Characteristics of Participants Willing to Enroll in a Workplace Based Shared Treadmill Workstation Study

by

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A Thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfillment of the requirements of the degree of

MASTER OF SCIENCE

Faculty of Kinesiology and Recreation Management

University of Manitoba

Winnipeg

ABSTRACT

Workplace sedentary behavior has been associated with many chronic diseases. A nine-month study has been initiated to determine participation and benefits of shared treadmill workstations. It would be an advantage to understand factors that would increase the use of these types of workplace interventions aimed at reducing sedentary behavior. To address some of these factors, characteristics of nineteen office workers willing to participate in this study were investigated. Baseline anthropometric measurements were taken. Participants provided seven-day exercise and sleep logs and three-day dietary records. Accelerometers were given to measure energy expenditure, step counts and activity durations. Participants also completed the questionnaires assessing their expectations and perceptions of a workplace intervention. The willing participants were generally overweight and sedentary middle aged individuals with below average daily energy expenditures and they had low fatigue and pain levels, poor sleep quality ratings, and wanted to reduce their sedentary behavior to achieve health benefits.

ACKNOWLEDGMENTS

I would like to extend my sincere gratitude towards my advisor, Dr. Gordon Giesbrecht, without whose precious time, advise and knowledge, this thesis would not have been possible. He has been a constant source of motivation to me.

I am also very grateful to my co-advisor, Dr. Danielle Bouchard, for keeping faith in me and providing me an opportunity to work on such an interesting topic.

I would also like to thank my external committee members Leslie Johnson and Dr. Fiona Moola, for their valuable suggestions.

Sincere thanks to the staff and employees of the Provincial Health Contact Center, for their kind co-operation throughout this study.

I thank Dr. Strachan, Dr. McMillan and Dr. Myrie for providing much appreciated suggestions.

I would also like to thank Faculty of Kinesiology and Recreation Management, Faculty of Graduate Studies for the financial support through research assistantship, teaching assistantship and GETS funding.

DEDICATION

This thesis is entirely dedicated to my wonderful husband, who has been a constant source of inspiration throughout my graduate studies. I would like to extend my deepest expression of love and appreciation for the encouragement he provided.

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CHAPTER 1

INTRODUCTION

Many exercise scientists and scholars have linked sedentary behaviour with impaired health and reduced longevity. Some of the chronic conditions associated with a sedentary lifestyle include obesity,[1-3] type 2 diabetes,[3-6] and cardiovascular mortality.[4] Pate et al. (2008) suggested that sedentary behaviour is comprised of tasks that do not increase the energy costs above resting levels and refers to activities in which the energy expenditure is equivalent to 1.0-1.5 METs (Metabolic Equivalent Units).[7] According to the Canadian Health Measures Survey, performed by Statistics Canada, Canadian adults spend 9.5 hours each day in sedentary activities.[8] Similarly, children and youth spend 8.6 hours engaged in sedentary activities.[9] Tudor-Locke et al. (2011) mentioned that Americans employed in sedentary jobs spend approximately half of their day being sedentary.[10]

In a systematic review by Proper et al. (2011) focussing on the association between sedentary behaviour and health outcomes, moderate evidence was found for a positive relationship between sedentary behaviour and type 2 diabetes, whereas there was a strong evidence for a sedentary lifestyle being directly related to cardiovascular diseases and all-cause mortality.[4] According to the Canadian Physical Activity Guidelines, 150 minutes of moderate to vigorous physical activity per week is required to increase or at least maintain health benefits associated with an active life. Although, according to a study by Katzmarzyk et al. (2009), regardless of leisure time physical activity, a direct relationship was observed between sedentary sitting time and all-cause mortality.[11] More specifically, Patel et al. (2010) found that a combination of more than

six hours of sitting and less than 24.5 MET hours of physical activity per week led to approximately 94% increase in all-cause death rates in women.[12] The rate was found to be lower (48%) in men.

Over the last decades, the urban population has shifted from the agricultural industry to the service industry.[13] With advanced technologies, workplaces have begun to focus on improving ergonomics and workplace safety measures. Church et al. (2011) have shown that in the last few decades, jobs requiring moderate amounts of physical activity in the workplace have reduced from 50% to 20%. This decreases the level of employee energy expenditure by approximately 100 kcal per day.[13] This change has contributed to a more sedentary and less active workplace. In a study by Tudor-Locke et al. (2011), it was concluded that the population working in sedentary jobs spend approximately 11 hours per day being inactive. In addition, employees feel like they have no time to achieve the required level of physical activity to maintain or improve health outcomes.[10] As per these findings, it is important to incorporate physical activity into the sedentary lifestyle of such workers. Given the length of time that employees spend at work, workplaces can be an ideal location to reduce the negative impacts of sedentary lifestyle and to target the risk factors that are associated with chronic conditions.

Some workstation strategies have been proposed to increase energy expenditure at work and therefore reduce sedentary time. A workstation is defined as an area where a workplace employee usually works and it often accommodates a computer terminal or other electronic equipment.[14] The strategies include a stepping device,[15] cycling workstations,[16] and treadmill workstations.[17] In 2007, Levine and Miller

proposed the concept of a walking workstation in which the office worker could walk on a treadmill while working. The idea behind this concept was for the worker to increase energy expenditure by 100 kcal per hour when compared to working at a sitting workstation.[18] According to this study, if sitting is replaced by walking on the treadmill for two to three hours at the speed of around 1.1 mph, it results in a significant weight loss in obese and overweight workers. Mean usage time per day was approximately two hours after three months of usage. On the other hand, an office stepping device proposed in a study by McAlpine et al. (2007) led to a significant increase in the energy expenditure by 289 ± 102 kcal per hour.[15] John et al. (2011) determined the effects of these workstations on anthropometric and other metabolic variables apart from sedentary levels.[17] They stated that the workstations led to reduction in waist circumference, resting heart rate, triglycerides and hemoglobin A1c after nine months.

Concerns arise regarding the effects of these workstations on work productivity or if these workstations affect the performance in terms of mouse or keyboard usage or other tasks requiring concentration. There are at least two studies[16, 19] that have explored the impact of treadmill workstation use on mouse and keyboard performance. They found a small but significant negative effect on performance specially typing speed and mouse usage. However, no study has yet addressed the long term adaptation to working on a treadmill as the participants were using the treadmill workstations for the first time in the study.[19] Thus, it is still to be determined if productivity increases or is maintained over the long term. Moreover, the potential positive impacts that treadmill workstations can have on, for example, stress and health, could outnumber the reductions in work performance.

Despite being an effective strategy to reduce sedentary behaviour and potentially create health benefits, difficulties are encountered with cost and the amount of space required if an individual treadmill workstation is provided to each employee at a workplace. Each treadmill workstation costs approximately $2000 and occupies a lot of space. It might not be possible for an employer to provide one of these for every employee. Moreover, when individuals use a personal treadmill workstation in the office, they use it for an average of less than two hours per day.[18] It is possible that the potential benefits of the treadmill workstations could be maximized by sharing these stations.

In addition to understanding the effectiveness of the intervention trials (such as shared treadmill workstations in the present study) on the sedentary lifestyles of these office workers, it is also important to study and understand the characteristics (physical/physiological, behavioural and perceptual) of the participants and how these shared treadmill workstations would have an effect on the health and workplace satisfaction of employees willing to participate in such an intervention. To the best of our knowledge, no study has characterised such a population, investigating their health indicators, perspectives and expectations from these shared walking workstations and explored whether they think that this novel way to work will influence their health and workplace performance and satisfaction. The connection between the physical/physiological attributes as well as the level of present physical activity of the employees and their intentions and interests has not been explored.

PURPOSE

This study investigated the characteristics (physical/physiological and behavioral) of the employees at a telephone contact center willing to participate in a shared treadmill workstation study aimed at reducing their sedentary behavior at work.

This thesis analyzed the expectations and interests of the participating employees related to using the shared treadmill workstations. The present study also investigated the perspectives of the participating employees about the anticipated effects of this novel strategy on their health, productivity, and workplace satisfaction.

HYPOTHESES

We hypothesized that the participants willing to use shared treadmill workstations would have one of two motives. They would be individuals who recognize themselves as unfit and want to add physical activity into their lifestyle to improve their well-being, or consider themselves healthy and active and want to participate in increased activity at work that will help them maintain their physical activity levels.

We also hypothesized that the workers who were willing to participate in the treadmill study would be confident in their ability to work effectively and efficiently on a treadmill workstation (e.g., typing and walking at the same time). It was likely that these participants would perceive this novel strategy as having a positive influence on their health and workplace satisfaction.

CHAPTER 2

REVIEW OF LITERATURE

SEDENTARY BEHAVIOR

Pate et al. (2008) defined sedentary behavior as those behaviors that have minimal energy costs.[7] Activities such as sitting, watching television or playing video games are some of the examples of sedentary activities. Sedentary behaviors are often justified by the performance of 150 minutes of moderate to vigorous physical activity per week. However, sedentary refers to activities in which the energy expenditure is equivalent to 1.0 to 1.5 METs (Metabolic Equivalent Units). Pate et al. (2008) in their study presented with two persons with very different activity patterns during a typical day.[7] The first participant was engaged more in light intensity activities, whereas the second participant met the current physical activity recommendations of 150 minutes of moderate to vigorous physical activity per week. Surprisingly, when the energy expenditure for a 13 hour period was calculated for these two subjects, it revealed that the participant who did not meet the physical activity guidelines and did more of light intensity activities, was actually expending more energy (26.3 MET-hours) as compared to the one actually meeting the guidelines (23.6 MET-hours).

After analyzing the data from 30,758 respondents, Tudor-Locke et al. (2011) concluded that sleep (32%) and work (31%) occupy most of the day in a large segment of the population, and apart from working, most of the time is spent in sedentary activities (17%) and light intensity activities (16%), and moderate to vigorous activities account for a very short proportion (approximately 2%).[10]

SEDENTARY BEHAVIOR AND CHRONIC DISEASES

According to the 2007-2009 Canadian Health Measures Survey, prevalence of chronic diseases such as obesity and type 2 diabetes has been on a growing trend in Canadian population.[20] The prevalence of obesity among adults was 24.3% (2007-2009).[20] Public Health Agency of Canada estimated that in 2008-2009, almost 2.4 million Canadians were suffering from type 2 diabetes in addition to about 20% of blood samples that were found to be undiagnosed.[21] Also, it was seen that the prevalence was more among the working population between 25 and 64 years of age.

Many studies in the past have correlated sedentary lifestyle with the risk of chronic diseases like obesity, type 2 diabetes and cardiovascular disorders.[1-6] In a study by Hu (2001), television viewing was positively correlated with the risk factors of these chronic diseases.[22] The risk of having type 2 diabetes was also increased when related with the duration of sedentary activities in another study from Hu (2003).[3] Similarly, Stephens et al. (2011) concluded that insulin action significantly reduces during inactivity.[6] According to them, if some efforts are applied to reduce daily sitting among the population, this may affect the metabolic disease risks.[6]

Two studies highlighted the role of dietary factors in the insulin action in the body.[23, 24] According to Patti (1999), fatty acids and amino acids inhibit early signaling of insulin and may act as a precipitating factor for type 2 diabetes. Both prolonged sitting and dietary factors might be responsible for the reductions in insulin actions due to inactivity.[23] It is known that insulin signaling pathways are affected when the amount of fatty acids, glucose or amino acids in body fluids are in abundance, which might explain such reductions.

In a systematic review by Proper et al. (2011), studies have confirmed the association of sedentary behavior and type 2 diabetes, cardio vascular disease (CVD) mortality and all-cause mortality.[4] Little evidence was found however, relating it to Body Mass Index (BMI) changes, cancer and CVD risk factors. The effects of sedentary lifestyle on the lipoprotein lipase activity have also gained attention in the recent past. In a study by Ekblom-Bak et al. (2010), using animal models to verify the impact of sedentarity on chronic diseases, the activity of lipoprotein lipase was reduced by 90% in rats after the periods of restricted muscular activity when compared with the rats doing light intensity activities like standing and moving.[25] Lipoprotein lipase is required for the breakdown of fat and its uptake by the working muscles. Reduction in lipoprotein lipase activity resulted in lower uptake of fat and hence, increasing the circulating levels leading to more body fat accumulation and clogging of arteries, and hence, increasing the risk of obesity and cardiovascular diseases.

SEDENTARY BEHAVIOR AT WORKPLACE

Office based sedentary behavior has been a matter of growing interest in the past century. According to Finkelstein et al. (2005), the trends of more prevalent sedentary jobs became more evident by the late 1970s.[26] Much of the Canadian population spends at least half of their weekday time in sitting jobs.[27] According to a systematic review by Van Uffelen et al. (2010), relating workplace sitting and health outcomes, many studies showed a positive relation between workplace sitting and an elevated risk of a high BMI, diabetes, cardiovascular diseases and cancer.[28] These authors concluded that there is insufficient evidence regarding such health risks of occupational sitting and mentioned that this area needs more research.

In past literature, obesity associated with workplace sitting has been studied on a large scale. Park (2009) mentioned that both workplace sedentary behavior and poor dietary intakes contribute to increasing BMI, leading to poor health results.[2] Finkelstein et al. (2010) showed that higher BMI affected medical costs, productivity and absenteeism negatively in a workplace.[29] They mentioned that the average costs that obese full-time working population accounted for was approximately $73.1 billion in the U.S.! According to Ostbye (2007), injuries and illnesses were more prevalent with increasing BMI at workplaces resulting in higher workers' compensation claims.[30] Also, employees with type 2 diabetes were found to be absent four times more from work as compared to the general population.[31]

STRATEGIES TO REDUCE WORKPLACE SITTING

It is important to reduce workplace sitting time even if the employee reaches the recommended activity levels of 150 minutes of moderate to vigorous physical activity per week. Sedentary workers need to have some strategies to reduce the workplace sitting without affecting their work performance. Many strategies such as climbing stairs in stairwells, distant printers, regular breaks during sitting, and walking meetings could not be implemented as those were considered to affect the productivity of the employees.[32] Mc Alpine et al. (2007) devised a workplace stepping device which was an easily movable mini-stepper equipped with an accelerometer that could be easily stored under the office desk.[15] It could be used when answering a telephone call or while reading a paper. It led to a considerable increase in the energy expenditure in both obese and lean office workers. When comparing the lean and obese office workers, they found the energy expenditure to be more in the latter. According to Mc Alpine et al. (2007) using

the stepping device for two hours every day could lead to a weight reduction of 20 kg per year if all other energy uptake and expenditure is kept constant.[15] However, another strategy of using walking workstations has been tested by a few researchers in terms of the effects on mouse and keyboard performance, which may be considered a more reliable way to work.

