned how to plant the seeds and how to water and weed the gardens. Once the gardens were planted, I took over the lessons and we moved on to the nutrition component.

The nutrition education lessons were held once per week for about 45 minutes. At the beginning of each lesson, we discussed MyPlate and the importance of each of the food groups for our bodies and health. The students would tell me which types of foods belonged in each group and I would explain to them the uses that each of those food had in their functioning. After we touched on those topics, we would move into the substance of the discussion for that day. Each lesson focused on a different nutrition topic, and these included vitamins and minerals, carbohydrates, fats, proteins and water. A couple of the workbook and content pages are shown as Figure 5-4. As you can see, we talked about how many calories each nutrient provided, and

how our body used each of these to properly function. During each of these lessons, the students would have time to ask questions and give examples about what would happen if they didn't consume each of the nutrients. Since I was working with young children, I had to make sure that the content was age-appropriate and that they were able to understand. As a whole, the students were very interactive and excited to learn about nutrition. Following the lesson, we would make a snack as a group. This was the students' favorite part of the lesson and they would become very excited to help me prepare the food for that day. The snacks included air popped popcorn, bean dip with vegetables, fruit smoothies and homegrown salads. Since Flint Hills Christian was a small class, each student got to have a role in the preparation and was confident that they would be able to make this food at home for their own snack. For my final day with the students, we harvested the gardens and they learned how to prepare a salad from the vegetables. They learned about why we needed to wash the vegetables, and then they helped me trim and cut in order to make the salad. They were happy to have a successful garden and were excited to eat the foods that they grew themselves. Overall, the activities and responsibilities that I had in the schools were incredibly rewarding. I loved interacting with and teaching the students, and these responsibilities increased my confidence in working with this age group. I was able to be involved with public health on a very different level than what I was with the Walk Kansas program.

While the nutrition educations lessons are important for the students, a critical view of the program highlights some areas where improvement could be achieved. The Society for Nutrition Education compiled a report released in 2009 that revealed gaps in the current programs that are being offered. The report revealed that an inadequate amount of time is being spent on teaching the students about nutrition, and that the average instruction time was

approximately four to five hours per year. Additionally, they found that insufficient funding is available to train staff on nutrition education (Society for Nutrition Education, 2009). These two gaps in nutrition education were reflected in the local schools. Since the research and extension office is responsible for the instruction, there is not enough time or trained staff to lead the instruction for more than the four to five hours that were cited in the report. Since the nutrition education instructors were from the area of research and extension, they are not considered staff at the schools and the funding and day-to-day interaction is minimal. Finally, the report mentioned that the most effective programs involved behavior change opportunities, including healthier snack and food options available in the lunchroom. To my knowledge, the nutrition education classes by the research and extension and Master Gardener series were only offered to specific classes in the school, so the reach of the program was relatively narrow in a given year. Since our nutrition education program did not utilize questionnaires, diet records or surveys to assess dietary intake, attitudes or self-efficacy, we cannot be sure of the impact that these classes are having on the students.

Figure 5.3 Garden plot selection worksheet

Site Selection Survey

You are trying to decide the best place to put your garden. Circle one number for each line. 1 = not very good and 5 = excellent

Location of Site #1

Area has sunlight	1	2	3	4	5
Area is near a water source	1	2	3	4	5
Area has good soil	1	2	3	4	5
Area is near where tools are stored	1	2	3	4	5
Area is close by and easy to get to	1	2	3	4	5

Add up all of the numbers you circled and write the total in the box.

Total Score for Site #1 ☐

Location of Site #2

Area has sunlight	1	2	3	4	5
Area is near a water source	1	2	3	4	5
Area has good soil	1	2	3	4	5
Area is near where tools are stored	1	2	3	4	5
Area is close by and easy to get to	1	2	3	4	5

Add up all of the numbers you circled and write the total in the box.

Total Score for Site #2 ☐

Location of Site #3

Area has sunlight	1	2	3	4	5
Area is near a water source	1	2	3	4	5
Area has good soil	1	2	3	4	5
Area is near where tools are stored	1	2	3	4	5
Area is close by and easy to get to	1	2	3	4	5

Add up all of the numbers you circled and write the total in the box.

Total Score for Site #3 ☐

Figure 5.4 Nutrition Education Workbook Pages

6 Nutrient Categories

1) Fat

Provides _____ to the body.

1 gram of fat = _____calories (energy).

Fat is divided into two categories:

1) _____
→ are hard at room temperature
→ examples: stick of butter/margarine

2) _____
→ are liquid at room temperature
→ examples: vegetable oils

2) Carbohydrates

Body's main source of _____.

1 gram of carbohydrate = _____ calories (energy).

If you skip _____ , your body may run _____ on energy.

Examples of carbohydrates:
vegetables, fruits, table sugar, rice, bread, pasta

3) Protein

Provides _____ to the body.

1 gram of protein = _____ calories (energy).

Protein helps your body _____, _____, and _____ disease.

Examples of protein:
meat, poultry, fish, eggs, beans, peas, nuts, and dairy products

4) Water

Provides _____ calories.

Water helps your body _____ nutrients, _____ waste, and _____ body temperature.

Your body is _____ water!

Your blood is _____ water!

Sources of water:
plain water, milk, juice, sports drinks, and many foods (watermelon is over 90% water!)

5) Vitamins

Provide _____ calories.

Only needed in _____ amounts.

They help the body:
→ build tissue
→ regulate body function
→ help other nutrients do their job

Sources of vitamins:
fruits, vegetables, whole grains, nuts, meats, milk

6) Minerals

Provide _____ calories.

Promote good health while regulating body functions AND become part of your _____, _____, and _____.

Your bones need _____, _____, and _____ to grow.

Your blood needs _____ to help red blood cells carry oxygen to all parts of your body.

Products Developed

During the first few weeks of my field experience, a significant portion of my time was spent developing the materials for the Walk Kansas program. Starting in January, I began organizing, developing and preparing the participant packets, brochures, posters and webpages that we utilized in the recruitment and registration of members. This year, for the first time, we decided to use yard signs as part of the promotional materials. I was given the responsibility of designing several samples to add to the state's selection options. The other recruitment products that I helped develop and update were the fliers and brochures that I took around town to various locations. One of the fliers that we used this year is shown as figure 5-5. Although I did not have a great deal of experience with the development of graphic materials prior to this position, it was a great learning experience. I began to understand how promotional materials were incredibly important to our program, and that they must be designed appropriately in order to be effective.

The participant packets required that I update and develop several different pieces of material. The goal was for each team to have one packet that contained all of the information for the program for that year. The captain's letter, shown as figure 5-6, explained the program to the captain, instructed them how to report their team totals, gave motivational messages and provided important dates for the upcoming events. The team registration form, shown as figure 5-7, was filled out by the team captain with their participants' name and e-mail address. Also on this form was a place for the team captain to mark the challenge that they accepted. Once I received these forms back from the captains, I entered all of the information into our online system so that they could enter their minutes through the website if they wished to do so. Figure 5-8 is a copy of the participant guide, and this was developed so that each individual knew how to count their minutes of physical activity and what activities would give their team "bonus minutes". Additionally, it mentioned the recommendations of MyPlate and explained what their

responsibilities were to their team for each week. This was developed to be useful document for the participants to use to answer any questions that might arise during the program. The individual registration form, shown in figure 5-9, was filled out by each participant. It was from this form that we were able to collect information regarding their age group, ethnicity and gender. There was also a section that explained the risks and the participants signed it to assume responsibility for anything that could happen during their participation in the program. Finally, they were asked whether or not we could use their photograph or voice for any of our education or promotional materials. Figures 5-10 and 5-11 are the individual and team captain logs, respectively. The participants were asked to keep track of their minutes of physical activity and servings of fruits and vegetables for each day throughout the program. Each person logged their own information and at the end of the week, they gave this information to the team captain. The team captain then filled in the team totals on their log sheets and this information was submitted to the extension office, either through email/fax or through the online reporting system. These documents were developed so that the participants would be able to log their information prospectively, as well as having a reference for discrepancies. This year, we also provided a physical activity prescription form, in keeping with the theme of "exercise as medicine". This document, shown as figure 5-12, was meant to be a fun and informal document explaining the dosage and types of physical activities that the participants should accumulate. It also touched on some of the health benefits of regular physical activity and some tips on how to exercise safely. The final product that I developed for the participant packets was the Walk Kansas apparel order form, shown in figure 5-13. Participants were able to purchase t-shirts, long-sleeve shirts, hooded sweatshirts and performance shirts in a variety of colors. Once they filled out and returned their order forms, I was able to enter them online and submit their orders.