Treadmill Workstations

Levine and Miller (2007) studied the energy costs of working while walking at self-selected speed.[18] They measured the energy expenditure when at rest, sitting, standing, and treadmill walking in 15 sedentary obese office workers. The energy expenditure was found to be more (191 ± 29 kcal/hour) when walking at a velocity of 1.1 ± 0.4 mph, compared to being seated in an office chair (72 ± 10 kcal/hour). According to the authors, if the workstation was used for half the working hours, the employees could have an expenditure of 500 kcal per day and thus, reduce body weight by two to four pounds per month if working five times per week.

John et al. (2011), in their study using treadmill workstations with overweight and obese office workers, showed the effects not only on the energy expenditure, but also on metabolic variables.[17] They studied twelve University staff members between the age of 20 and 65 years with BMI above 28 $kg.m^{-2}$ for nine months and observed significant decreases in waist and hip circumference, low density lipoprotein and total cholesterol levels and hemoglobin A1c percent with their dietary intake remaining constant. Body weight, BMI, mean percent body fat and truncal fat mass were also reduced by the end of the study, but these changes did not meet statistical significance. After nine months, 99%

of the participants wanted to keep the workstation in their office, which the researchers speculated to be an indication of long term adherence.

Few studies have examined the effects of such physical activity on other workplace variables such as absenteeism, job satisfaction, stress or social impacts after long term exposure. Conn et al. (2009) in their meta-analysis on workplace physical activity interventions found that the subjects who underwent physical activity interventions had better workplace attendance and job satisfaction than the control subjects.[33] Job stress was also found to be reduced in the intervention subjects. Proper et al. (2002) in their review on the effectiveness of workplace physical activity interventions also mentioned that there can be a positive influence on absenteeism and job satisfaction though the results were inconclusive.[34]

One of the main concerns of these strategies to reduce sitting time is the potential effect these might have on the work performance. A study based on the concept of walking and cycling computer workstations was done by Straker et al. (2009).[16] They studied the effects on the computer performance of the employees when simultaneously walking or cycling. They concluded that standing performance was not much different than sitting performance in terms of computer usage and that mouse tasks were a little more affected than typing tasks. John et al. (2009) worked on the similar aspects of the effects of treadmill workstations on work tasks such as math problem solving, mouse usage and typing performance and found the effects to be minor (6-11%), which, they speculated could be reduced with acclimation.[19] They also mentioned that the benefits of treadmill workstation with regards to health could outweigh the minor reductions in the performance. Alderman et al. in 2013 compared the walking and sitting workstations in

terms of cognitive performance and found that the speed or accuracy of the tasks were not impaired during walking activities. They concluded their study by encouraging the use of treadmill desks in offices and classrooms to reduce sitting times.[35] Another study by Funk et al. (2012) studied the effects of treadmill walking speeds (1.3, 2.25 and 3.2 km/hr) on typing performance. Interestingly, the typing performance (at the speed of 2.25 km/hr) was not different than when doing the same tasks in a seated position. This indicated that the treadmill desks can be used to a maximum of 2.25 km/hr without compromising typing performance.[36]

IMPLEMENTATION

Research is still needed before implementing these strategies to the workplace as these strategies are costly and require large storage space. Treadmill workstations might be an attainable option to reduce the burden of chronic diseases due to sedentary lifestyle. Though, having an individual workstation for each employee at the workplace might be challenging due to the financial burden for the employers. A more cost effective way to help counteract that burden can be by introducing a novel concept of sharing treadmills. If a workstation is shared among employees with each employee walking and working for two hours per shift, that might help reduce the problems of excessive cost and space issues.

PARTICIPANT CHARACTERISTICS

Waters et al. (2011) studied the characteristics of participants by reviewing physical activity intervention trials from 1996 to 2006.[37] These included physical activity intervention studies performed in workplace as well as healthcare facilities, home and communities. The participant population in his studies included employees, patients and

members of the general public. They concluded that the majority of the population that participates in these trials are Caucasian middle-aged sedentary females. Specifically, they mentioned that the participating population was comparatively younger in those intervention settings where recruitment occurred through workplace and older where community-based adults were recruited. Another study by Chan et al. (2004), evaluating the health benefits of a physical activity intervention in sedentary workers presented with the participants' mean pre-intervention daily step count as 7,029.[38] The sleep characteristics of the participants were also of interest among previous physical activity intervention trials. It is known that shift work affects the sleep quality of the employees.[39] Atlantis et al. (2006) studied the effects of a physical activity worksite intervention trial on the sleep quality of the employees. They described that more than half of the participants interested to participate were poor sleepers.[40]

The majority of the previous literature has only evaluated the effectiveness of the interventions. None of the studies has independently investigated the physical, physiological, perceptual and behavioral characteristics and beliefs of the participants interested in a worksite physical activity intervention trial. We believe that this is of value because the results can guide future studies to focus on the specific interests and expectations of the participating population. This study aimed to evaluate the characteristics of the employees interested in participating in a shared treadmill workstation study.

CHAPTER 3

METHODS

The study was conducted at Provincial Health Contact Centre (PHCC) in Winnipeg. Employees at PHCC sit all day at their workstations and answer health care calls. Most of them are nurses, dieticians, or social workers. An e-mail was sent to all employees asking them if they want to participate in a shared treadmill workstation study aimed at reducing their sedentary behaviour at work. The interested employees were recruited in the study if they met the inclusion criteria. The participants were eligible if they were working for a minimum of three shifts per week (including at least 20 hours) at the contact centre, and were able to walk one hour continuously. All study participants provided written informed consent and the study was approved by the Education/Nursing Research Ethics Board at the University of Manitoba (APPENDIX A) and the Ethics Board of Misericordia Hospital.

All participants were instructed to arrive at the workplace 60 minutes prior to the scheduled shift or remain after their shift for data collection and instructions. Anthropometric variables such as height, weight, hip circumference and waist circumference, and blood pressure and resting heart rate were measured. In addition, the participants were instructed to fill out the self-report questionnaires assessing their pain (APPENDIX B) and fatigue levels (APPENDIX C), sleep quality (APPENDIX D) and their overall view of a healthy workplace and job satisfaction including questions relating to the interest of the participants in this novel intervention and any barriers associated with it, (APPENDIX E). The questionnaires also assessed the confidence levels of the participants to use the shared treadmill workstations (APPENDIX F).

Finally, self-reported records of physical activity (APPENDIX G), sleep (APPENDIX H), and diet were collected for one week. Total physical activity levels of the participants were measured by accelerometers. Participants were instructed to wear an accelerometer for seven consecutive days on their waist for all waking hours. These accelerometers have been validated to measure sedentary time as well as moderate to vigorous intensity activities.[41] Dietary intake (proportion of proteins, lipids and carbohydrates) and caloric intake were assessed with the help of a self-report dietary log (APPENDIX I) completed by the participants for three days of the week with one weekend day.[42] The participants were instructed to enter the description and amount of the food or beverage they took throughout the day for all three days. A sleep log was provided to all the participants to report total sleep duration for each of the seven consecutive days of the week. Accelerometers, dietary records as well as the exercise and sleep logs were collected from the participants after a week's time.

DATA ANALYSIS

Normality of data was tested by the Shapiro-Wilk test to determine if parametric or non-parametric analyses were to be done.

The anthropometric variables including height (cm), weight (kg), hip and waist circumference (cm) as well as the heart rate (beats per minute) and blood pressure (mmHg) were measured, and body mass index (kg/m^2) was calculated. Chi squared test was applied on the proportion of participating male and female workers.

The fatigue and pain levels on the Visual Analogue Scales (VAS) were determined by measuring the positioning of the "X" on the scales (cm; where, 0 = minimal values). As the length of the line on the VAS scales was 9.5 cm, an equivalent

percentage was calculated to estimate the pain and fatigue scores out of 10 cm. All these parameters were presented as individual values as well as group means ± SD. Individual pain and fatigue values were divided into before-shift or after-shift responses, based on if the participant responded before or after their respective shifts. Unpaired t-test was applied to the before- and after-shift pain as well as fatigue values.

The three-day dietary intake for each participant was analyzed with the help of Food Processor software (ESHA Research, Salem, OR, USA) for each participant. The daily mean of food intake was presented as total caloric intake (kcal) and the proportional contributions of fat, protein, and carbohydrate. Group means were also presented. The mean daily caloric intake for each participant was correlated with the individual Body Mass Index by using Pearson correlation test.

The Pittsburgh Sleep Quality Index (PSQI) was analyzed as follows: clock times and duration times were assigned to corresponding two-hour intervals, for the remaining questions subjects responded by choosing a category. All data was then presented in frequency tables. A global score was calculated based on the responses of the participants in the PSQI.[43] The participants with a global score of more than five were rated as individuals with poor sleep quality.[43]

Two questionnaires named Treadmill and Intervention Interest Questionnaire (APPENDIX E), and Intentions and Expectations Questionnaire (APPENDIX F) were developed by team of researchers working on this project to collect information of what is expected and motivates people to be involved in such projects. The raw data from the self-report questionnaires were transcribed. For the Treadmill and Intervention Interest

Questionnaire, the written responses of the participants were divided into separate answers, if applicable. For example, if a participant mentioned ventilation, more ergonomic workstations and gym facilities as response to "What are the essential features of a healthy workplace?", the response was divided into three separate answers to be assigned to the categories of workplace environment, ergonomics and physical activity at the workplace. The categories were established according to the responses of the participants and the sub-categories were created according to the separate answers in each response. Each answer was then assigned to the respective category and sub-category. The answers pertaining to the same context were assigned to the same sub-categories. Frequency tables were then established for each question. For the Intention and Expectation Questionnaire, frequency tables were created according to the responses ranging from 0% to 100%.

The accelerometry data was analyzed with the help of Actical® software (Koninklijke Philips Electronics, Version 3.0). Number of steps, as well as energy expenditure (kcal) and time (min) spent in sedentary, light, moderate and vigorous activities were determined for each participant. The accelerometers used activity count cut-offs of less than 100, 100 to 1534, 1535 to 3961 and more than 3961 for sedentary, light, moderate and vigorous activities respectively.[8] Individual and group daily mean were calculated. The responses by the participants in the exercise and sleep logs were also transcribed. Exercise was quantified based on the individual activity type and duration reported by the participants. MET-hours were estimated on the basis of the METs expended in each activity over the duration of the activity.[44] These data in MET-hours were used to estimate the daily energy expenditure in kcal (assuming a mixed diet

and a respiratory quotient of 0.83) The estimated energy expenditures were then compared to actual measured values from accelerometry to determine the validity of individual activity self-reports. The mean daily energy expenditure measured by self-reported exercise logs and accelerometry were correlated by Pearson correlation test. Also, the daily energy expenditure measured by accelerometry was correlated with the individual BMI of each participant by the same test. Sleep duration was presented as a daily mean for each individual and a group mean was calculated.

In the following chapters, the findings are presented, analyzed, and discussed.

CHAPTER 4

RESULTS

ANTHROPOMETRY

Nineteen participants (15 female, 4 male) with mean ± SD age 50.5 ± 10.7 years entered the study. Chi squared analysis indicated that the proportion of participating male and female population was not different than the proportion of eligible male and female population at the workplace ($\chi^2 = 2.06$).

Individual and mean (median for weight) data for anthropometry are presented in Table 1 (sorted by gender and age). The distribution of normal, overweight and obese female participants in the 18-39 year ($\chi^2 = 1.60$), 40-59 year ($\chi^2 = 1.99$) and 60-79 year ($\chi^2 = 4.61$) age groups were not different than the general Canadian population.[42] Twelve out of fifteen female participants had waist circumferences ≥ 88cm and one out of four men had waist circumference ≥ 102 and hence, were at increased risk for developing health problems such as type 2 diabetes, coronary heart disease and hypertension.[45]

The overall mean ± SD BMI of the participants was 29.9 ± 6.5. None of them were underweight, while, more than 75% of the total participants were overweight or obese based on BMI cut-offs. Chi squared analysis could not be done for men because there were only two men in each category.

Table 1. Anthropometry Information

Age group (yrs)	Age (yrs)	Gender	Mass (kg)	Height (m)	WC (cm)	HC (cm)	BMI (kg/m^2)
18-39	36	F	117.0	1.70	124.5	118.5	40.5
	38	F	68.5	1.69	93.4	101.6	24.0
Mean or Median	37		92.8	1.70	109.0	110.1	32.3
SD or 25-75th	1		34.0	0.00	22.0	12.0	11.7
40-59	55	F	101.4	1.66	119.5	128.0	36.8
	41	F	79.7	1.61	103.0	113.3	30.8
	43	F	55.9	1.63	78.8	94.0	21.0
	49	F	68.6	1.67	93.8	104.3	24.6
	59	F	73.0	1.69	107.3	104.8	25.6
	47	F	70.6	1.63	104.4	108.9	26.6
	53	F	123.6	1.68	138.1	153.7	45.5
	50	F	89.8	1.60	109.5	117.0	33.9
Mean or Median	49.6		764	1.60	106.8	115.5	30.6
SD or 25-75th	6.0		70.1;92.7	0.00	17.4	18.4	7.9
60-79	64	F	71.6	1.56	98.0	108.8	29.4
	62	F	82.6	1.67	97.5	109.8	29.6
	69	F	64.6	1.55	85.3	146.1	26.9
	61	F	71.7	1.65	84.5	102.0	26.3
	64	F	82.9	1.53	105.0	119.5	35.4
Mean or Median	64.0		71.7	1.59	94.1	117.2	29.5
SD or 25-75th	3.1		71.6; 82.6	0.10	8.9	17.3	3.6
Mean or Median	53	F	73	1.63	102.8	115.4	30.5
SD or 25-75th	10		69.6; 86.3	0.1	15.8	16.4	6.8
18 – 59	39	M	76.4	1.74	99.5	103.0	25.2
	27	M	75.8	1.88	83.8	101.0	21.5
	54	M	116.1	1.82	115.0	114.5	35.1
	59	M	69.1	1.54	88.8	110.0	29.1
Mean or Median	45	M	76.1	1.75	96.8	107.1	27.7
SD or 25-75th	15		74.1; 86.3	0.1	13.8	6.3	5.8

WC, Waist Circumference; HC, Hip Circumference; SD Standard Deviation; F Females; M Males

PAIN AND FATIGUE VISUAL ANALOGUE SCALES (VAS)

The mean ± SD fatigue levels and median (25^{th}; 75^{th} percentile) pain levels were 3.05 ± 2.6 and 0 (0, 2.08) respectively. Nine participants were tested before their regular shifts and 10 participants were tested after for both pain and fatigue levels. There were no significant differences between pre- and post-shift responses for either pain or fatigue. The mean ± SD fatigue and median (25^{th}; 75^{th} percentile) pain levels of nine participants who responded before shift were 2.44 ± 2.3 and 0 (0, 0.8) respectively. However, the fatigue and pain levels after shift (10 participants) were 3.62 ± 2.8 and 0 (0; 2.5) respectively.