In addition to the participant packet material and promotional products, I also sent out requests for sponsorship letters leading up to our celebration event. In these letters, I explained the Walk Kansas program and the importance of community-based health promotion campaigns, and told them that we wanted to list their business as a sponsor of the program. Overall, I was able to help create and update many different materials and products for the Walk Kansas program this year.

Figure 5.5 Walk Kansas promotional flier

Walk Kansas 2014

An 8-week healthy lifestyle challenge!

March 16 - May 10

Walk Kansas

celebrate healthy living

Walk Kansas is a team-based program that will help you and others lead a healthier life by being more active, making better nutrition choices, and learning positive ways to deal with stress.

You can participate by gathering a team of 6 people, register the team in your local program, and start your journey toward a healthier life!

General information about Walk Kansas is available at:

www.walkkansas.org

For local program information, contact:

Riley County Research and Extension
110 Courthouse Plaza
Room B220
Manhattan, KS 66502

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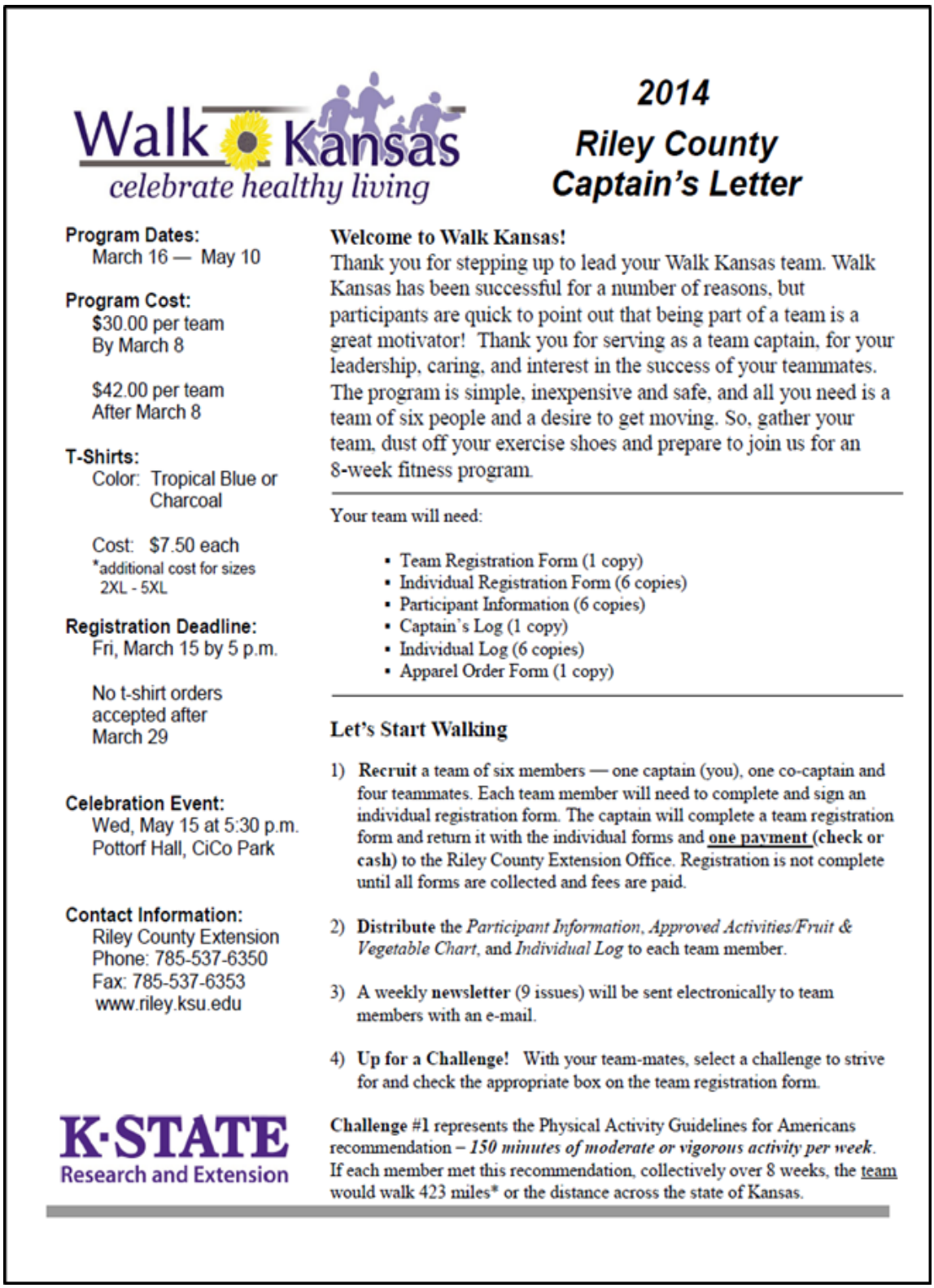
Figure 5.6 Participant packet captain's letter



Walk Kansas
celebrate healthy living

2014
Riley County
Captain's Letter

Program Dates:
March 16 — May 10

Program Cost:
$30.00 per team
By March 8

$42.00 per team
After March 8

T-Shirts:
Color: Tropical Blue or Charcoal

Cost: $7.50 each
*additional cost for sizes 2XL - 5XL

Registration Deadline:
Fri, March 15 by 5 p.m.

No t-shirt orders accepted after March 29

Celebration Event:
Wed, May 15 at 5:30 p.m.
Pottorf Hall, CiCo Park

Contact Information:
Riley County Extension
Phone: 785-537-6350
Fax: 785-537-6353
www.riley.ksu.edu

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Welcome to Walk Kansas!
Thank you for stepping up to lead your Walk Kansas team. Walk Kansas has been successful for a number of reasons, but participants are quick to point out that being part of a team is a great motivator! Thank you for serving as a team captain, for your leadership, caring, and interest in the success of your teammates. The program is simple, inexpensive and safe, and all you need is a team of six people and a desire to get moving. So, gather your team, dust off your exercise shoes and prepare to join us for an 8-week fitness program.

Your team will need:

- Team Registration Form (1 copy)
- Individual Registration Form (6 copies)
- Participant Information (6 copies)
- Captain's Log (1 copy)
- Individual Log (6 copies)
- Apparel Order Form (1 copy)

Let's Start Walking

1) **Recruit** a team of six members — one captain (you), one co-captain and four teammates. Each team member will need to complete and sign an individual registration form. The captain will complete a team registration form and return it with the individual forms and **one payment (check or cash)** to the Riley County Extension Office. Registration is not complete until all forms are collected and fees are paid.

2) **Distribute** the *Participant Information*, *Approved Activities/Fruit & Vegetable Chart*, and *Individual Log* to each team member.