THREE-DAY DIETARY INTAKE

The median (25^{th}; 75^{th} percentile) for daily caloric intake for eighteen participants (one participant did not return the questionnaires) was 1863.5 (1552; 2235) kcals (Table 2) with the proportional contributions of protein, carbohydrate and fat being 18.9%, 46.8% and 32.6% respectively.

The daily caloric intake of all age groups for female participants was more than the estimated energy requirements by Health Canada (except female between 19 to 30 years). The daily caloric intake for male participants was lower than the energy requirements estimated by Health Canada.[46] The average proportion for proteins, carbohydrates and fats were within the Acceptable Macronutrient Distribution Ranges (AMDR) for all age groups.[47]

Table 2. Mean daily dietary intake (sorted by gender and age)

Age (Females)	Participant #	DCI Mean (SD) or Median (25%- 75%)
19 – 30 yrs	2	1414 (512)
31 – 50 yrs	3	2121 (69)
	6	2332 (215)
	13	4820 (514)
	16	2907 (1269)
	17	1320 (287)
	19	2407 (132)
Median (25-75th)		2369.5 (2173; 2782)
51 – 70 yrs	1	2035 (654)
	4	2093 (524)
	7	1424 (0)
	8	1548 (198)
	12	1756(109)
	14	1564 (245)
	15	2273 (412)
	18	1838 (828)
Median (25-75th)		1797 (1560; 2049)
Age (Males)		
19 – 30 yrs	10	1889 (481)
31 – 50 yrs	9	864 (234)
51 – 70 yrs	11	1695 (343)

DCI, Daily Caloric Intake.

PITTSBURGH SLEEP QUALITY INDEX (PSQI)

The sleep quality questionnaire showed that more than 65% of the participants go to bed between 9:00 pm and 1:00 am and wake up between 4:00 am and 8:00 am. The duration times showed that it usually takes most of them less than 30 minutes to fall asleep and the actual sleep they get at night is more than 6 hours (Table 3).

Table 3. Sleep times and durations

Bed Times	# of participants
9:00 pm to 10:59 am	8
11:00 pm to 12:59 am	7
1:00 am to 2:59 am	2
3:00 am to 5:00 am	2
Waking times	
4:00 to 5:59 am	5
6:00 to 7:59 am	8
8:00 to 9:59 am	2
10:00 to 11:59 am	3
after 12:00 pm	1
Time taken to fall asleep	
≤15 Minutes	8
16 to 30 Minutes	8
31 to 60 Minutes	2
>60 minutes	1
Sleep duration	
>7 hours	8
6 - 7 hours	5
5 - 6 hours	4
< 5 hours	2

Table 4 lists the frequency that respondents chose related to each of ten reasons for having trouble. The majority of participants reported that they did not have trouble sleeping (less than once a week) because they cannot get to sleep within 30 minutes or due to uncomfortable breathing, loud cough or snoring, feeling too cold or too hot, or having bad dreams and pain. The majority of them however did experience of waking up in the middle of the night. Half of them reported that they had to get up to use the bathroom.

Table 4. Reasons for trouble sleeping

Reasons	Not during the past 30 days	Less than once a week	Once or twice a week	3 or more times a week
Cannot get to sleep within 30 minutes	5	8	3	3
Wake up in the middle of the night	4	3	3	9
Have to get up to use the bathroom	5	5	2	7
Cannot breathe comfortably	16	2	0	1
Cough or snore loudly	15	2	1	1
Feel too cold	17	2	0	0
Feel too hot	11	3	2	3
Had bad dreams	11	7	0	1
Have pain	11	3	3	2
Other reason(s)	0	1	0	5

Regarding sleep quality, more than half of the participants rated their overall sleep quality as fairly good as presented in Table 5. Most of the participants did not take any medications to help them sleep (14 participants) nor had any trouble staying awake during the daytime activities (13 participants). However, keeping up enough enthusiasm to get things done was a concern for more than half of the participants.

According to the responses, a global sleep quality score was calculated.[43] The median (25^{th}; 75^{th} percentile) of global score was 6 (4; 8.5). Eleven out of 19 participants were rated as poor sleepers (Global score > 5).[43]

Table 5. Sleep quality and its effects

Sleep Quality	# of participants
Very good	3
Fairly good	11
Fairly bad	2
Very bad	3
Intake of medicines	
Not during the past 30 days	14
Less than once a week	3
Once or twice a week	0
3 or more times a week	2
Trouble staying awake	
Not during the past 30 days	13
Less than once a week	3
Once or twice a week	3
3 or more times a week	0
Enough enthusiasm to get things done	
Not during the past 30 days	4
Less than once a week	9
Once or twice a week	4
3 or more times a week	2

TREADMILL AND INTERVENTION INTEREST QUESTIONNAIRE

Fourteen questions related to the participants' overall view of a healthy workplace, were analyzed with responses assigned to different categories. Major categories and their sub-categories were created based on the responses. The responses representing similar contexts were sub-categorized under each category. The following tables present the number of responses for each category and sub-category for each question. The questionnaire is reproduced in APPENDIX E. The raw data are presented in APPENDIX J.

Question 1. What are the essential features of a healthy workplace?

Sixteen participants listed a good physical environment as an essential feature of a healthy workplace (Table 6). Ventilation and lighting were the most important among the physical environmental factors. Eleven participants considered ergonomics, including good chairs, desks and workstations, as the essential features of a healthy workplace.

Table 6. Essential features of a healthy workplace

Features	# of responses for each general category	# of responses for each specific sub-category
Physical Environment	**16**	
Ventilation		9
Sound		2
Lighting		8
Others		9
Ergonomics	**11**	
Chairs		8
Desks		1
Workstations		5
Social Environment	**9**	
Relationship with staff		11
Others		4
Promoting PA and health	**9**	
Workout equipment		4
Adding PA at work		4
Others		2

PA, Physical Activity.

Question 2. What strategies would you like to see in your workplace to help improve your health?

Fourteen participants listed increase in physical activity as a strategy to help improve workplace health (Table 7). Fourteen participants also listed that an improvement in the physical environment can play a role.

Table 7. Strategies in the workplace to help improve health

Strategies	# of responses for each general category	# of responses for each specific sub-category
Increase in physical activity	**14**	
Workout equipment/ Increasing activity at work		13
Treadmill study		7
Education		1
Improved physical environment	**14**	
Ventilation		4
Lighting		2
Healthy food		2
Others		4
Improved social environment	**2**	
Reduced work stress		1
Longer breaks		1
Improved ergonomics	**5**	
Better chairs/workstations		5

Question 3. What aspects of work contribute most to your job satisfaction?

Being able to positively impact people's lives was the most significant factor contributing to their job satisfaction (13 participants). Ten participants also considered staff and social environment including interaction with co-workers and the managerial staff as an important aspect of work contributing to job satisfaction (Table 8).

Table 8. Aspects of work contributing most to job satisfaction

Aspects of work	# of responses for each general category	# of responses for each specific sub-category
Work related	**13**	
Improve patient's health		11
Hours		1
Others		1
Staff/ Social environment	**10**	
Interaction with co-workers		10
Interaction with managerial staff		2
Physical Environment	**3**	
Cleanliness		2
Comfortable environment		2
Physical activity	**1**	

Question 4. How has the addition of a treadmill workstation changed your workplace satisfaction?

Eight participants responded that the excitement about the study itself has changed their workplace satisfaction; however, a similar number listed that they cannot answer the question before the study starts (Table 9).

Table 9. Changes in workplace satisfaction by addition of the treadmill workstation

Change in workplace satisfaction	# of responses for each general category	# of responses for each specific sub-category
Excitement about the study	**8**	
Not applicable	**8**	
Increase in physical activity	**5**	
Incorporate exercise		5
Reduce sedentary behavior		1
Administration's positivity	**1**	

Question 5. What factors motivated you to participate in this study?

The motivation factors to participate in the study were related to excessive weight, requiring more physical activity, sedentary behavior, health, staff or just that the study needed more participants. The majority of the participants responded that physical well-being (including weight reduction, increasing physical activity, reducing sedentary behavior and improvements in health) as the motivating factor (Table 10).

Table 10. Motivation factors to participate in the study

Motivation factors	# of responses for each general category	# of responses for each specific sub-category
Improve health	**10**	
Reducing pain due to sitting		1
Reducing muscle tightness due to sitting		2
Improve overall health		5
Others		2
Physical activity	**8**	
Want to increase physical activity		4
Like physical activity		2
Increased motivation to be active		2
Reduce sedentary behavior/ sitting time	**6**	
Excessive weight/ Wanting to lose weight	**5**	
Staff	**2**	
Study needed more participants	**1**	

Question 6. Why do you believe that some of your colleagues did not want to participate?

Most of the participants responded that they did not know why their colleagues were not interested in the study. Some considered that multi-tasking (working on the treadmill and computer or phone at the same time) as a hindering factor for their colleagues not choosing to be a participant (Table 11).

Table 11. Reasons why colleagues did not want to participate

Reasons	# of responses for each general category	# of responses for each specific sub-category
Do not know	**7**	
Miscellaneous	**5**	
Psychological		2
Others		3
Multitasking	**4**	
Study requirements	**4**	
EFT requirements		2
Hours/ shift		2
Health factors	**3**	
Already active		1
No weight issues		1
Prefer to sit	**1**	
Not interested	**1**	

Question 7. What are the potential barriers to employees using the treadmill workstation at Provincial Health Contact Centre?

Many participants were concerned about the walking workplace setup. Six participants also listed health and safety concerns such as physical disability and weight as the potential barriers of using treadmill workstations at PHCC. Inability to talk and walk together and its effects on productivity was another potential barrier (Table 12).

Table 12. Potential barriers to employees using the treadmill workstation at PHCC

Barriers	# of responses for each general category	# of responses for each specific sub-category
Workplace setup	**7**	
Computer/other resources set up on workstation		2
Stopping when speaking to colleagues		2
Structure of treadmill use/ hours per shift		3
Others		4
Health/ safety concerns	**6**	
Multitasking	**4**	
Inability to talk and walk		3
Effects on productivity		1
Study restrictions	**3**	
Complaints about noise	**3**	

Question 8. How do you think the addition of a treadmill workstation will change the social dynamics in the work environment?

Motivating other staff to become more active by interacting and encouraging them to go longer on the workstation were the effects, participants mentioned, workstations would have on the social dynamics. They also listed that the work environment will be healthier and positive (Table 13).

Table 13. Effects on social dynamics by addition of treadmill workstation

Changes in social dynamics	# of responses for each general category	# of responses for each specific sub-category
Motivation	**7**	
Encourage each other to go longer		1
Motivate other staff to be more active		5
Stimulate conversation		1
Staff	**7**	
Interaction with other staff		5
Managerial positivity		2
Others	**6**	
Negative effects		2
No change		2
Unsure		2
Healthy and positive environment	**4**	

Question 9. What impact do you think that working on a treadmill workstation will have on your work productivity?

Thirteen participants stated that working on a treadmill workstation will have no effects on their work productivity. However, some of them did list that the productivity can slow down at first but will be maintained once they get used to working on it. Only two of them listed that the productivity will actually decrease (Table 14).

Table 14. Effects on work productivity

Effects	# of responses for each general category	# of responses for each specific sub-category
No effects	**13**	
Slow at first and then maintained		4
Little to no impact		8
Unsure		1
Increase	**5**	
Decrease	**2**	

Question10. Do you think you will be less or more productive while working on a treadmill workstation?

Eighteen participants thought that they will either be more than or equally as productive while working on treadmill workstation as they are on a sitting workstation. Only one participant was not very sure about maintaining the work productivity (Table 15).

Table 15. Productivity while working on a treadmill workstation

Productivity	# of responses for each general category	# of responses for each specific sub-category
More	**9**	
Maintained	**9**	
Initially less and then maintained		3
Remains the same		6
Less	**1**	

Question 11. Are you concerned about being more tired after your shift if you work on the treadmill workstation?

Almost all of the participants felt energized and happy with the idea of the walking workstation and responded that they are not concerned about being more tired after the shift (Table 16).

Table 16. Concerns about being more tired

Concerned about being more tired	# of responses for each general category	# of responses for each specific sub-category
No	**19**	
Will sleep better		2
More energized		2
Yes	**1**	

Question 12. Are you afraid to injure yourself if you work on the treadmill workstation?

The majority of the participants were not afraid to injure themselves while walking on a walking workstation, as shown in Table 17.

Table 17. Concerns of being injured if working on treadmill workstation

Injury concerns	# of responses for each general category
No	**17**
Yes	**2**

Question 13. Are you afraid that your productivity will decrease if you work on the treadmill workstation?

Fourteen participants were not concerned about any reductions in productivity, however, three participants mentioned that the productivity may initially reduce but will be maintained after (Table 18).

Table 18. Will productivity decrease while working on the treadmill workstation

Concerns about reduction in productivity	# of responses for each general category
No	**14**
May initially but maintained after	**3**
Yes, a little	**2**

Question 14. Do you think that by using the treadmill workstation you are active enough to achieve health benefits?

Participants were also positive about achieving health benefits by using treadmill workstations at the workplace. Fourteen participants stated that they will be active enough to achieve health benefits, as presented in Table 19.

Table 19. Health benefits by using treadmill workstation

Health benefits achieved	# of responses for each general category	# of responses for each specific sub-category
Yes	**14**	
No	**5**	
Need to watch diet		1
Need more vigorous activity		1
Do not know	**2**	

INTENTIONS AND EXPECTATIONS QUESTIONNAIRE

Table 20 presents the levels of confidence of the participants for using the treadmill workstation for 1, 2, 3, 4 or 5 days per week. All participants reported that they are 100% confident of using the workstation for one day in a week. However, the confidence levels of the participants reduced with the increase in the number of days per week. Only eight and seven participants were 100% confident of using the walking workstation for four and five days a week, respectively (Table 20).