3) A weekly **newsletter** (9 issues) will be sent electronically to team members with an e-mail.

4) **Up for a Challenge!** With your team-mates, select a challenge to strive for and check the appropriate box on the team registration form.

Challenge #1 represents the Physical Activity Guidelines for Americans recommendation – ***150 minutes of moderate or vigorous activity per week***. If each member met this recommendation, collectively over 8 weeks, the team would walk 423 miles* or the distance across the state of Kansas.

Let's Start Walking, cont.

Challenge #2 - Across and Back
This challenge requires more than the minimum recommendation. Each team member would log 5 hours of activity per week, enough for your team to make it across the state and back.

Challenge #3 - Around
This challenge asks each team member to log 6 hours of activity per week. Collectively, over the 8 weeks, your team would walk 1200* miles or the distance around the perimeter of the state of Kansas.

* Based on calculation of 15 minutes = one Walk Kansas mile.

Captains Report Team Totals Online OR to Extension Office On:

March 24
March 31
April 7
April 14
April 21
April 28
May 5
May 12

4) Participants will begin to log minutes on Sunday, March 17.

5) Team members will need to report weekly minutes and fruit/veggies to their team captain. As team captain, you will need to communicate with your team members about the best way for them to report information to you. **The team captain will report totals to the Extension Office by 5 p.m. on Monday OR online at www.walkkansas.org**

   You may call (785-537-6350), e-mail (sriffey@ksu.edu) or fax (785-537-6353) your total team minutes.

   Captains will receive an e-mail reporting reminder message each week. If the captain plans to be out-of-town or cannot report for some reason, the co-captain will need to assume the reporting duty.

6) Team progress will be posted on the ***Walk Kansas*** website at ***www.walkkansas.org*** by Wednesday of each week.

Bonus Minutes!
Each participant can earn 15 bonus minutes per week for breaking every hour of sitting (at work, home, while traveling, etc.) These minutes will be added to the physical activity minutes they report to you each week, so captains do not need to track bonus minutes.

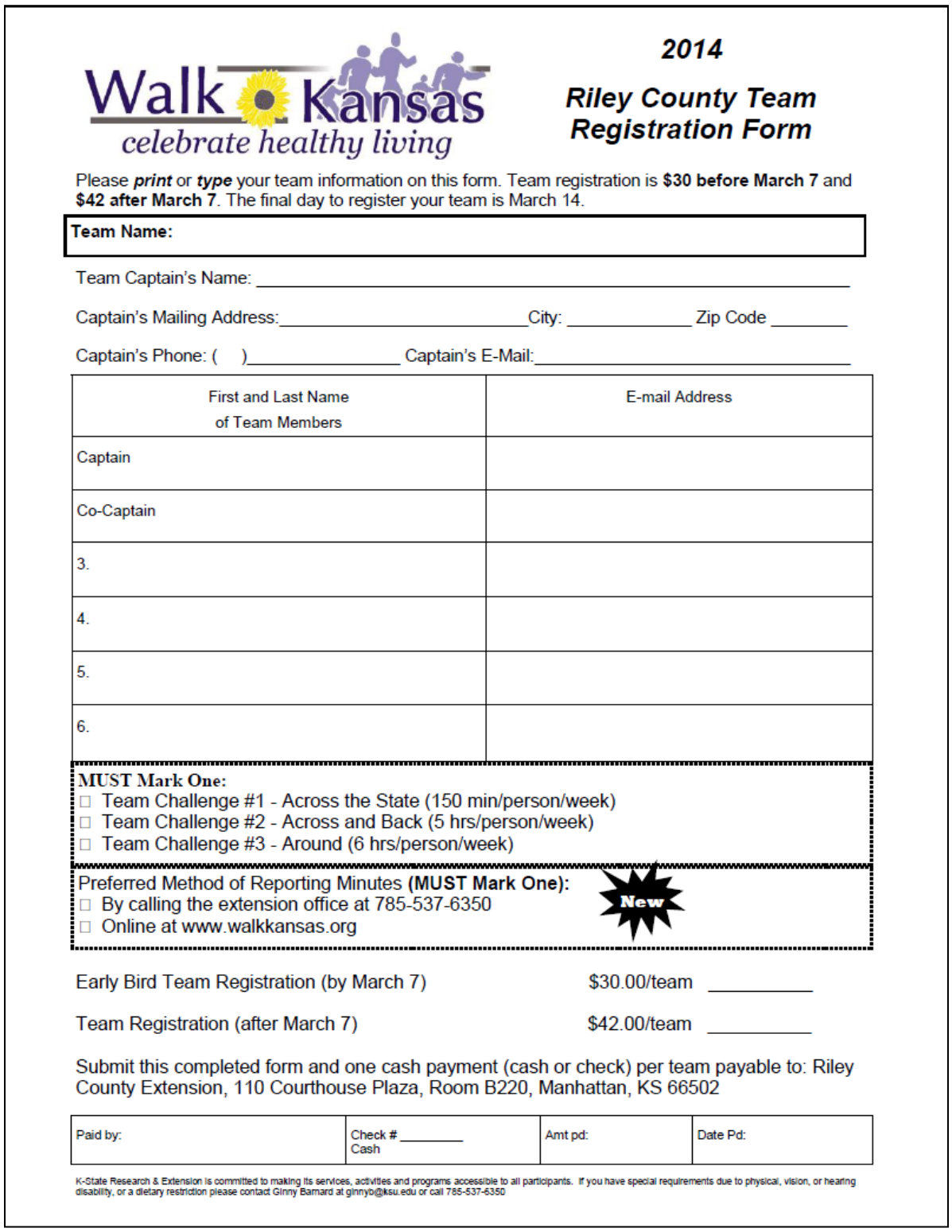
What Activities Count as Walk Kansas Minutes?
This is the most popular question from participants each year! The physical activity guide is a good resource. Just to reinforce what counts, the activity must be at least 10 consecutive minutes (not 3 minutes walking from the parking lot, another 2 minutes walking up the stairs, etc.) Activities must also be moderate and/or vigorous, or they can be strengthening activities. Examples of these activities and the "talk test" are described in the packet materials or can be found at www.riley.ksu.edu

Reporting Your Minutes Online
Captains can enter their team's minutes online at www.walkkansas.org.

- Click the "Team Captain" tab on the left side of the page
- Click on Riley County
- Enter the team leader's email address and password (we will provide your password to you)
- Click on "Leader Login"
- Enter you team's minutes for the week

Thanks for making Riley County Walk Kansas a Success!

Figure 5.7 Participant packet team registration form



Walk Kansas
celebrate healthy living

2014

Riley County Team Registration Form

Please ***print*** or ***type*** your team information on this form. Team registration is **$30 before March 7** and **$42 after March 7**. The final day to register your team is March 14.

Team Name:

Team Captain's Name: _____

Captain's Mailing Address:_____City: _____ Zip Code _____

Captain's Phone: ( )_____ Captain's E-Mail:_____

First and Last Name of Team Members	E-mail Address
Captain	
Co-Captain	
3.	
4.	
5.	
6.	

MUST Mark One:
- ☐ Team Challenge #1 - Across the State (150 min/person/week)
- ☐ Team Challenge #2 - Across and Back (5 hrs/person/week)
- ☐ Team Challenge #3 - Around (6 hrs/person/week)

Preferred Method of Reporting Minutes **(MUST Mark One):** New
- ☐ By calling the extension office at 785-537-6350
- ☐ Online at www.walkkansas.org

Early Bird Team Registration (by March 7) $30.00/team _____

Team Registration (after March 7) $42.00/team _____

Submit this completed form and one cash payment (cash or check) per team payable to: Riley County Extension, 110 Courthouse Plaza, Room B220, Manhattan, KS 66502

Paid by:	Check # _____ Cash	Amt pd:	Date Pd:

K-State Research & Extension is committed to making its services, activities and programs accessible to all participants. If you have special requirements due to physical, vision, or hearing disability, or a dietary restriction please contact Ginny Barnard at ginnyb@ksu.edu or call 785-537-6350

Figure 5.8 Participant guide

Walk Kansas
celebrate healthy living

Welcome to Walk Kansas!
March 16 – May 10, 2014

How Walk Kansas Works

Recording Activity Minutes

Minutes you log and report for Walk Kansas should meet these guidelines.

- **Activity should last for 10 consecutive minutes** or more.
- During exercise, strive for moderate to vigorous exertion. Check yourself against these measurements: **moderate** = you're barely able to talk, but not sing; **vigorous** = you are only able to say a few words before stopping to catch your breath.
- **Muscle strengthening** activities are also important. You should do these two days per week, which also count toward Walk Kansas minutes.
- The physical activity prescription in this packet explains the recommendations in more detail.

Source: Physical Activity Guidelines for Americans are recommendations from the U.S. Department of Health and Human Services; http://www.health.gov/paguidelines

Bonus Minutes: You can earn 15 bonus minutes per week for breaking every hour of sitting (during hours you are awake). If you move every hour, 6 days during the week, add 15 bonus minutes to your weekly total.

Why the bonus? Research is showing that sedentary living is a big health risk. If you sit for more than one hour at a time at work, home, while driving or traveling – take a 1-2 minute break. Just standing for a few minutes every hour makes a difference.

Fruits and Vegetables – How Much?

- The health benefits of physical activity are greater when you also follow a healthy eating plan.
- MyPlate recommends that you fill half of your plate with fruits and vegetables. Ideally, you should eat 4 - 5 cups each day. This may sound like a lot, so add a fruit or vegetable to what you currently eat each day and increase gradually.
- **Use your Daily Log to track cups of fruits/vegetables you eat.**
- More healthy eating information will be included in your weekly newsletters and is also available at www.choosemyplate.org.

How do I get started?

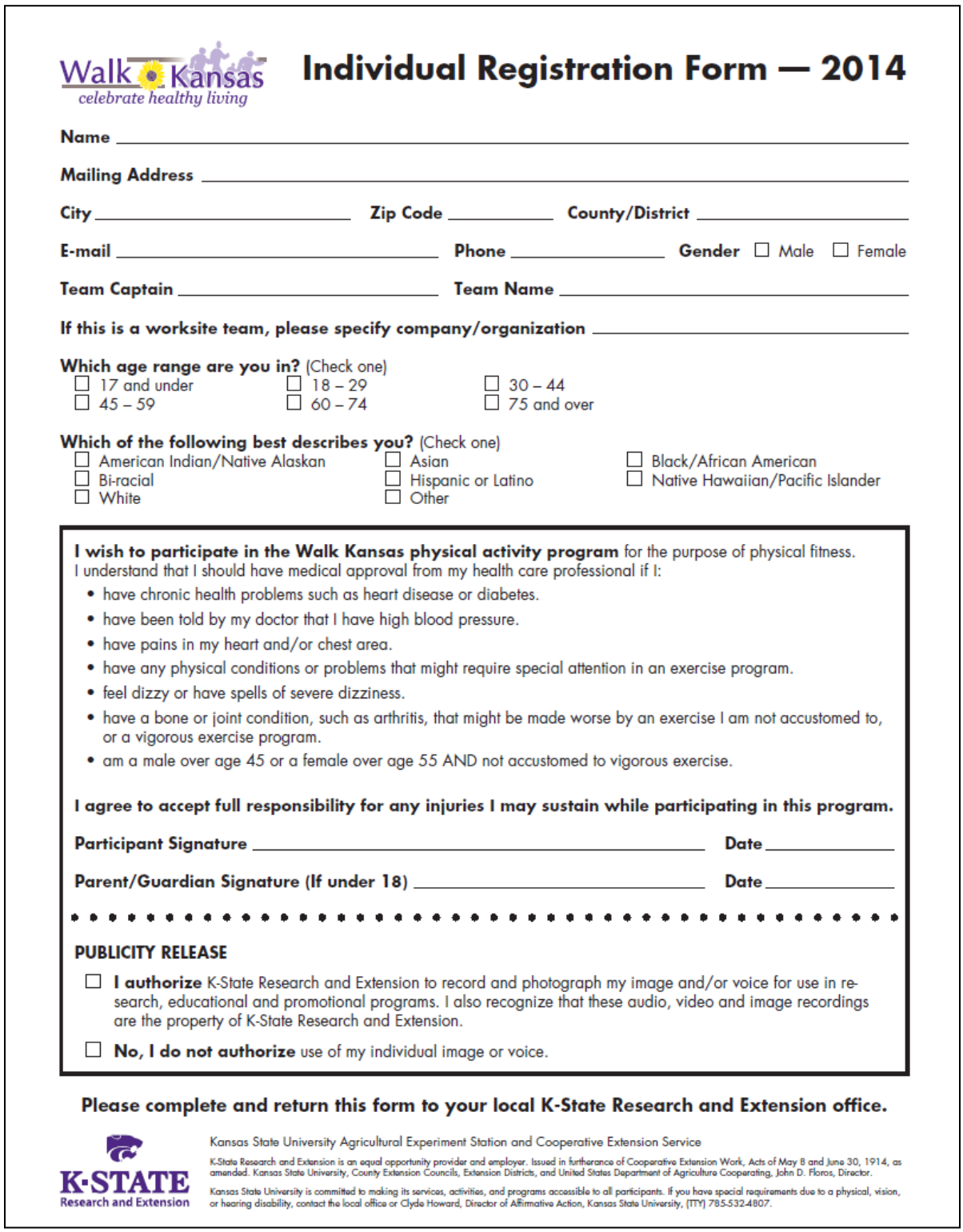
- Fill out a participant registration form and return it, along with program fee payment, to your team captain. Order a Walk Kansas T-shirt, long sleeve shirt, sweat shirt, or performance shirt if you want one. Apparel can be ordered online through the Walk Kansas link on www.riley.ksu.edu.
- Read and follow your *Physical Activity Prescription*.
- Use the *Daily Log* to record physical activity minutes and fruits/vegetables. **(Begin March 16.)**
- Physical activity minutes and fruit/vegetable consumption can also be turned in by the team captain online at www.walkkansas.org.
- Report weekly to your team captain.
- Read your newsletter. If you don't receive it weekly, contact your Extension office at 785-537-6350.
- Explore the website www.walkkansas.org
- Participate in any events, educational programs, fun walks/runs, kick-off and/or celebration events offered in your community or promoted through your team.
- Enter the photo challenge – your photo could earn you a Walk Kansas hoodie!
- Complete a Walk Kansas evaluation after week 8.

Have a great Walk Kansas experience!

New in 2014!!

• **Videos** to show each "move of the week" on www.walkkansas.org.
• **Walk Kansas on social media** – you don't want to miss this! Like "Kansas State University Walk Kansas" and "Riley County K-State Research & Extension"
• **Walk Kansas Photo Challenge!** Guidelines available from your local Extension office and www.walkkansas.org.