Table 20. Confidence levels of using the treadmill workstation for the recommended duration

Levels of confidence	**1 day /week**	**2 days /week**	**3 days /week**	**4 days /week**	**5 days /week**
100%	19	16	15	8	7
90%		3		1	1
80%			3	2	1
70%				2	
60%				1	2
50%			1	2	3
40%					
30%					1
20%					
10%					
0%					
Not possible				3 (3 shifts /week)	4 (3 or 4 shifts /week)

DAILY ENERGY EXPENDITURE

The mean (for seven days) energy expenditure (kcal) for activity above resting metabolic rate measured by accelerometry as well as self-reported exercise logs are presented in Table 21. The raw data of the self-reported exercise logs are presented in APPENDIX K.

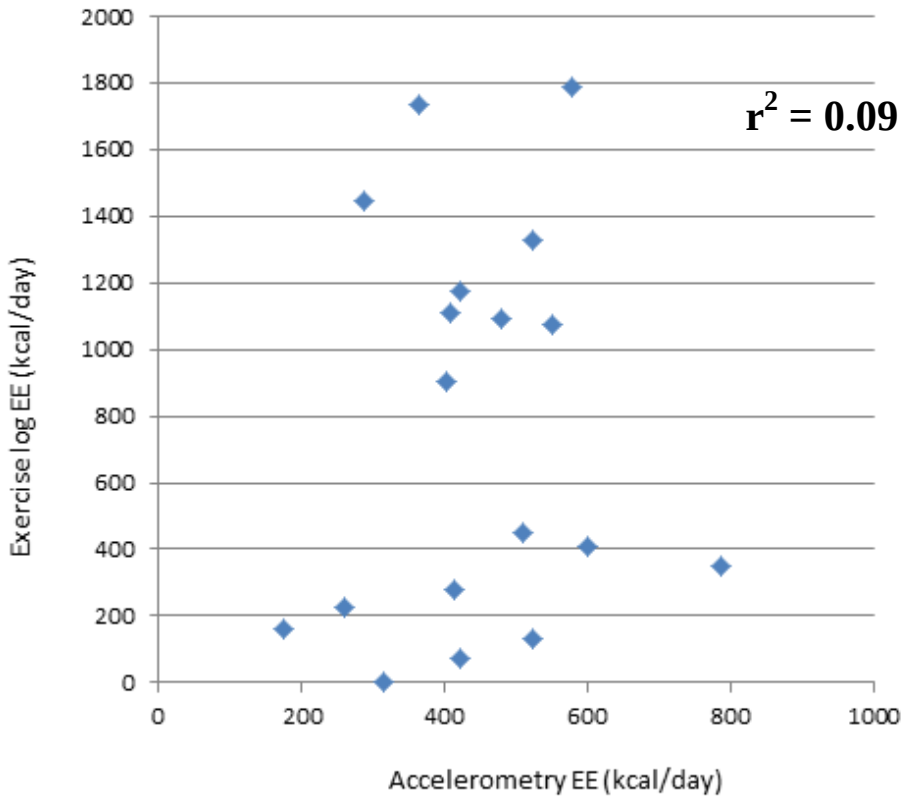
The mean energy expenditures (EE) measured by both accelerometers and self-reported exercise logs were not correlated ($r^2 = 0.0942$) as shown in the Figure 1.

On average, energy expenditure from self-reports were higher than actual measurements from accelerometry. However, individually, half participants overestimated while half underestimated. Generally, the underestimates were small, whereas, the overestimates were large (ranging from two to five times measured values).

Table 21. Mean energy expenditure (EE in kcal/day)

Participant #	Mean EE (Accelerometer) (kcal)	Mean EE (Exercise logs) (kcal)
01	599	406
02	315	0
03	524	1330
04	176	163
06	288	1444
07	260	226
08	413	280
09	422	75
10	552	1075
11	421	1172
12	403	905
13	479	1093
14	408	1112
15	578	1789
16	509	447
17	524	132
18	364	1733
19	788	351
Mean (±SD)	**446 (139)**	**763 (595)**

Figure 1. Relationship between mean energy expenditure (EE, accelerometry) and mean energy expenditure (EE, estimated from self-reported exercise logs)



STEP COUNTS AND ACTIVITY DURATIONS

The average step count and durations of sedentary, light, moderate and vigorous (median) are presented in Table 22 (sorted by age and gender). Both female and male participants of all age groups had lesser number of steps per day, more sedentary duration, lesser duration of light physical activity and higher durations of moderate physical activity compared to average Canadian population.[8]

Table 22. Mean number of steps and time spent in sedentary, light, moderate and vigorous (median) activities.

Age group (yrs)	Gender	PHCC/ CAN	Age (yrs)	Steps	Sedentary total (min)	Sedentary waking (min)	Light (min)	Moderate (min)	Vigorous (min)
20-39	F	PHCC	37	6244	1228	770	118	91	7
		CAN		8875		572	249	20	4
40-59		PHCC	50	5783	1142	756	192	106	0
		CAN		8677		588	245	19	3
60-79		PHCC	64	4715	1195	772	176	69	0
		CAN		6970		602	205	12	1
20-39	M	PHCC	33	6659	1140	803	196	105	0.5
		CAN		9926		571	253	28	5
40-59		PHCC	57	3106	1172	690	186	83	0
		CAN		9996		570	258	24	3
Total	F	PHCC	52.6	5488	1171	763	177	91	0
	M	PHCC	44.7	4882	1155	765	191	93	0

PHCC, Provincial Health Contact Center; CAN, average Canadian population.

RESULTS SUMMARY

In summary, the employees who were willing to participate in a shared workplace treadmill workstation study generally had the following characteristics.

- 78% of the participants interested to participate in the study were women, which is comparable to the percentage of eligible female employees at the workplace (89%).
- Twelve out of fifteen women had waist circumferences ≥ 88 cm and one out of four men had a waist circumference ≥ 102 cm indicating increased risk for developing health problems such as type 2 diabetes, coronary heart disease and hypertension.[45]
- The distribution of women among normal, overweight and obese categories were not different from the average Canadian population.[45]
- Overall, the pain and fatigue values are low and seem to not be increased by working a shift.
- The daily caloric intakes, and the balance of macronutrients, fall within the recommended dietary intake for most of the participants.
- 58% of the participants were ranked as poor sleepers; this is comparable to other shift values.
- In general, the participants expected treadmill workstations to decrease their sedentary behavior, increase physical activity and provide health benefits. They were generally not concerned about injury or fatigue or reductions in their work productivity.
- All participants were 100% confident of using the treadmill workstation for one day a week. Their confidence to use a workstation decreased proportionately as more days per week were considered.

- The mean duration of moderate to vigorous physical activity per week was lower (by 62%) than the recommended Canadian Physical Activity guidelines (150 minutes of moderate to vigorous activity per week).
- Activity estimates from self-reported exercise logs tended to be overestimated compared to the actual measured energy expenditures from accelerometry.
- Men accumulated just under half and women accumulated over half the number of steps per day accumulated by average Canadian population.[8] The mean number of steps per day (5361) for all the participants was 46% less than the recommended number of steps (10,000) per day.
- The participants were sedentary for about 12-13 hours each waking day, which is more than the sedentary duration of average Canadian adults (9.6 hours)[8] and did light to moderate physical activity for about four hours per day. They generally did not do any vigorous activities.[8]

CHAPTER 5

DISCUSSION

With the rise in sedentary occupations, it has become critical to add physical activity interventions in the sedentary lifestyles of these employees. Studies have revealed that worksite physical activity interventions play a great role in achieving health benefits for sedentary employees.[15, 17] Recent studies have concluded that worksite treadmill workstations help improving the sedentary lifestyles of such workers.[17] However, none of the previous studies have aimed at reducing the workplace sedentary behavior by sharing treadmill workstations. Also, in addition to knowing the effectiveness of the physical activity intervention, it is important to know the characteristics and expectations of the employees who want to be a part of these interventions. Previous studies have described pre-intervention physical and physiological characteristics of the population participating in different workplace intervention trials to reduce workplace sedentary behavior, but this study is first of its kind to focus on the behavioral and perceptual characteristics of employees at a sedentary workplace, who were interested in participating in a shared treadmill workstation intervention. This is the first study to determine the size (number of eligible employees) and gender distribution of the entire eligible workforce. This allowed us to determine the overall participation rate and compare the participation rates within each gender group.

Overall, the participants interested in using the shared treadmill workstations were those individuals who considered themselves as inactive and thought that they could be healthier by adding physical activity during their sedentary work shifts. Most of the participants were confident in their ability to work on the treadmill stations and were not

concerned about multitasking (e.g., talking, typing and walking together) or negative effects on their work productivity. In general, the participants expected that the addition of workplace treadmill stations would improve their workplace satisfaction.

COMPARISON TO OTHER STUDIES

Very few studies have reviewed the characteristics of populations interested in reducing workplace sedentary behavior. Recently, Waters et al. (2011) described the participant characteristics (e.g., gender, age group, education levels etc.) by reviewing 32 physical activity intervention trials on employees (in the workplace) or patients and members of the general public (in primary healthcare facilities or community and home-based interventions) from 1996 to 2006.[37] Nine studies focused on employees in the workplace. The mean (range) age of participants was 45.4 (18 – 70) years. The current participants had a similar average age of 51 years indicating that more of the middle age group wants to participate in these interventions. The mean percentage of female participants in the nine workplace studies was 64%. Only two of those nine studies had more male participants and those were workplaces where men were more likely to be employed (manufacturing and municipal service employees). In the remaining seven studies, the gender make-up at the workplace was not known, so it is not known if higher percentage of female participants was due to a corresponding predominant proportion of female workers or because females had a higher rate of interest compared to males. However, in the present study, the gender make-up of the PHCC workplace is known (33 female and 4 male workers met the inclusion criterion of working three or more shifts a week). Seventy eight percent of the participants in this study were females. We conclude

that the gender make-up of participants in this study is based on the make-up of the worker population and not due to a higher interest for female workers.

In the present study, the majority of participants were overweight or obese (based on BMI). These results were consistent with Chan et al. (2004) who studied the effects of a physical activity intervention, using a pedometer, on various health indices in a sedentary working population.[38] Participants had a mean baseline BMI of 29.5 ± 6 which is virtually equal to the present study. In the present study, the mean BMI of the female participants was 30.5 and that of the male participants was 27.7, which was more than the average BMI of 24.8 (females) and 25.8 (males) reported by Canadian Heart Health Surveys.[48] Also, the mean waist circumferences of 12 female and one male participants were higher than the waist circumference cut-off points (of ≥ 88 cm for females and ≥ 102 cm for males) that indicate increased risk for developing health problems such as type 2 diabetes, hypertension and coronary heart diseases.[45] The majority of our participants with these health risks are possibly interested in these physical intervention studies because of their self-conception of being more physically unfit and at risk health wise compared to the normal weight population. Also, it was observed that when these participants were asked about the factors that motivated them to participate in the study, five out of twelve at-risk female participants (based on WC) reported that they want to lose excess weight. Only one participant met/exceeded the Canadian Physical Activity guidelines of 150 minutes of moderate to vigorous physical activity per week. These results support the hypothesis of having more unfit and non-active participants who believe that there is a need of adding physical activity in their lifestyles. Other active and healthier employees did not show any interest in being a participant. However, the

majority of participants expected a healthier lifestyle with a positive influence on their job satisfaction.

In general, the mean pain and fatigue levels, measured by Visual Analogue Scales, for the participants were low and there were no significant differences between the responses given before or after their shifts. However, four out of ten after-shift responders reported higher fatigue levels (ranging from 6.1 to 7.5) while only two of nine before-shift responders had higher fatigue levels (ranging from 5.5 to 5.7), and none of the before-shift responders reached the fatigue levels of 6.0 or greater. It was also observed that all four of the after-shift responders with very high fatigue level were rated as having poor sleep quality, which might have played a role in their higher fatigue level. Interestingly, all participants mentioned that they were not concerned about being tired when using treadmill workstations. Also, 57% of the participants, who reported painful areas, reported pain in the neck and lower back. This is consistent with a cohort study by Ariens et al. (2001) indicating that there was increased risk of neck pain for workers who sit for more than 95% of their working time.[49] Previous studies have also concluded that sedentary occupations are risk factors for low back pain.[50] In the present study, four participants with 12 sedentary waking hours complained of low back pain irrespective of the shift timings.

The daily caloric intake for the male participants was lower than the estimated requirements by Health Canada. The caloric intake for most of the female participants was more than the estimated requirements. However, the proportional contributions of fat, proteins and carbohydrates of all the participants were within the recommended

levels.[47] In contrast, the study participants of previous workplace physical activity studies had baseline fat intake of more than recommended levels.[51, 52] The possible reasons of this inconsistency might be the workplace environment. As the workplace in this study was a health call centre (hospital setting) and most of the participants were medical professionals, they may have a better idea of the ideal proportions of macronutrients compared to other workplace settings. It was also seen that the mean caloric intake and BMI of the participants was not correlated. This is however unexpected and could be due to the inaccuracy of the dietary intake reported by the participants.

Sleep quality is a common area of discussion among shift workers. According to Tilley et al. (1982), sleep of rotating shift workers is disrupted and shorter in duration.[39] The results of the present study with mean sleep quality global score of 7.2 ± 4.8 are consistent with these findings. In a study by Atlantis et al., evaluating the effects of a worksite physical activity intervention on sleep quality in shift workers, the global sleep quality score was 6.5 ± 2.9, which, however, improved to 5.0 ± 2.6 after moderate to vigorous aerobic exercise sessions (3 days a week) for 24 weeks.[40] More than half of the study participants were described as poor sleepers (based on global sleep quality score of >5)[43] at baseline, which is comparable to our results of 57.9% of the study participants. The results show that the participants interested in such workplace physical activity interventions have poor sleep quality ratings. However, after working on the treadmill workstations for nine months, the sleep quality of the participants is expected to improve. Future studies should also focus on the effects of treadmill workstations on the sleep quality of normal day shift workers to establish if the shift work plays a role in the results.