Figure 5.9 Individual registration form



Walk Kansas
celebrate healthy living

Individual Registration Form — 2014

Name _____

Mailing Address _____

City _____ **Zip Code** _____ **County/District** _____

E-mail _____ **Phone** _____ **Gender** ☐ Male ☐ Female

Team Captain _____ **Team Name** _____

If this is a worksite team, please specify company/organization _____

Which age range are you in? (Check one)

☐ 17 and under ☐ 18 – 29 ☐ 30 – 44
☐ 45 – 59 ☐ 60 – 74 ☐ 75 and over

Which of the following best describes you? (Check one)

☐ American Indian/Native Alaskan ☐ Asian ☐ Black/African American
☐ Bi-racial ☐ Hispanic or Latino ☐ Native Hawaiian/Pacific Islander
☐ White ☐ Other

I wish to participate in the Walk Kansas physical activity program for the purpose of physical fitness. I understand that I should have medical approval from my health care professional if I:

- have chronic health problems such as heart disease or diabetes.
- have been told by my doctor that I have high blood pressure.
- have pains in my heart and/or chest area.
- have any physical conditions or problems that might require special attention in an exercise program.
- feel dizzy or have spells of severe dizziness.
- have a bone or joint condition, such as arthritis, that might be made worse by an exercise I am not accustomed to, or a vigorous exercise program.
- am a male over age 45 or a female over age 55 AND not accustomed to vigorous exercise.

I agree to accept full responsibility for any injuries I may sustain while participating in this program.

Participant Signature _____ **Date** _____

Parent/Guardian Signature (If under 18) _____ **Date** _____

PUBLICITY RELEASE

☐ **I authorize** K-State Research and Extension to record and photograph my image and/or voice for use in research, educational and promotional programs. I also recognize that these audio, video and image recordings are the property of K-State Research and Extension.

☐ **No, I do not authorize** use of my individual image or voice.

Please complete and return this form to your local K-State Research and Extension office.

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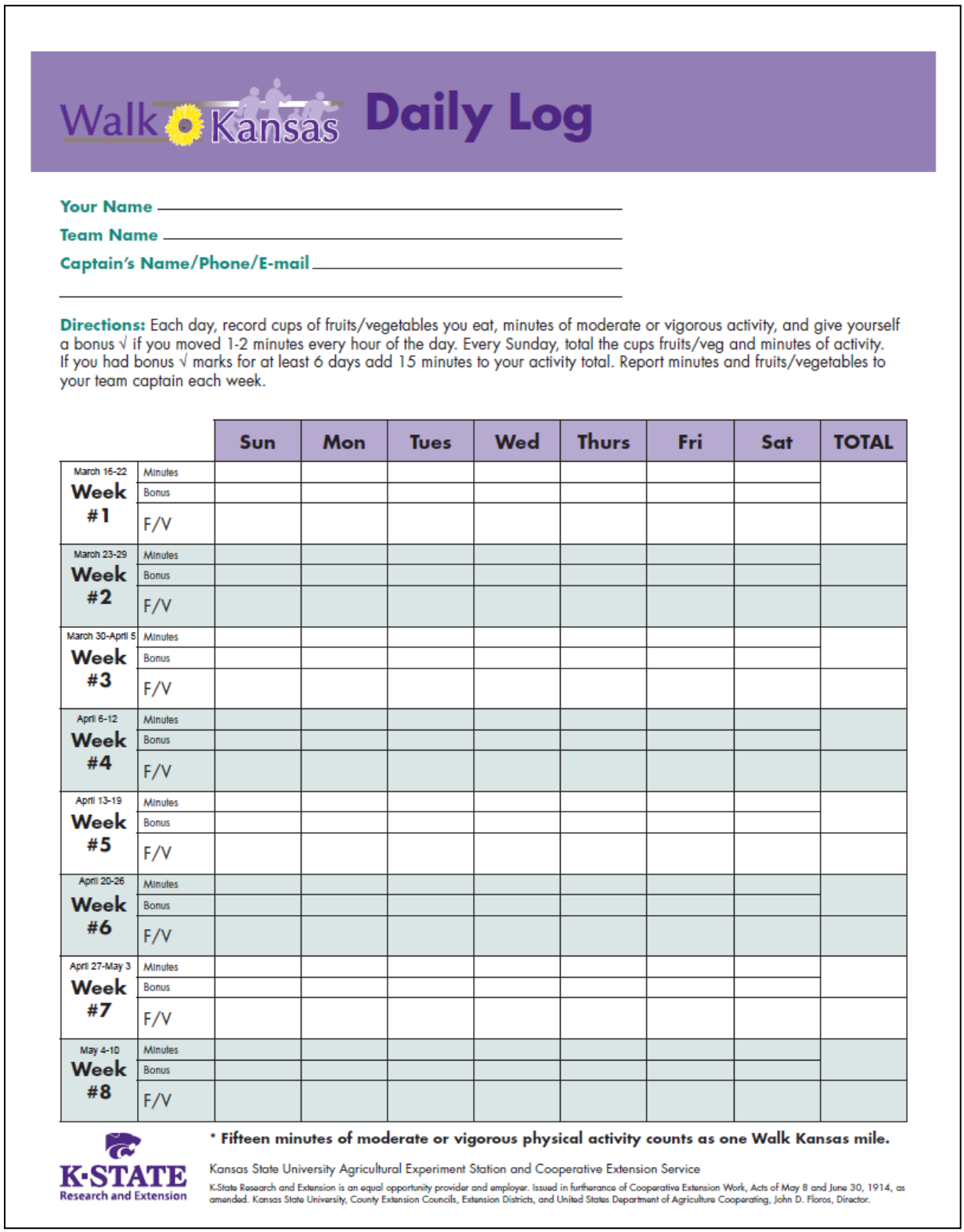
Kansas State University is committed to making its services, activities, and programs accessible to all participants. If you have special requirements due to a physical, vision, or hearing disability, contact the local office or Clyde Howard, Director of Affirmative Action, Kansas State University, (TTY) 785-532-4807.

Figure 5.10 Individual daily log



Walk Kansas Daily Log

Your Name _____

Team Name _____

Captain's Name/Phone/E-mail _____

_____

Directions: Each day, record cups of fruits/vegetables you eat, minutes of moderate or vigorous activity, and give yourself a bonus √ if you moved 1-2 minutes every hour of the day. Every Sunday, total the cups fruits/veg and minutes of activity. If you had bonus √ marks for at least 6 days add 15 minutes to your activity total. Report minutes and fruits/vegetables to your team captain each week.

		Sun	Mon	Tues	Wed	Thurs	Fri	Sat	TOTAL
March 16-22 Week #1	Minutes								
	Bonus								
	F/V								
March 23-29 Week #2	Minutes								
	Bonus								
	F/V								
March 30-April 5 Week #3	Minutes								
	Bonus								
	F/V								
April 6-12 Week #4	Minutes								
	Bonus								
	F/V								
April 13-19 Week #5	Minutes								
	Bonus								
	F/V								
April 20-26 Week #6	Minutes								
	Bonus								
	F/V								
April 27-May 3 Week #7	Minutes								
	Bonus								
	F/V								
May 4-10 Week #8	Minutes								
	Bonus								
	F/V								

*** Fifteen minutes of moderate or vigorous physical activity counts as one Walk Kansas mile.**

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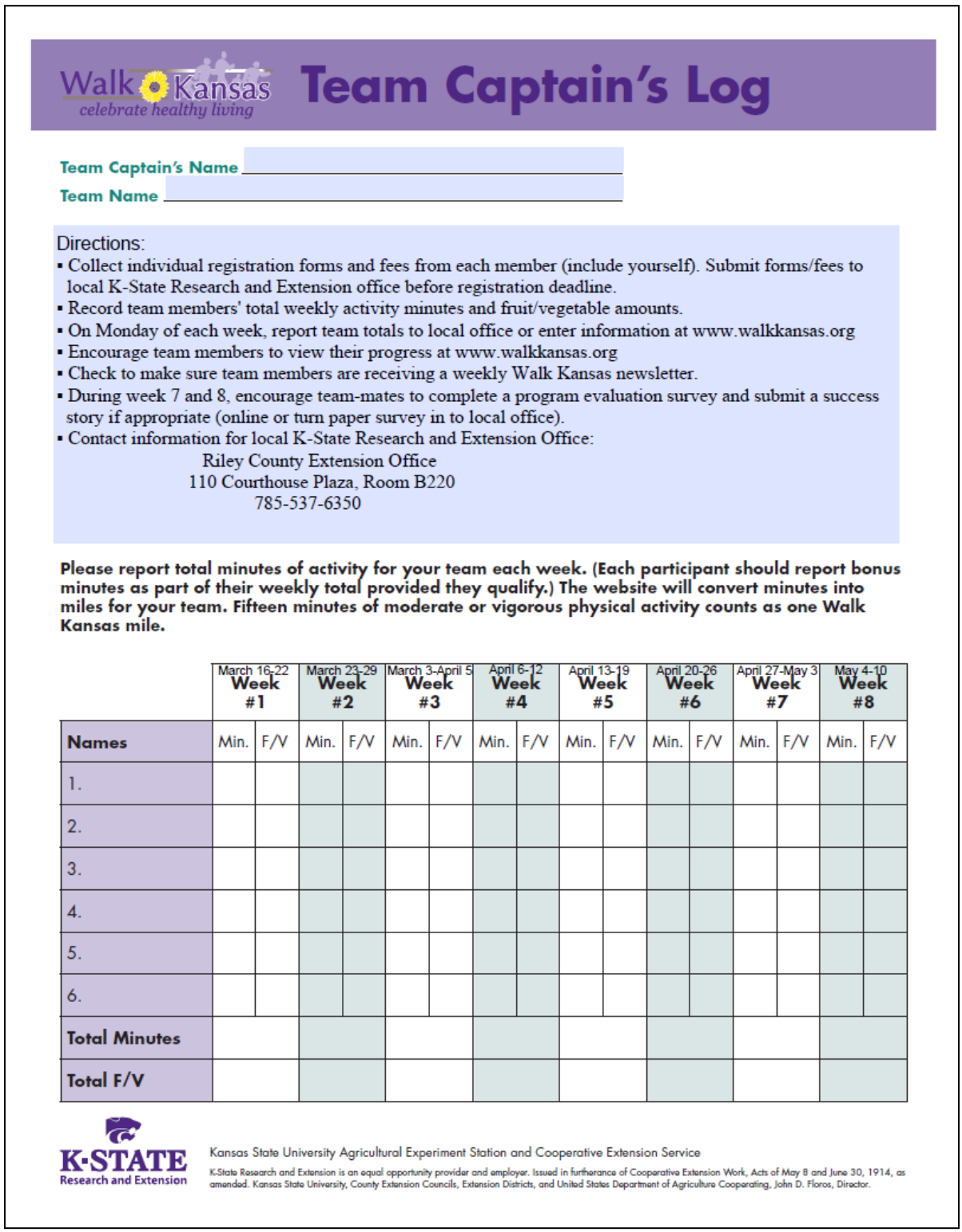
Figure 5.11 Team captain's log



Walk Kansas
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Team Captain's Log

Team Captain's Name _____

Team Name _____

Directions:

- Collect individual registration forms and fees from each member (include yourself). Submit forms/fees to local K-State Research and Extension office before registration deadline.
- Record team members' total weekly activity minutes and fruit/vegetable amounts.
- On Monday of each week, report team totals to local office or enter information at www.walkkansas.org
- Encourage team members to view their progress at www.walkkansas.org
- Check to make sure team members are receiving a weekly Walk Kansas newsletter.
- During week 7 and 8, encourage team-mates to complete a program evaluation survey and submit a success story if appropriate (online or turn paper survey in to local office).
- Contact information for local K-State Research and Extension Office:

Riley County Extension Office
110 Courthouse Plaza, Room B220
785-537-6350

Please report total minutes of activity for your team each week. (Each participant should report bonus minutes as part of their weekly total provided they qualify.) The website will convert minutes into miles for your team. Fifteen minutes of moderate or vigorous physical activity counts as one Walk Kansas mile.

	March 16-22 **Week #1**		March 23-29 **Week #2**		March 3-April 5 **Week #3**		April 6-12 **Week #4**		April 13-19 **Week #5**		April 20-26 **Week #6**		April 27-May 3 **Week #7**		May 4-10 **Week #8**	
Names	Min.	F/V	Min.	F/V	Min.	F/V	Min.	F/V	Min.	F/V	Min.	F/V	Min.	F/V	Min.	F/V
1.																
2.																
3.																
4.																
5.																
6.																
Total Minutes																
Total F/V																

K-STATE Research and Extension

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

K-State Research and Extension is an equal opportunity provider and employer. Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, as amended. Kansas State University, County Extension Councils, Extension Districts, and United States Department of Agriculture Cooperating, John D. Floros, Director.

Figure 5.12 Physical activity prescription form

Walk Kansas
celebrate healthy living

Riley County Extension
110 Courthouse Plaza
Room B220
Manhattan, KS 66502

(785) 537-6350
www.riley.ksu.edu

Important

How to use this information: This is a summary and does NOT have all possible information about this product.

Helpful information for using this medication

Walk Kansas:
www.walkkansas.org

Physical Activity Guidelines for Americans:
www.health.gov/paguidelines/

MyPlate" United States Department of Agriculture:
www.choosemyplate.gov/foodgroups/physicalactivity.html

You will also find the "SuperTracker" here, which can help you plan, analyze and track your diet and physical activity.
https://www.supertracker.usda.gov/default.aspx

K-STATE
Research and Extension

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Prescribed for Walk Kansas participants.
RX# WALKKANSAS2014

Product information

Drug: Walking

Generic name: Physical Activity; also known as the "wonder drug."

Dosage: Minimum 30 minutes a day, 5 days a week (total of 150 minutes a week.) Take at least 10 minutes at a time. It is safe to take during pregnancy and lactation, and in combination with most other medications.

Type: Something enjoyable that uses large muscle groups. Generic versions of this drug can include biking, swimming, dancing, team sports, jogging, aerobics, Zumba, team sports, gardening, strengthening exercises and more.

Administration: Administer alone or take in company with others.

Refills: Unlimited

Price: Little to nothing

Uses: This medication is used to prevent chronic disease and to extend life. It has been proven to help prevent and treat diabetes, high blood pressure, cardiovascular disease, breast and colon cancer, obesity, depression, anxiety, and osteoporosis. It also aids in achieving and maintaining a healthy weight, helps ease pain from chronic disease, and slows functional decline from aging. The impact of this drug is enhanced if taken with a healthful diet and adequate sleep.

How to use: Take this medicine on most days of the week. Take at least three 10-minute segments of physical activity per day at a moderate or vigorous intensity. (Moderate is when you can barely carry on a conversation. If you can sing, work harder.)