Among other characteristics, it is crucial to have an understanding of the participants' perceptions and expectations from the addition of workplace physical activity intervention (treadmill workstation) and how it affects their workplace satisfaction. No study has ever evaluated this aspect of participant characteristics. Overall, the participants displayed positive perceptions of using the treadmill workstations.

Health benefits

The majority of participants reported that, while working on the treadmill workstations, they would be active enough to achieve health benefits. The participants were not concerned about any injury or fatigue while walking. In contrast, almost all of them mentioned that they felt energized and happy about the idea of these workstations. One of them mentioned that, "sitting for longer durations makes her feel sluggish and dragged down" and thus, introduction of this novel way to work will help her feel better. Many participants reported that improvement in their health, such as reducing pain or muscle tightness due to prolonged sitting, or a desire to lose excessive weight, were some of the motivating factors for them to participate in this study. Overall, the participants were interested in increasing their workplace physical activity as a strategy to improve their workplace health and satisfaction, which also included having workout equipment or educating the staff, other than having a treadmill workstation.

Barriers and reasons for non-participation

The reasons that participants thought the treadmill workstations could not be used at PHCC included the workplace set-up. They mentioned that they would be too far from

their resources and they would have to stop when speaking to colleagues. The requirements of the study (e.g., the eligibility criteria, limitations on using the workstation for a maximum of two hours every shift or sharing the workstation with other employees) were other potential barriers why the participants thought their colleagues did not participate as well as why the workstations could not be used at PHCC. Some of the participants considered multitasking and its effects on work productivity as a barrier due to which other employees did not show interest. Health and safety concerns such as physical disability and weight issues were also considered as hindrances. Most of the participants who were willing to participate were overweight. This indicates that excessive weight was both a hindrance and motivator to participate in the study. This might be because some of the overweight employees intended to lose weight by using the treadmill workstations.

Healthy workplace facilitators

According to the responses of study participants, it could be concluded that the essential features of a healthy workplace included primarily a better physical environment (e.g., better lighting and ventilation) and better ergonomics (e.g., better chairs, desks or workstations). Also, by the addition of treadmill workstations, their workplace satisfaction changed with increased workplace physical activity levels incorporating exercise and reduced sedentary behavior. Thirteen out of nineteen participants had positive perceptions about the effects of treadmill workstations on their work productivity. Although, most of the participants responded that their productivity would be maintained, some mentioned that it might decrease a little initially but will be

the same after. The participants also believed that the addition of workstations would affect the workplace social dynamics by creating a healthy and positive environment.

Future intervention studies focusing on workplace physical activity interventions should concentrate on eliminating the barriers to both using the workstations at PHCC and to non-participation by other employees. The workplace set-up could be improved in a way that the workers are close to their work resources. The study limitations could also be minimized to improve participation rates. However, in general, the overall expectations and perceptions of the participants interested in a shared treadmill workstations study reflected positive commitments to continue using the walking workstation and gaining health benefits by reducing their workplace sedentary behaviors. This might be because the mean waking hour's sedentary duration for the interested participants was about 12 hours and introduction of an activity intervention has made them think and feel positive about the health benefits and reduction in their sedentary times and behavior.

Eighteen out of 33 eligible employees did not want to participate in the study. Based on our discussion with participants and non-participants, possible reasons for the non-participation could be low knowledge about the impact of sedentary behavior on health or low self-confidence. Future studies might improve the participation rate by educating workplace employees about the benefits and importance of reducing sedentary time. This could be done through either group presentations at the workplace or individual meetings with employees. A potential way to increase the confidence level could be to provide practice sessions before recruiting.

The majority of the participants were 100% confident in using the treadmill workstation for one to three days per week. However, as the number of usage days increased to four and five, the confidence levels of the participants reduced (ranging from 100% to 30%). This suggested that the participants were not very sure about increasing their workplace physical activity for more days in a week and their confidence reduced as the frequency of the activity increased. Less than half of the participants were 100% confident of using the workstation for all five days in a week. These results indicated about the self-efficacy of the employees based on their determinations and intentions to perform an activity and what they believed they could do under certain circumstances. The gap between their intentions and behaviors could have been influenced by their self-efficacy. This information can also guide future studies to find the effectiveness of using the workplace strategies for three or lesser number of days in a week which might increase participation rates.

The mean daily energy expenditure on physical activity was estimated from self-reported exercise logs as well as accelerometer measurements for seven days. Titze et al. (2001) studied the effects of four month long physical activity intervention on energy expenditure of sedentary employees.[53] The baseline pre-intervention daily energy expenditure was 470 kcal for the intervention group employees (calculated by seven-day recall questionnaire) which was comparable to the energy expenditure measured by accelerometry in our group (446 kcal). However, the mean daily energy expenditure estimated by seven day self-reported activity logs in the present study was 763 kcal. This might be because the participants over-reported their activities. Half of the participants overestimated their mean energy expenditure and half of them underestimated. People

who thought they were more active than they really were tended to overestimate by large amounts in contrast to those who thought they did less activity than they really did, whose underestimations were smaller. Most participants who overestimated (four out of six) were either overweight or obese while those who underestimated were classified as normal weight. In the present study, the estimates of energy expenditure by self-reported activity logs were not correlated with the actual measurements of activity based energy expenditure by accelerometers. Jakicic et al. (1998) compared self-reported exercise to the exercise measured by Tri-Trac accelerometers in overweight women and concluded that 42% of the participants over-reported and 58% under-reported the number of exercise bouts they performed.[54] These results were comparable to the proportion of participants over- or under-estimating the energy expenditure in our study.

Our participants spent about 12 - 13 of their waking hours every day being sedentary and the majority of them did not do any vigorous activity. These results support the hypothesis that people who wanted to be a part of this interventional study were more sedentary and wanted to participate in order to improve their health and well-being as they felt they were at risk. The average sedentary times of the study participants of all age groups were more than the average for the Canadian population.[8] Similar to our results, the participants in a study by Carr et al. (2012) aimed at reducing workplace sitting times by using a portable pedal exercise machine, sat for 83% of their working days.[55]

In the present study, surprisingly, the participants did more moderate activity than the means for the Canadian population.[8] The mean number of steps per day measured by seven day accelerometry was also lower (by one-half) than the recommended levels of

10,000 steps per day. In a previous study by Chan et al. (2004), which focused on the health benefits of a pedometer-based physical activity intervention in sedentary workers, the pre-intervention step count per day was 7,029 which was higher than the mean step count in our group.[38] These results indicate that it is very important to focus on increasing the step count in order to reduce sedentary times. The workplace treadmill stations are the appropriate way to achieve this and it is likely that the participants will have increased daily step-counts after nine months of the study.

This study investigated the physical, physiological, perceptual, and behavioral characteristics of the workplace employees who were interested to participate in a study aimed at reducing their sedentary behavior. To increase overall participation rates; this information may be used to guide future intervention trials by identifying the characteristics of those most likely to participate. This study also indicates that knowing the gender if the eligible workplace population is important when targeting the specific interests of the participants. However, there were some limitations to this study, presented in the next section.

LIMITATIONS OF THE STUDY

The results of the present study could not be compared with the characteristics of the workplace employees who did not want to participate in the treadmill intervention trial because they did not want to get involved. Therefore, the results were compared to the average Canadian population.

The durations of activity in the self-reported energy expenditure activity logs were not reported by some of the participants. These activities were finite activities

common to all/most participants (e.g., grocery shopping, walk from office to bus stop). The missing durations were estimated by averaging durations of similar activities reported by other participants. The missing durations which could not be estimated were not included in the calculation of mean values.

This study was limited in the number of participants. This was because there were only 37 eligible employees (much less that we believed). This reduced the strength of generalizing characteristics in sedentary workers and establishing external validity.

FUTURE RECOMMENDATIONS

Future shared treadmill workstation intervention studies should include a higher number of participants and different types of sedentary occupations where a treadmill workstation is practical. To increase the participation rates, future investigators could hold presentations addressing the negative effects of sedentary behavior and how treadmill workstations can improve them.

We recommend that the size and gender make-up of the entire eligible workplace population should be determined.

We also endeavor to measure as many characteristics of the non-participating workplace population as possible specially addressing their barriers to participating in the study and their confidence issues.

The exercise logs could be replaced by validated physical activity questionnaires using closed-ended questions to report the mode of activity, frequency, and duration.

The employers should be educated about how a less sedentary workplace can potentially increase productivity.

Future studies should focus on collecting more physiological data (e.g., bone density and blood profile), as this will further elaborate on the characteristics of the participants willing to participate in such interventions.

CONCLUSION

This study showed that the overall characteristics of the workers interested in workplace physical activity intervention study include overweight and sedentary middle aged individuals with below average daily energy expenditure, low fatigue and pain levels, and a poor sleep quality rating, who actually want to increase their physical activity and achieve health benefits. However, this study had a limitation of not comparing the results with the non-participating population. It is recommended that future studies should also concentrate on the characteristics of the non-participating population so the workplace intervention strategies can be modified to be more inclusive and can focus on the interests of non- participating population as well.

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APPENDIX A

ETHICS APPROVAL

UNIVERSITY OF MANITOBA | Research Ethics and Compliance
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APPROVAL CERTIFICATE

January 31, 2013

TO: **Danielle Bouchard**
Gordon Giesbrecht
Principal Investigators

FROM: **Stan Straw, Chair**
Education/Nursing Research Ethics Board (ENREB)

Re: **Protocol #E2012:121**
"Efficacy of shared treadmill workstation to reduce sedentary behavior"

Please be advised that your above-referenced protocol has received human ethics approval by the **Education/Nursing Research Ethics Board**, which is organized and operates according to the Tri-Council Policy Statement (2). **This approval is valid for one year only**.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

Please note:

- **If you have funds pending human ethics approval, the auditor requires that you submit a copy of this Approval Certificate to the Office of Research Services, fax 261-0325 - please include the name of the funding agency and your UM Project number. This must be faxed before your account can be accessed.**

- **if you have received multi-year funding for this research, responsibility lies with you to apply for and obtain Renewal Approval at the expiry of the initial one-year approval; otherwise the account will be locked.**

The Research Quality Management Office may request to review research documentation from this project to demonstrate compliance with this approved protocol and the University of Manitoba *Ethics of Research Involving Humans.*

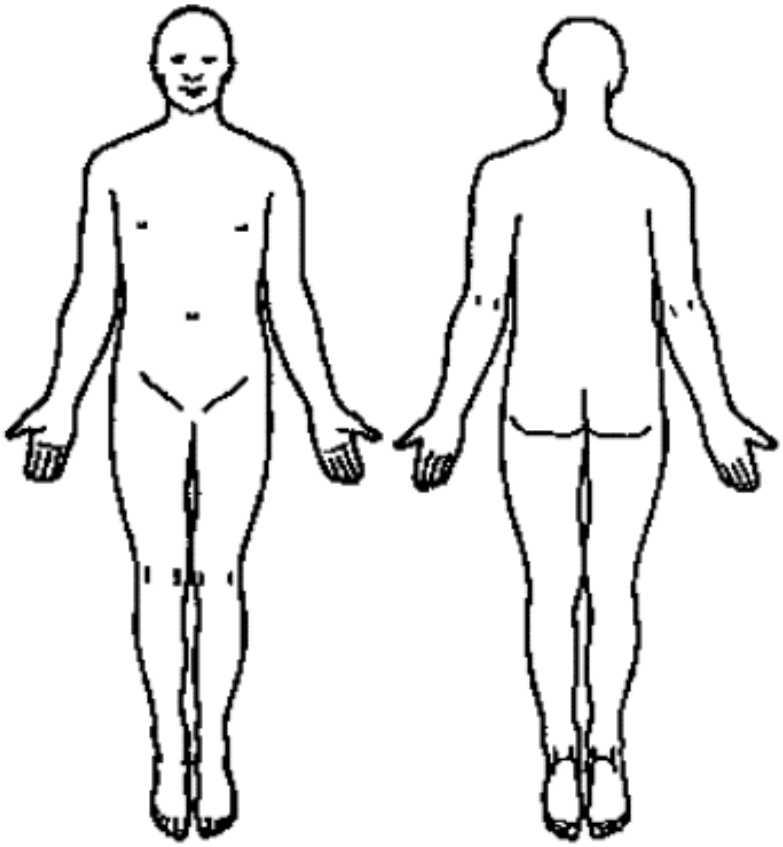
The Research Ethics Board requests a final report for your study (available at: http://umanitoba.ca/research/orec/ethics/human_ethics_REB_forms_guidelines.html**) in order to be in compliance with Tri-Council Guidelines.**

APPENDIX B

VISUAL ANALOGUE SCALE FOR PAIN

RIGHT NOW, PLEASE RATE YOUR EXPERIENCE OF PAIN BY PLACING AN "X" ON THE LINE

With a pencil, shade one or two areas where you feel pain. Indicate most painful area as #1, and the second most painful area as #2.



APPENDIX C

VISUAL ANALOGUE SCALE FOR FATIGUE

RIGHT NOW, PLEASE RATE YOUR EXPERIENCE OF FATIGUE BY PLACING AN "X" ON THE LINE

APPENDIX D

PITTSBURGH SLEEP QUALITY QUESTIONNAIRE

Pittsburgh Sleep Quality Questionnaire

*The following questions relate to your usual sleep habits during the **past 30 days only**. Your answers should indicate the most accurate reply for the majority of days and nights in the past 30 days. Please answer all questions.*

1. When have you usually gone to bed at night? _____
2. How long (in minutes) has it usually take you to fall asleep each night? _____
3. When have you usually gotten up in the morning? _____
4. How many hours of actual sleep did you get at night? _____ (This may be different than the number of hours you spend in bed.)

For each of the remaining questions, check the one best response. Please answer all questions.