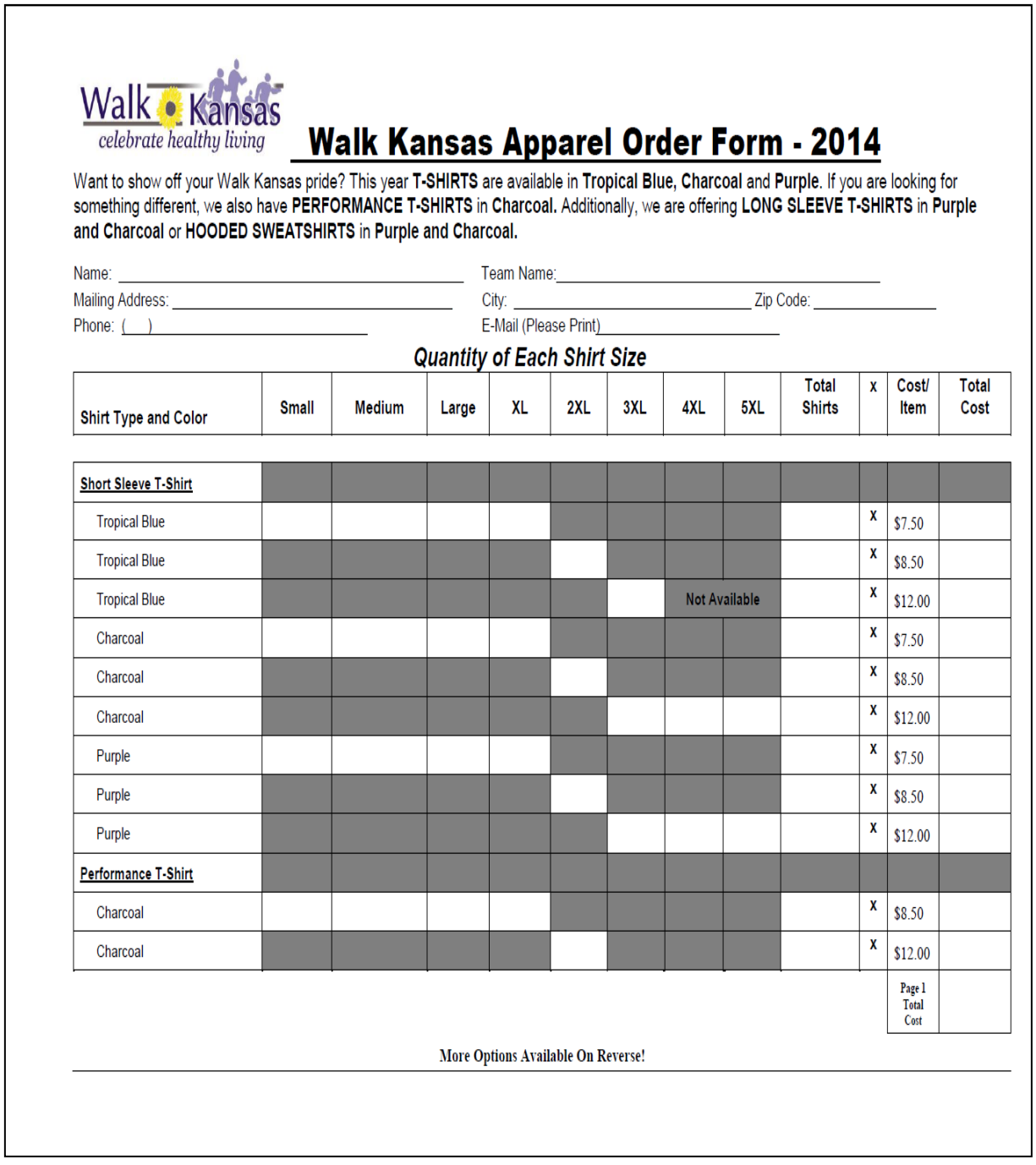
If walking, work toward a pace of 3 miles per hour or faster. Drink plenty of water while on this medication — staying hydrated is important. This medication works best if you break prolonged periods of sitting during your waking day. Stand or move every hour.

See your doctor before taking this medication if you: have chronic health problems such as heart disease or diabetes; have high blood pressure; have pains in your heart/chest area; have severe dizziness; have a bone or joint condition that might be made worse with new exercise activities; are over age 45 and not accustomed to vigorous exercise.

Side effects: Decreased blood pressure; stronger muscles; stronger bones; more energy; positive attitude; better sleep; more productive at work and home; improves ability to handle stress; lowers risk for suffering a heart attack or stroke; better posture; increased flexibility; healthy weight; improved fitness; sharper memory; better pain management; reduced anxiety; improved balance and coordination; improved self-esteem; more opportunities to socialize actively with friends and family.

Missed dose: Start taking again as soon as possible. Don't worry about a missed dose.

Figure 5.13 Apparel order form



Walk Kansas
celebrate healthy living

Walk Kansas Apparel Order Form - 2014

Want to show off your Walk Kansas pride? This year **T-SHIRTS** are available in **Tropical Blue, Charcoal** and **Purple**. If you are looking for something different, we also have **PERFORMANCE T-SHIRTS** in **Charcoal.** Additionally, we are offering **LONG SLEEVE T-SHIRTS** in **Purple and Charcoal** or **HOODED SWEATSHIRTS** in **Purple and Charcoal.**

Name: _____ Team Name: _____

Mailing Address: _____ City: _____ Zip Code: _____

Phone: (___) _____ E-Mail (Please Print) _____

Quantity of Each Shirt Size

Shirt Type and Color	Small	Medium	Large	XL	2XL	3XL	4XL	5XL	Total Shirts	x	Cost/ Item	Total Cost
Short Sleeve T-Shirt												
Tropical Blue										x	$7.50	
Tropical Blue										x	$8.50	
Tropical Blue							Not Available			x	$12.00	
Charcoal										x	$7.50	
Charcoal										x	$8.50	
Charcoal										x	$12.00	
Purple										x	$7.50	
Purple										x	$8.50	
Purple										x	$12.00	
Performance T-Shirt												
Charcoal										x	$8.50	
Charcoal										x	$12.00	
											Page 1 Total Cost	

More Options Available On Reverse!

Shirt Type and Color	Small	Medium	Large	XL	2XL	3XL	4XL	5XL	Total Shirts	x	Cost/ Item	Total Cost
Long Sleeve T-Shirt												
Purple										x	$10.00	
Purple							Not Available			x	$13.00	
Charcoal										x	$10.00	
Charcoal							Not Available			x	$13.00	
Hooded Sweatshirt												
Purple										x	$18.50	
Purple							Not Available			x	$21.50	
Charcoal										x	$18.50	
Charcoal							Not Available			x	$21.50	
										Page 2 Cost +		
										Page 1 Cost =		
										Total Amount Due		

Submit this completed form and **ONLY ONE PAYMENT METHOD (All cash or one team check or one credit card)** per team payable to:
Riley County Extension, 110 Courthouse Plaza Room B220, Manhattan, KS 66502
Questions? Call the extension office at 785-537-6350

For Office Use Only	Person Paying:	Check # or Cash:	Amt Pd.:	Date Pd.:

K-State Research & Extension is committed to making its services, activities and programs accessible to all participants. If you have special requirements due to physical, vision, or hearing disability, or a dietary restriction please contact Ginny Barnard at ginnyb@ksu.edu or call 785-537-6350.

Alignment with Public Health Core Competencies

Over the course of my field experience and thesis research, I was able to meet the core competencies of my public health education. The first core competency is biostatistics, and I was able to acquire a great deal of knowledge and experience relevant to this area through my research and time at the extension and research office. During the Walk Kansas program, we utilized a survey method at the conclusion of the program to collect information and compile the results for the group. I also analyzed the baseline demographic data and compiled the information to send to the state level department. My research in the nutrition and exercise field allowed for me to help design and test a question relevant to the area of public health, specifically sedentary behavior and potential compensatory behaviors in adults. My statistics knowledge increased exponentially as my mentors helped me understand appropriate use of measurements, data acquisition and the analysis of the data.

The second core competency is environmental health. In addition to the information that I acquired during my course work in the area, I was able to utilize this knowledge during my work with the gardening and nutrition education in the elementary schools. When we were preparing and harvesting our gardens, we talked about food safety and how to ensure that we cleaned and prepped our foods to minimize the risk of environmental hazards and adverse events.