5. How often have you had trouble sleeping because you...

	Not during the past 30 days	*Less than once a week*	*Once or twice a week*	*Three or more times a week*
(a) Cannot get to sleep within 30 minutes	_____	_____	_____	_____
(b) Wake up in the middle of the night or early morning	_____	_____	_____	_____
(c) Have to get up to use the bathroom	_____	_____	_____	_____
(d) Cannot breathe comfortably	_____	_____	_____	_____
(e) Cough or snore loudly	_____	_____	_____	_____
(f) Feel too cold	_____	_____	_____	_____
(g) Feel too hot	_____	_____	_____	_____
(h) Had bad dreams	_____	_____	_____	_____
(i) Have pain	_____	_____	_____	_____
(j) Other reason(s), please describe: _____	_____	_____	_____	_____

6. How would you rate your sleep quality overall?

___Very good ___Fairly good ___Fairly bad ___Very bad

7. How often have you taken medicine (prescribed or "over the counter") to help you sleep?

Not during the	Less than	Once or	Three or more
_____past 30 days	_____once a week	_____twice a week	_____times a week

8. How often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during the	Less than	Once or	Three or more
_____past 30 days	_____once a week	_____twice a week	_____times a week

9. How much of a problem has it been for you to keep up enough enthusiasm to get things done?

____ No problem at all ____Only a very slight problem ____Somewhat of a problem ____A very big problem

APPENDIX E

TREADMILL AND INTERVENTION INTEREST QUESTIONNAIRE

1. What are essential features of a healthy workplace?

_____
_____
_____

2. What strategies would you like to see in your workplace to help improve your health?

_____
_____
_____

3. What aspects of work contribute most to your job satisfaction?

_____
_____
_____

4. How has the addition of a treadmill workstation changed your workplace satisfaction?

_____
_____
_____

5. What factors motivated you to participate in this study?

_____
_____
_____

6. Why do you believe that some of your colleagues did not want to participate?

_____
_____
_____

7. What are the potential barriers to employees using the treadmill workstation at the Provincial Health Calling Center?

_____
_____
_____

8. How do you think the addition of a treadmill workstation will change the social dynamics in the work environment?

_____
_____
_____

9. What impact do you think that working on a treadmill workstation will have on your work productivity?

_____
_____
_____

10. Do you think you will be less or more productive while working on a treadmill workstation?

_____
_____
_____

11. Are you concerned about being more tired after your shift if you work on the treadmill workstation?

_____
_____
_____

12. Are you afraid to injure yourself if you work on the treadmill workstation?

_____
_____
_____

13. Are you afraid that your productivity will decrease if you work on the treadmill workstation?

_____
_____
_____

14. Do you think that by using the treadmill workstation you will be active enough to achieve health benefits?

_____
_____
_____

APPENDIX F

INTENTIONS AND EXPECTATIONS QUESTIONNAIRE

Use the scale below to indicate how **confident** you are that you will use the treadmill workstation for the recommended duration for:

1 day per week

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Not at all confident Completely Confident

2 days per week

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Not at all confident Completely Confident

3 days per week

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Not at all confident Completely Confident

4 days per week

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Not at all confident Completely Confident

5 days per week

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Not at all confident Completely Confident

APPENDIX G

EXERCISE AND SLEEP LOG

Subject #_____

Starting day of the week_____ Date_____

	Activity 1	Activity 2	Activity 3	Activity 4	Total Sleep Duration
DAY 1					
Name of the activity: Duration:					
DAY 2					
Name of the activity: Duration:					
DAY 3					
Name of the activity: Duration:					
DAY 4					
Name of the activity: Duration:					
DAY 5					
Name of the activity: Duration:					
DAY 6					
Name of the activity: Duration:					
DAY 7					
Name of the activity: Duration:					

APPENDIX H

EXERCISE AND SLEEP LOG

Subject #_____

Starting day of the week_____ Date_____

	Activity 1	Activity 2	Activity 3	Activity 4	Total Sleep Duration
DAY 1					
Name of the activity: Duration:					
DAY 2					
Name of the activity: Duration:					
DAY 3					
Name of the activity: Duration:					
DAY 4					
Name of the activity: Duration:					
DAY 5					
Name of the activity: Duration:					
DAY 6					
Name of the activity: Duration:					
DAY 7					
Name of the activity: Duration:					

APPENDIX I

Dietary Record

Participant number_____

Date -		Weekday-	
Time of the day	Food/Drink	Description	Amount

Date -		Weekday-	
Time of the day	Food/Drink	Description	Amount

Date -		Weekend day-	
Time of the day	Food/Drink	Description	Amount

APPENDIX J

RAW DATA

(TREADMILL AND INTERVENTION INTEREST QUESTIONNAIRE)

Question	**Answer**	**Participant #**
What are essential features of a healthy workplace?	seating; ventilation; sound; lighting	TW01
	clean environment; support for good health	TW02
	respect, gym facilities, bike racks, clean air	TW03
	Good ventilation, ergonomic workstations, regular breaks, available exercise equipment which can be used at while working +/or during breaks	TW04
	low stress, ability to perform some type of physical activity, good working relationships	TW05
	good air; good chairs; good lighting	TW06
	ventilation; desk, chair, computer updates; good working atmosphere; lighting; co-worker attitude etc.	TW07
	proper workplace stations that can be individualized per needs; no distraction - noise (including loud conversation); calm atmosphere; good lighting, moderate temperature	TW08
	relaxed environment, supportive supervision, well - timed breaks, head supports for chairs would reduce neck strain	TW09
	Ventilation, proper chairs, adjustable workstations (i.e., desks, keyboards), proper lighting, access to workout equipment, water, appropriate assistive devices (i.e., ergonomics, mice, wrist pads)	TW10
	ergonomic workplace station, chair, air circulation, proper lighting, ability to get up and stretch (walk)	TW11
	Clean, approachable superiors; ability to reduce stress (work related)	TW12
	chairs/ ventilation/ better headsets - Bluetooth sets	TW13
	fresh air! Also a balance of work/ exercise; chance to interact with co-workers during working hours	TW14
	comfortable temperature, chair - good height arms, back support; availability of cold water; good	TW15

	lighting	
	clean and safe work environment; pleasant environment supported by co-workers; an understanding of the person in the workplace i.e., supporting workload, family life ensuring you have the ability to do your job	TW16
	physical activity busted into the work day, outside time; ventilation	TW17
	lighting needs to improve; good choices in the cafeteria	TW18
	Good ergonomics at workstations; opportunity for physical activity, such as access to a gym; good communications; fair treatment	TW19
What strategies would you like to see in your workplace to help improve your health?	improved fresh air; ventilation; more ergonomically friendly workstations	TW01
	more active work environment; continue use of treadmill	TW02
	get rid of the fluorescent lights/glare issues; exercise equipment in PHCC itself for breaks, better flooring/carpet that reduce allergens	TW03
	air quality measures at equinoxes +/or solstices, exercise equipment provided or allowed to be brought from home (safekeeping available when not at work), availability of trainers, coaches to provide fitness plans (1-2/year)	TW04
	this treadmill study seems like a perfect idea	TW05
	see above (good air; good chairs; good lighting)	TW06
	better chairs; more updated computers; better headphones	TW07
	improving tools we have to work with, i.e., actual computer programs	TW08
	the chairs are essential since we are always sitting. To stand up and work is an option but most time is spent sitting … chairs need to be better	TW09
	Access to workout equipment (i.e., treadmills, stationary bike), properly fitted chairs	TW10
	treadmill, exercise ball, on site massage	TW11
	ways to reduce work related stress, ways to become more active/ less sedentary	TW12

	versatile working stations	TW13
	slightly longer breaks of 20 minutes coffee and 40 minutes meal breaks; also windows accessible for fresh air	TW14
	provide free passes to fitness place	TW15
	access to a study like this and ongoing education around health risks to sitting, being at a computer all day and then supporting and carrying out of the study recommendations	TW16
	Treadmill stations; physical activity classes that can be done at work during breaks	TW17
	I believe the treadmill study is helpful; also would like to see low CHO diet in the cafeteria	TW18
	workplace treadmills, more open access to pool and gym facilities (better hours and no cost); healthier food options in cafeteria	TW19
What aspects of work contribute most to your job satisfaction?	comfort-calm environment, being able to move	TW01
	clean environment, the rest area	TW02
	friendly staff, feeling like I have made a difference in patients' lives	TW03
	Being able to set up a workplace station to suit my work habits, at start of each shift; cleaning of carpets regularly, common purpose	TW04
	helping people	TW05
	job itself, people in workplace	TW06
	work is related to self performance, and making a difference in this world	TW07
	people I work with; direct contact with callers and dealing with the situation	TW08
	interaction with co-workers and clients	TW09
	Being able to assist clients to the best of my ability	TW10
	interaction (positive) with co-workers and management	TW11
	sense of accomplishment at the end of the day	TW12
	hours	TW13
	caring for people, workplace relationships	TW14
	friendly colleagues, supportive manager	TW15
	being able to leave the work here at the end of the day, i.e., turn off phone and leave	TW16

	Helping people improve their relationship with food	TW17
	I work with really great people	TW18
	opportunity to connect with patients and good relationships with colleagues	TW19
How has the addition of a TWS changed your workplace satisfaction?	looking forward to being able to move while doing work	TW01
	I am looking forward to the study	TW02
	N/A	TW03
	Prior to study - ?	TW04
	I anticipate that it will	TW05
	I like idea of being able to include activity in work day since its difficult on short breaks to go for walks (as other Miz facility staff do), i.e., walking club	TW06
	N/A	TW07
	N/A	TW08
	given me a positive outlook	TW09
	Looking forward to the opportunity to try something new, to reduce sedentary behavior at work; excited to be more dynamic while working.	TW10
	just the fact that study is available is cause for increased satisfaction	TW11
	encourage more active lifestyle	TW12
	not yet - believe it would be great	TW13
	sounds exciting and a way to incorporate exercise during working hours	TW14
	excited, something new	TW15
	I don't know yet - haven't tried it	TW16
	has indicated that employee health is valued	TW17
	N/A	TW18
	I am not sure; we tried to set up a room in the PHCC for exercise but idea was shot down, then suddenly this study comes along; interesting timing!	TW19
What factors motivated you to participate in this study?	currently overweight, have had a DVT, back problems exacerbated by prolonged sitting	TW01
	I have gained 40 lbs in 1 year, need to lose weight for better health	TW02

	Me wanting to lose weight; I've also been getting tight and sore hip muscles which are worse with sitting for prolonged times.	TW03
	I am very out of shape for my age, obese, heavy fat on chest and abdomen, low motivation to become active, very fatigued so the thought of extra exercise outside work is challenging, low energy; sleeping excessively, particularly after evening shifts.	TW04
	Physical activity at work	TW05
	I like activity; I like walking; want to stay healthy	TW06
	myself	TW07
	Sitting at work all day, trying to find the time and motivation to exercise, especially in winter month	TW08
	I am getting older and want to improve my health and quality of life	TW09
	decrease sedentary activity at work; (DECREASE) feel better about coming to work; decrease stiffness after a shift	TW10
	need to improve activity level - healthier joints	TW11
	improve overall health and to become more active	TW12
	get away from the chair - sit 8 hours a day, 5 days a week!	TW13
	ability to walk as I do when not working, thus encouraging to keep mental feelings of health rather than sleepy periods during 8 hours of sitting	TW14
	want to lose 20 pounds	TW15
	My Boss and the personal benefits / awareness of my sedentary behavior at work	TW16
	My boss and lack of participation and curiosity	TW17
	needed more participants	TW18
	I am a member of the fitness committee and actively interested in making our workplace healthier; I am conscious that I am returning to a sedentary job and concerned about my general health being affected by this	TW19
Why do you believe that some of your colleagues did not want to participate?	nervous about doing 2 things at once, some people prefer to sit	TW01
	not interested, or not weight issues	TW02
	worried about walking and typing at same time; only work part-time	TW03

	unknown	TW04
	don't know	TW05
	Don’t care, never asked!	TW06
	didn't ask, none of my business	TW07
	not sure	TW08
	It is not for everyone	TW09
	Don't fulfill EFT requirement; not interested; get enough exercise outside of work	TW10
	Fear of “failure”?	TW11
	going to the U of M for assessment pose difficulties (too far)	TW12
	too fat + health	TW13
	unsure	TW14
	time factor; embarrassed	TW15
	need to move workstations, structure/hours required each shift	TW16
	difficulty multi-tasking	TW17
	they don't think they can type and walk at the same time	TW18
	they are skeptical that there is a real commitment on the part of senior management; many feel they have been "burned" too many times; some may want to see the study fail as "pay back" for the fitness room for the PHCC being turned down by our director	TW19
What are the potential barriers to employees using the TWS at Provincial Health Contact Center?	noise may be an issue	TW01
	that the use is time restricted, calls could take longer than normal	TW02
	Other employees complaining? Maybe that they are loud etc. Hard to say since we haven't seen what a station looks like	TW03
	Getting the computer keyboard integrated into walking on treadmill and mouse and phone; calls slow down occasionally and we may all want to use treadmill at same time.	TW04
	number of treadmill stations available	TW05
	injuries or health concerns; may be not enough treadmills	TW06

	weight; joint problems	TW07
	integrating activity with our present situation - changing attitudes	TW08
	If it gets busy it may be awkward to walk; you may have to leave your station to speak to the supervisor	TW09
	facts; reading, typing while walking; having to stop and start when speaking to colleagues	TW10
	NOT FILLED	TW11
	for myself - being too far away from resources required to work efficiently	TW12
	weight	TW13
	the inability to walk and record calls	TW14
	physical disability	TW15
	see # 6 (need to move workstations, structure/hours required each shift); also need to change clothes	TW16
	safety concern, requiring special shoes, concerns about effects on productivity	TW17
	lack of time at break time; inability to talk to callers; type and walk at the same time	TW18
	concerns about noise - if it is too loud, it can affect others while trying to take calls; some of the staff are here due to physical problems (are unable to be on their feet all day) and may be unable to use the treadmill	TW19
How do you think the addition of a TWS will change the social dynamics in the work environment?	I think it will motivate them to move	TW01
	I feel that a healthy environment tends to be more positive	TW02
	would likely increase the social dynamics - i.e. chatting with other staff about it	TW03
	Sharing adaptation strategies with workstation setup; encouraging each other to go a little longer, when they are wanting to stop; laughing at our own foibles and add experiences with equipment.	TW04
	Management initiatives and allowing a study such as this one shows that they have the employees well being in mind!	TW05
	active people may be happier people, endorphins	TW06

	release with good activity	
	should be positive	TW07
	may motivate other staff to think about their own physical activity	TW08
	It will be a novelty inviting questions at first but eventually nothing will change	TW09
	it could isolate those involved due to location of treadmills; could encourage interest and communication	TW10
	May provide more reason for interaction and perhaps motivate non- participants to exercise or exercise more	TW11
	it will help morale - sense of accomplishment	TW12
	socially - nothing - we are isolated with barriers at work - if there are no barriers may be it will be better socially	TW13
	very positive benefits of mental alertness and an exciting change to benefit all involved	TW14
	noise might affect co-workers	TW15
	unsure, I do hope it will stimulate conversation and motivate some to use it	TW16
	it will likely bring the various groups working in the PHCC closer together	TW17
	Good attitudes show management is interested in our health	TW18
	I am not sure	TW19
What impact do you think that working on a TWS will have on your work productivity?	Increase and improve, increase energy level	TW01
	I don't think it should reduce the amount of calls. I think if I am healthier, I would be working more than OFF with illness	TW02
	Probably the same. I can't see it distracting or reducing it	TW03
	I will want to end calls more quickly to concentrate on walking. Walking will keep my circulation and thinking processes stronger; the work will at times, distract me from the process of walking, without my having to pause	TW04
	little to none	TW05

	None	TW06
	not sure - thinking positive	TW07
	concerned that it may slow down productivity at first - hopefully will increase energy eventually and maintain or increase productivity	TW08
	I think overall it will have little to no impact	TW09
	it may slow at first while getting used to set up; would likely balance out or improve once adjusted	TW10
	slower at first until one gets used to typing and walking at same time	TW11
	once organized hopefully productivity will be the same	TW12
	think productivity will be the same	TW13
	hopefully create more alertness with help of exercise; also feeling of comradely amongst participants	TW14
	no change	TW15
	unsure	TW16
	I am hoping no impact	TW17
	I don't really know right now, my spelling will probably get worse	TW18
	I don't think it will affect it	TW19
Do you think you will be less or more productive while working on a TWS?	More	TW01
	I think I would be more productive	TW02
	Possibly more	TW03
	More productive - and I need to improve my productivity	TW04
	the same	TW05
	I expect should be same	TW06
	more	TW07
	initial learning curve may make it a bit slower at first but should be able to maintain productivity once the learning curve is achieved	TW08
	In the beginning . . . . Less; toward the end . . . Same	TW09
	less at first, improve and possibly increase	TW10
	perhaps more once I get used to it	TW11
	may be less initially, then should be the same - just require re-organizing routines	TW12

	not less	TW13
	unsure as of this time; hopefully will be more productive	TW14
	no change	TW15
	possibly less	TW16
	equally as productive	TW17
	written "="	TW18
	it may improve it if feeling more energized and comfortable	TW19
Are you concerned about being more tired after your shift if you work on the TWS?	Not at all, the opposite	TW01
	No	TW02
	No, I think I would likely feel less tired	TW03
	No; I imagine I will sleep easier and better after evening shifts - without needing snacks etc; I am sure I will have more energy after day shifts, to get out and about.	TW04
	no	TW05
	not at all; I expect to feel better - sitting for long times makes me feel sluggish - dragged down	TW06
	no	TW07
	no	TW08
	Yes but maybe I will sleep better	TW09
	no	TW10
	no	TW11
	no - sitting all day is very tiring	TW12
	no	TW13
	no, exercise builds tolerance and I think I will be more energized	TW14
	no	TW15
	no	TW16
	no	TW17
	not really	TW18
	no	TW19
Are you afraid to injure yourself if	Not at all	TW01

you work on the TWS?		
	No	TW02
	No, I use treadmills at my gym all the time	TW03
	No - had not thought of it	TW04
	no	TW05
	no	TW06
	no	TW07
	Perhaps - trying to do many things at once!	TW08
	No	TW09
	no	TW10
	no	TW11
	no	TW12
	no	TW13
	no	TW14
	no	TW15
	no	TW16
	no	TW17
	a little	TW18
	no	TW19
Are you afraid that your productivity will decrease if you work on the TWS?	It may initially, but not substantially. I currently take numerous breaks due to discomfort from sitting	TW01
	No	TW02
	No	TW03
	No - it cannot get much poorer; any activity at work is bound to improve it	TW04
	no	TW05
	no	TW06
	no	TW07
	initially perhaps	TW08
	A little worried	TW09
	no	TW10
	perhaps at first	TW11
	no	TW12
	no	TW13
	unsure - hopefully not	TW14

	no	TW15
	Not afraid; feel may need to withhold during some aspects until off the treadmill, i.e., completing mailing procedures……..	TW16
	no	TW17
	a little	TW18
	no	TW19
Do you think that by using the TWS you are active enough to achieve health benefits?	It is a good start	TW01
	It will be more than I am active now, so I feel it could be a benefit to me	TW02
	Yes - anything is better than sitting all day	TW03
	I think it will improve my health and motivation sufficiently to start + maintain other physical activities outside of work + at work if available	TW04
	Potentially yes!	TW05
	Yes - anything is better than sitting for sooo long!	TW06
	not really; need to watch my diet	TW07
	it will be a start - may motivate one to increase physical activity	TW08
	I hope so . . . But I don't know.	TW09
	no, but may contribute to healthier lifestyle choices	TW10
	yes	TW11
	yes	TW12
	no	TW13
	yes, combined with continuing diet	TW14
	yes	TW15
	Unsure - depends on what benefits I want it to achieve	TW16
	no	TW17
	yes, since I am not active at all right now	TW18
	No, I feel you need more vigorous activity (that increases your heart rate) in order to do that	TW19

APPENDIX K

RAW DATA (SELF-REPORTED EXERCISE LOGS)

Participant #	Day	Activity 1/Duration	Activity 2/Duration	Activity 3/Duration	Activity 4/Duration	Sleep duration
TW01	Day 1	Wii Fit/ 30 minutes	Dog walk/ 15 minutes	Treadmill/ 50 minutes	None	6 hours
TW02		None	None	None	None	4 hours
TW03		Water aerobics/ 45 minutes	None	None	None	7-7.5 hours
TW04		Walking to work with poles/ 10 minutes	Walking home from work with poles/ 10 minutes	None	None	5.5 hours
TW05						
TW06		Various types of up and down till go to work; stairs X 7; up and about at home; to work at 11; walk from car and back	walk to car at 3; up and down at home	stairs X 7	Grocery store/ 1.5 hours	6 hours
TW07		kitchen stuff/ 30 minutes; upstairs; lunch at 1230	up and down stairs at 1400	None	None	6.5 hours
TW08		walk and stairs during break/ 10 minutes	walk and stairs during break/ 10 minutes	None	None	≈7 hours
TW09		Walking/ 30 minutes	None	None	None	6 hours
TW10		Walk from	Workout at	walk 63	walk home	7.5

		bus stop at Portage to Work/ 10 minutes	Gym - squats, lunges, leg extension, abs etc./ 2.5 hours	stairs/ 1 minutes		hours
TW11		Getting ready for work/ 6:10 - 6:45 am	Coffee break - walk hallway/ 9:30 am	Making supper/ 4:10 -5:00 pm	Hospital visit/ 5:30 - 8:30 pm	7 hours
TW12		Morning routine/ 45 minutes	work/ 8 to 4:15	Grocery shopping/ 1 hour	Dinner prep/ 45 minutes	7 hours
TW13		Laundry/ 1 hour	meal prep/ 20 min	House work/ 1 hour	Play with grandson/ 20 min	6.5 hours
TW14		Dog to daycare, Car for oil change/ 2 hours	Raked back garden, began tidying/ 90 mins	vacuumed LR	dog walk, slow walk/ 20 mins	8 hours
TW15		cleaning house - vacuum, floors, laundry / 6 to 11 am	grocery shopping and errands/ 12 to 4	preparing for birthday party / 3.5 hours	visiting in evening / 4.5 hours	6 hours
TW16		clean house, vacuum, dust/ 2 hours	wash floor/ 20 mins	walk dog/ 35 mins	none	8 hours
TW17		walking/ 75 mins	None	None	None	9 hours
TW18		play ukulele/ 2.5 hours	sew/ 1 hour	walked up and down stairs	None	4.5 hours (night), 4 hours (afternoon)
TW19		Wii Fit Free step/ 30 mins	None	None	None	8 hours
TW01	Day 2	Walk/ 45 minutes	Cycling/ 15 minutes	Dog walk/ 15 minutes	Wii Fit/ 20 minutes	5-6 hours

TW02		None	None	None	None	4 hours
TW03		Dog walk/ 1 hour	None	None	None	7-7.5 hours
TW04		Walking to work with poles/ 10 minutes	Walking home from work with poles/ 10 minutes	None	None	9 hours
TW05						
TW06		walk at 08:30, moved furniture, rest 10 to 11:30	Painted hallway and stairwell, up and down ladder all day till 11:30 pm, shower at midnight	Laundry X 1	None	7.5 hours
TW07		kitchen stuff/ 30 minutes; upstairs; lunch at 1230	stairs; walk/ 20 minutes	None	None	6 hours
TW08		light housekeeping, laundry, cleaning/ 10-15 minutes	walked dog/ 10-15 minutes	preparing meal/ 30 minutes	None	5-6 hours
TW09		Walking/ 30 minutes	None	None	None	5 hours
TW10		walk the dog/ 1 hour	Workout at gym - shoulders and arms/ 1.5 hours	wood working/ 2 hours	Walk home from portage/ 30 minutes	3.5 hours
TW11		Getting ready for work/ 6:10 - 6:45 am	Coffee break - walk hallway/ 9:40 am	Making supper/ 4:10 - 5:00 pm	Hospital visit/ 5:30 - 8:30 pm	7 hours
TW12		Morning routine/ 45 minutes	Work/ 8 to 4:15	Supper routine + house work/ 1.5 hours	none	7 hours
TW13		work/ 7.5	gym/ 1 hour	Dinner and	None	6 hours

		hours	20 minutes	lunch prep/ 20 min		
TW14		played with grandson/ 30 mins	dog walk/ 60 mins	shopping/ 2.5 hours	dog walk/ 40 mins	8.5 hours
TW15		housework, walk around house/2.05 hours	delivery, shopping, visiting / 8 to 3 pm	exercise bike / 15 minutes	make supper, watch TV	8.5hours
TW16		laundry all day, up - down stairs/ approx 3 hours intermittent	grocery and plant shopping/ 2 hours	gardening/ 75 mins	walk dog/ 45 mins	6.5 hours
TW17		None	None	None	None	7 hours
TW18		ran down stairs to be dog's out for pee/ 5-10 mins	went to Costco/ 30 mins	sat in park/ 1 hour	worked from 3:30 to midnight	4-5 hours
TW19		None	None	None	None	6 hours
TW01	Day 3	None	None	None	None	6 hours
TW02		None	None	None	None	3 hours
TW03		Work/ 8 hours	Dog walk/ 30 minutes	None	None	7-7.5 hours
TW04		Vacuuming / 10 minutes	Furniture temporarily moved / 10 minutes	dusting - sorting/ 1 hour	Chipping ice off parking space / 10 minutes	9.5 hours
TW05						
TW06		Walk at 08:30, up and about at home, breakfast, laundry, back to bed	laundry, phone calls, tidy stuff at home	to paint store and eyeglasses store, home shack, moved to son's soccer	home at 9, get ready, to lounge, home at 1230	9.5 hours
TW07		kitchen stuff/ 30 minutes;	stairs, walk / 20 minutes	lifting boxes/ 2 hours	None	6 hours

		upstairs; lunch at 1230				
TW08		Breakfast, helping parent with breakfast, dressing	visited parent in hospital	visited another parent	None	≈6 hours
TW09		Walking/ 30 minutes	None	None	None	6 hours
TW10		walk from bus stop at Portage to work/ 10 minutes	stairs 63/ 1 minute X 2	wood working / 2 hours	None	7 hours
TW11		Morning prep/ 6:10 - 7:00 am	Setting house ready for painting/ Noon - 4:00 pm	Hospital visit/ 5:30 - 8:30 pm	None	6.5 hours
TW12		Morning routine/ 45 minutes	work	supper routine/ 30 minutes	none	7.5 hours
TW13		Work/ 7.5 hours	house work with dinner prep/ 1 hour 40 min	clean up after dinner with lunch prep/ 38 min	ironing + 17 min stretches/ 21 min	7 hours 15 minutes
TW14		church - nursery/ 2 hours	dog walk/ 20 minutes	grocery shopping/ 1.5 hours	dog walk/ 20 mins	7.5 hours
TW15		getting ready for work, drive to work, stairs / 5.30 to 7 am	work/7 to 12.00 noon; lunch 12 to 1; stairs; 1 - 3 work	drive home, make supper / 4 - 6	TV/ 6 to 7.30; to Canadian tire/at 7:30; 15 minutes	8 hours
TW16		walk/ 15 mins	lunch walk/ 30 mins	walk dog/ 25 mins	None	6.5 hours
TW17		Walking/ 15 minutes	None	None	None	9 hours
TW18		walk in the park with dog/ 2 hours	walked to work, stairs X 2 (3 flights) - at work	worked 8 hours	None	7 hours