Epidemiology is the third core competency, and I was given ample opportunities to increase my experience and understanding in this area. In order to do my background research for both my thesis and field experience, I spent a lot of time reading the epidemiological literature regarding these two areas. I was able to make inferences about the data and make assessments regarding the study quality, as well as its strengths and limitations. Since I was involved with the entirety of the data collection process with my thesis research, I gained experience in the appropriate informed consent process, as well as the maintenance and use of

epidemiological data. A significant portion of my thesis literature review was based upon the findings from large-scale epidemiology studies, and I used this information to help understand the importance of completing our study with an experimental design in order to see if changes were occurring on an individual or small group level.

The fourth core competency is health care administration, and this became a relevant topic during my time with the research and extension office. I was able to more fully understand the role that public health plays in the health of our country, and how healthcare and health services are also provided in community departments outside of a physician's office. Since we are all consumers of healthcare, it is important for public health professionals to understand the role that they play in promoting disease prevention and healthy lifestyles. I was certainly able to understand how the research and extension unit accomplishes this role in Riley County through their numerous community health education programs, as well as through programs like Walk Kansas.

The final core competency area is related to social and behavioral sciences. Successful completion of this competency requires that the ways in which behavioral factors impact the health of individuals and populations is understood. Throughout my field experience and in the research setting, this competency area played a significant role in my learning. In order for an individual to improve their health and decrease their risk of disease, it is imperative that they understand how their behaviors can positively or negatively affect their progress. A key role for my field experience was helping to give people opportunities and structure for successful behavior changes, either through a physical activity promotion program or through nutrition education. In order to be successful in this task, I had to refer back to my public health education and rely on the models and theories regarding behavior change and health interventions. For my

area of public health nutrition, I felt that this competency was where I gained the greatest deal of experience and understanding. Throughout the process, I learned that the goal of public health interventions and improvements in quality of life are incredibly complex. The best laid out programs can be meaningless if people don't have access to them or the desire to participate. As with each of the public health core competencies, understanding the facets that make up the social and behavioral sciences is key to being a successful public health professional and promoter.

Conclusion

The education and experience that I gained through the public health program at Kansas State University has absolutely changed the way that I view the world. It has instilled in me a passion to continue research and work to improve the lives of those who need it most. Although I felt that I understood the context of public health when I began the program two years ago, I now reflect back and realize that many of the things that I believed to be true were, in fact, very far from it. I feel that this program has given me the tools to be a better researcher, public health professional and educated citizen. I am incredibly grateful for those who mentored me, worked with me, and encouraged me along the way. While this may be the closing of one chapter in my public health experience, I am confident that I have just begun to help advance the goals and mission of our profession.

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Appendix A - Riley County Walk Kansas Survey Results

1. Consider your experience in Walk Kansas 2014 and answer the following questions. As a result of this program, I feel motivated to follow physical activity recommendations.

#	Answer	Bar	Response	%
1	Strongly agree		22	26%
2	Agree		47	56%
3	Neither agree or disagree		14	17%
4	Disagree		1	1%
5	Strongly disagree		0	0%
	Total		84	

Statistic	Value
Min Value	1
Max Value	4
Mean	1.93
Variance	0.48
Standard Deviation	0.69
Total Responses	84

2. During the 8 weeks of Walk Kansas, I reached the minimum goal for physical activity – 150 minutes of moderate/vigorous activity per week.

#	Answer	Bar	Response	%
1	Yes		72	86%
2	No		12	14%
	Total		84	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.14
Variance	0.12
Standard Deviation	0.35
Total Responses	84

3. If you answered "yes" to the previous question, please indicate how confident you are in your ability to continue this amount of physical activity over the next 6 months.

#	Answer	Bar	Response	%
1	Completely confident		33	46%
2	Confident		30	42%
3	More often than not		8	11%
4	Somewhat confident		1	1%
5	Not confident		0	0%
	Total		72	

Statistic	Value
Min Value	1
Max Value	4
Mean	1.68
Variance	0.53
Standard Deviation	0.73
Total Responses	72

4. As a result of this program, I understand the need to break prolonged sitting and move several minutes every hour during the day.

#	Answer	Bar	Response	%
1	Strongly Agree		42	50%
2	Agree		35	42%
3	Neither Agree nor Disagree		5	6%
4	Disagree		2	2%
5	Strongly Disagree		0	0%
	Total		84	

Statistic	Value
Min Value	1
Max Value	4
Mean	1.61
Variance	0.51
Standard Deviation	0.71
Total Responses	84

5. As a result of this program, I learned that I should do strengthening exercises twice a week.

#	Answer	Bar	Response	%
1	Strongly agree		20	24%
2	Agree		34	41%
3	Neither agree or disagree		18	22%
4	Disagree		9	11%
5	Strongly disagree		1	1%
	Total		82	

Statistic	Value
Min Value	1
Max Value	5
Mean	2.23
Variance	0.97
Standard Deviation	0.99
Total Responses	82

6. As a result of this program I am more aware of healthy eating recommendations.

#	Answer	Bar	Response	%
1	Strongly agree		21	25%
2	Agree		43	52%
3	Neither Agree nor Disagree		15	18%
4	Disagree		3	4%
5	Strongly Disagree		1	1%
	Total		83	

Statistic	Value
Min Value	1
Max Value	5
Mean	2.04
Variance	0.69
Standard Deviation	0.83
Total Responses	83

7. During the 8 weeks of Walk Kansas I ate more fruits and/or vegetables.

#	Answer	Bar	Response	%
1	Yes		60	72%
2	No		23	28%
	Total		83	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.28
Variance	0.20
Standard Deviation	0.45
Total Responses	83

8. If you answered yes to the previous question, indicate how confident you are that you will continue to eat this amount of fruits and/or vegetables over the next 6 months.

#	Answer	Bar	Response	%
1	Strongly agree		29	47%
2	Agree		25	40%
3	Neither Agree nor Disagree		6	10%
4	Disagree		2	3%
5	Strongly Disagree		0	0%
	Total		62	

Statistic	Value
Min Value	1
Max Value	4
Mean	1.69
Variance	0.61
Standard Deviation	0.78
Total Responses	62

9. As a result of this program I have adopted healthier lifestyle habits.

#	Answer	Bar	Response	%
1	Yes		64	79%
2	No		17	21%
	Total		81	

Statistic	Value
Min Value	1
Max Value	2
Mean	1.21
Variance	0.17
Standard Deviation	0.41
Total Responses	81

10. If you experienced any physical or mental changes as a result of this program, check all that apply.

#	Answer	Bar	Response	%
1	Increased energy		39	59%
2	Increased endurance		23	35%
3	Increased muscle strength		24	36%
4	Increased flexibility		14	21%
5	Lower blood pressure		11	17%
6	Lower cholesterol		7	11%
7	Better attitude		41	62%
8	Better able to manage stress		15	23%
9	Improved sleep		22	33%
10	Decreased weight		18	27%

Statistic	Value
Min Value	1
Max Value	10
Total Responses	66

12. Please identify the primary make-up of your team.

#	Answer	Bar	Response	%
1	Workplace		50	64%
2	Friends/family		26	33%
3	Neighbors		1	1%
4	Church or community group		1	1%
	Total		78	

Statistic	Value
Min Value	1
Max Value	4
Mean	1.40
Variance	0.35
Standard Deviation	0.59
Total Responses	78

15. Your age category -- please check one.

#	Answer	Bar	Response	%
1	17 and under		0	0%
2	18-34		18	22%
3	35-54		28	34%
4	55-74		31	37%
5	75 and over		6	7%
	Total		83	

Statistic	Value
Min Value	2
Max Value	5
Mean	3.30
Variance	0.80
Standard Deviation	0.89
Total Responses	83