TW19		None	None	None	None	9 hours
TW01	Day 4	Treadmill/ 30 minutes	Treadmill/ 30 minutes	None	None	5 hours
TW02		None	None	None	None	4 hours
TW03		Work/ 8 hours	Reh fit - cardio - bike/ 20 min; treadmill/ 30 min; weights/ 20 min	None	None	7 to 7.5 hours
TW04		walking to work with poles / 10 minutes	walking home from work with poles / 10 minutes	None	None	10 hours
TW05						
TW06		up at 1030, lay in bed till 1130, up to eat	laundry and clean at home, to the store in afternoon/2.5 hours	paint inside house in afternoon/4.5 hours	shower and get ready for birthday party 7 pm to 1 am	8 hours
TW07		kitchen stuff/ 30 minutes; upstairs; lunch at 1230	stairs	None	None	6 hours
TW08		laundry 4 loads/ 30 minutes	folding, sorting/ 45 minutes	shopping/ 40 minutes	Wiifit step/ 20 minutes	5-6 hours
TW09		Walking/ 30 minutes	None	None	None	6 hours
TW10		walked dog/ 1 hour	worked at gym - chest and back/ 1.5 hours	wood working/ 3 hours	walk home from portage/ 30 minutes	3.5 hours
TW11		Morning prep/ 6:30 - 7:30 am	At Dad's, providing care/ 9:00 am-2:30 pm	Shopping/ 5-6 pm	None	7 hours
TW12		forgot for	None	supper	shopping/	9 hours

		most of morning routine/ 20 min		routine/ 1 hour	1 hour	
TW13		Work/ 7.5 hours	workout/ 37 min	Dinner, dishes, general tiding/ 20 min	stretches/ 5 min	6 hours 20 min
TW14		cleaning house/ 3 hours	vacuuming	hard raking/ 2 hours	ladies meeting/ 2 hours	7 hours
TW15		getting ready for work, drive to work/ 5.30 am to 6.45 am	working at Telecom on computer; stairs to-from photocopier/ 6.45am to 3.00 pm	shopping, errands, visiting/ 3-7	make supper, TV, bath/ 7-10	7.5 hours
TW16		walk into work and stairs/10 mins	walk at lunch and stairs/ 10 mins	shopping and gardening/ 60 mins	walk dog/ 20 mins	7 hours
TW17		Walking/ 70 minutes	None	None	None	8 hours
TW18		play ukulele/ 2 hours	worked 5:45 to midnight	None	None	6 hours
TW19		walk/ 40 minutes	Yard work (mowing, raking)/ 2.5 hours	None	None	8 hours
TW01	Day 5	Dog walk/ 30 minutes	Wii Fit/ 30 minutes	None	None	4 hours
TW02		None	None	None	None	4 hours
TW03		Work/ 8 hours	Aqua fit - deep water/ 45 minutes	None	None	7-7.5 hours
TW04		Disposing of recyclables and garbage from	walk with friend and her dog at dog park / 1 hour	None	None	8 hours

		apartment and car/ 15 minutes				
TW05						
TW06		sleep till 10; getup, get ready for work	work 11 to 3, home for shack	shop at superstore, Costco till 5:30	home for dinner, paint house in evening	5 hours
TW07		kitchen stuff/ 30 minutes; upstairs; lunch at 1230	stairs; walk/ 20 minutes	None	None	6 hours
TW08		walked during break/ 10 minutes	Wiifit step/ 30 minutes	None	None	6 hours
TW09		Walking/ 30 minutes	None	None	None	5 hours
TW10		walked the dog/ 45 minutes	shoveled snow/ 15 minutes	bathed dog/ 10 minutes	None	2.5 hours
TW11		Morning prep; breakfast/ 8:00 - 10:30 am	Hair appointment/ 11:00 am - 1:30 pm	Supper; walk; house/ 5 - 9 pm	None	7 hours
TW12		Forgot to wear for 1st 2 hours up	Errands/ 10 am to 3	Dinner out	None	8 hours
TW13		Work/ 7.5 hours	gym/ 1 hour 20 min	dinner/ lunch + dishes/ 35 minutes	TV	6 hours
TW14		Dog walk/ 45 minutes	Jets game!! Worked/ 8 hours	None	None	5 hours
TW15		get up - ready to go out/ 7:45 to 9:00 am	To Bank, to Mom's- delivery 1 store to another/ 4 hours	drive to Saint. James, errands/15minutes	paradise village for supper; long walk there/ 5 - 10:30	9.5 hours
TW16		walk into	walk at lunch	walk out of	dog walk/	6 hours

		work and stairs/ 10 mins	and break/ 30 mins	work and stairs/ 10 mins	35 mins	
TW17		walking/ 60 minutes	yoga/ 30 minutes	walking/ 45 minutes	None	7 hours
TW18		slept until 1, rested	work from 3:45 to midnight	None	None	5 hours
TW19		None	None	None	None	11.5 hours
TW01	Day 6	None	None	None	None	6 hours
TW02		None	None	None	None	4 hours
TW03		work/ 8 hours	Dog walk/ 30 minutes	None	None	7 -7.5 hours
TW04		Shopping at store/ 15 minutes (without pause)	None	None	None	10 hours
TW05						
TW06		Awake 8:45, up at 9	stuff in kitchen and home/ 9 to 10:30	work 11 to 3, Doctor's office/ 3:45 to 4:45	drive home and eat/ 15 minutes, pick son to go to soccer/ 6 to 8; Home at 8:30, shower, make lunch, watch TV	7 hours
TW07		kitchen stuff/ 30 minutes; upstairs; lunch at 1230	stairs	None	None	6 hours
TW08		walked /10 minutes	walked /10 minutes	None	None	6 hours
TW09		Walking/ 30 minutes	None	None	None	5 hours

TW10		walk from bus stop at Portage/ 10 minutes	stairs 63 / 1 minute X 2	worked out - chest, shoulder, triceps/ 1.5 hours	walk home from Portage/ 30 minutes	9 hours
TW11		Breakfast; Shopping/ 8:00 - 10:30	Dancing/ 8:30 - 11:30	None	None	8 hours
TW12		Sunday AM relax routine	week house hold, routine laundry etc	None	None	6.5 hours
TW13		work/ 7.5 hours	Played darts - late night at pub/5.5 hours	None	None	10 hours
TW14		cleaning, vacuuming/ 60 mins	Costco	dog walk/ 45 mins	None	7 hours
TW15		getting ready, drive for errands	drive to graves to visit parents; to neighbors/3.75 hours	to Dollar store/15min, back to neighbors (short walk)/10min	None	6.5 hours
TW16		walk into work and stairs/ 10 mins	walk at lunch and stairs/ 20 mins	walk out of work and stairs/ 10 mins	walk dog/ 30 mins	7 hours
TW17		walking/ 70 minutes	None	None	None	8 hours
TW18		played ukulele at park/ 2 hours	worked 1530 to 2330	None	None	4 hours
TW19		None	None	None	None	6.5 hours
TW01	Day 7	None	None	None	None	4 hours
TW02		None	None	None	None	4 hours
TW03		Work/ 8 hours	Dog walk/ 20 minutes	None	None	
TW04		Walking to work with poles / 10 minutes	walking home from work with poles / 10 minutes	None	None	7 hours

TW05						
TW06		awake 6:45	to work for 8 to 4	Home and relax, shop at 6:30 to 9 (grocery store and Marshalls)	Walk at midnight ≈ 20 minutes	6-7 hours
TW07		kitchen stuff/ 30 minutes; upstairs; lunch at 1230	stairs	None	None	6 hours
TW08		shopping/ 2 hours	Wiifit step/ 30 minutes	None	None	7 hours
TW09		Walking/ 30 minutes	None	None	None	5 hours
TW10		walk from bus stop at Portage/ 10 minutes	stairs 63/ 1 minute X 3	work out - legs, squat, lunges, extension, abs/ 2.5 hours	walk home from Portage/ 30 minutes	7.5 hours
TW11		Hanging pictures/ Noon - 6:00	None	None	None	7 hours
TW12		Morning routine/ 45 minutes	work/ 8 to 4:45	supper routine/ 1 hour	None	7 hours
TW13		shopping/ 1.5 hours	Errands/ 30 minutes	Chores + cooking/ 1 hour	Shuttle band darts at pub/ 5.5 hours	8 hours
TW14		shoveling snow out of front yard/ 30 mins	None	None	None	7 hours
TW15		up and dressed, drove to neighbours/ 6.00 am to 9.22 am	delivery from 1 store to another - lifting up tp 40 lbs/ 4 hours	passport office, parked a few blocks away/ 11.00 to 13.00	To Bank, to MPIC, to store/ 1300 to 1700; make supper/28. 75minutes,	8 hours

					water, news	
TW16		walk into work and stairs/10mins	walk at lunch and stairs/ 20 mins	walk out of work and stairs/ 10 mins	None	6 hours
TW17		Walking/ 40 minutes	None	None	None	8 hours
TW18		wedding ceremony 8:30 to 12:30	home and napped	wedding reception 1800 - 2200	watched show till 1 am	6 hours
TW19		Yard work (cutting down trees)/ 5 hours	None	None	None	7 hours

APPENDIX L

INFORMED CONSENT

Efficacy of shared treadmill workstations to reduce sedentary behavior

Principal Investigator: Danielle Bouchard, Ph.D

Faculty of Kinesiology and Recreation Management. Health, Leisure and Human Performance Research Institute. 318 Max Bell Centre University of Manitoba, Winnipeg, Manitoba, Canada, Phone (204) 474-8627.

You are being asked to participate in this research study because you have a job that requires that you sit most of the day. Please take your time to review this consent form and discuss any questions you may have with the research staff. You may take your time to make your decision about participating in this clinical trial and you may discuss it with your regular doctor, friends and family before you make your decision. This consent form may contain words that you do not understand. Please ask the study doctor or study staff to explain any words or information that you do not clearly understand.

Purpose of Study

Sedentary behavior has always been linked with impaired health and reduced longevity. Over the last decades, jobs requiring moderate amounts of physical activity in the workplace have reduced from 50% to 20% reducing the levels of energy expenditure. Thus, it becomes important to incorporate some physical activity in the sedentary lifestyle of such workers. Treadmill workstations have been recently used to achieve this goal. The main objective of the study is to evaluate the feasibility of using shared treadmill workstations to reduce sedentary behavior and achieve heath gains.

Study procedures

The study will be divided into two phases. Phase 1 (0 to 3 months) where 20 out of 30 participants will have access to treadmill workstations for two hours every shift, whereas in phase 2 (0 to 9 months), all participants will have access for a maximum of four hours per shift. To decide if you need to wait for the second phase to have access to the treadmill workstations will be done randomly. This is done to compare the changes observed in participants using the treadmill workstations and those who do not have access.

Evaluations meeting

If you choose to participate in the study, you will be asked at work 60 minutes prior to your scheduled time for three times over a period of nine months: before the study, after three months, and after nine months. In this 60 minutes period, the following measurements will be taken:

1. Body weight, height, waist circumference, hip circumference

2. Blood pressure
3. Resting heart rate
4. Fatigue level – you will be asked to rate your level of fatigue at that time on a scale of 1 to 10.
5. Pain level - you will be asked to rate your level of pain at that time on a scale of 1 to 10.
6. Treadmill and intervention interest questionnaire – you will be asked to answer open questions regarding your view of a healthy workplace and why were you interested to participate in this study.
7. Intention and expectation questionnaire – you will be asked to rate certain questions relating to your intentions and expectations of the treadmill workstation usage.

Instructions for safe and correct use of treadmill workstations will also be provided in this 60 minutes session and you will receive instructions to do the week evaluation to measure your physical activity level, diet and sleep.

<u>One-week evaluation</u>

One week evaluation will occur prior to the start of the study, last week of the 3 month period and last week of the nine months period. You will be provided with accelerometers to be worn on your waist for all waking hours for seven consecutive days, and sleep and physical activity logs to be filled in. You will also be provided with a 3-day dietary record to be filled in for two weekdays and one weekend day.

Measurements during the study

Treadmill usage patterns

The treadmill usage (frequency and duration of treadmill use and the walking velocity) will be evaluated by accelerometers, mounted cameras (no sounds) on the treadmill to record speed and slope variations, and login sheets, during the study duration. You will be instructed to wear the accelerometer while using the treadmill workstations. Finally, you will be asked to fill the login sheets placed permanently at each treadmill workstation to indicate your participant's number, start time, finish time and your mean walking speed.

Job productivity

Job productivity (number of calls taken per hour) will be assessed by accessing your workplace monthly reports. This will be done to measure if the use of treadmill workstations affects your work performance based on calls per hour. We are asking you, by signing the authorization to obtain employee's information form at the end of this document.

Risks and Discomforts

There is no more risk to work while walking at 1.0 mph to 2.0 mph than walking outside a normal pace. Importantly, you will be walking at your self-selected speed, and you will be able to stop whenever you want. Using treadmill workstations compared to doing your job sitting may affect minimally your work performance initially. Remember that you

are free to withdraw from the study at any time during the study duration. Withdrawal will not affect your rapport with your colleagues or managers.

Benefits

The major benefit to you from participating in this study is that you get a chance to reduce your sedentary behavior at your workplace within your work hours. It could lead to health benefits and increase your job satisfaction.

Confidentiality

Information gathered in this research study may be published or presented in public forums; however, your name and other identifying information will not be used or revealed. All study documents related to you will bear only your assigned participant number. Records that contain your identity will be treated as confidential in accordance with the Personal Health Information Act of Manitoba. However, the University of Manitoba Health Research Ethics Board may review records related to the study for quality assurance purposes.

All records will be kept in a locked secure area and only the primary investigators and the research assistant staff will have access to these records. If any research records need to be copied, information that may reveal personal identifiers will be removed. No information revealing any personal information such as your name, address or telephone number will leave the locked cabinet located at the work site. The anonymous data will

be carried to the University of Manitoba in forms of electronic files on a password protected computer.

Feedback

All participants will be provided with an opportunity to fill in their contact details in the feedback request form (provided at the end of this document) to request feedback about their individual results. The study results will also be mailed to the interested participants upon request approximately two months after the end of the study.

Costs

There will be no costs of any of the research procedures provided to you during the study duration.

Payment for participation

No compensation will be provided for participating in this study.

Voluntary Participation/Withdrawal From the Study

Your decision to take part in this study is voluntary. You may refuse to participate or you may withdraw from the study at any time. Your decision not to participate or to withdraw from the study will not affect your rapport at our workplace in any way.

Medical Care for Injury Related to the Study

In the case of injury or illness resulting from this study, necessary medical treatment will be available at no additional cost to you. You are not waiving any of your legal rights by signing this consent form or releasing the investigator from their legal and professional responsibilities.

Questions

You are free to ask any questions that you may have about your treatment and your rights as a research participant. If any questions come up during or after the study or if you have a research-related injury, contact the Primary investigator of this study: Dr. Danielle Bouchard by phone at 204-474-8627 or by email at danielle_bouchard@umanitoba.ca.

For questions about your rights as a research participant, you may contact the University of Manitoba Education and Nursing Research Ethics Board at (204) 474-7122.

Do not sign this consent form unless you have had a chance to ask questions and have received satisfactory answers to all of your questions.

Statement of Consent

I have read this consent form. I have had the opportunity to discuss this research study with Dr. Danielle Bouchard or her research staff. I have had my questions answered by them in language I understand. The risks and benefits have been explained to me. I believe that I have not been unduly influenced by any study team member to participate

in the research study by any statement or implied statements. Any relationship (e.g., employee, student or family member) I may have with the study team has not affected my decision to participate. I understand that I will be given a copy of this consent form after signing it. I understand that my participation in this study is voluntary and that I may choose to withdraw at any time. I freely agree to participate in this research study.

I understand that information regarding my personal identity will be kept confidential in accordance with the Personal Health Information Act of Manitoba. The University of Manitoba Research Ethics Board(s) and a representative(s) of the University of Manitoba Research Quality Management / Assurance office may require access to your research records for safety and quality assurance purposes.

By signing this consent form, I have not waived any of the legal rights that I have as a participant in a research study.

Participant signature_____ Date _____

(day/month/year)

Participant printed name: _____

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has knowingly given their consent.

Signature of the research staff: _____

Date_____

(day/month/year)