INCREASING NON-EXERCISE PHYSICAL ACTIVITY: EXTENDED THEORY OF PLANNED BEHAVIOUR MODEL TESTING AND THE ROLE OF STRESS WITHIN SEDENTARY PARENTS.

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ABSTRACT

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Although much research has been done in studying physical activity and its health benefits, inactive behaviour has obtained little attention. The main purpose of the present study is to test the Theory of Planned Behaviour (TPB) in predicting sedentary behaviour to a group of parents with young children and a sedentary job. The secondary purpose of this study is to explore if stress explains additional variation when is entered as an additional variable between intention and sedentary behaviour.

The sample consisted of 68 sedentary adults with young children, both men (N = 29) and women (N = 39), (M = 37.8 years and SD = 5.8). Participants were divided into two groups: an experimental group who received the intervention and a control group who was not exposed to the intervention but underwent the same measurements.

Sedentary behaviour has been assessed with EMG data and calculated to sedentary ratio. Variables of the TPB model (intention, attitude strength, perceived behaviour control , self-identity and perceived knowledge) were assessed by questionnaires. Occupational stress was measured by Heart Rate Variability (HRV) where RMSSD functioned as an indicator for stress. Linear regression analyses indicated that the extended TPB model explained the variance only in the experimental group. Stress has been found to explain larger amount of variation in the control group than in the experimental group.

This study shows that the intervention to increase non-exercise physical activity makes people aware of their sedentary behaviour. Also, stress seems to be a factor that interferes between intention and behaviour for sedentary people.

Overall, paying attention to diminishing sitting time should be beneficial for public health and increase health outcomes. People need to be aware of the harming effects of their sedentary behaviour and how to increase their non-exercise physical activity in order to be able to make small changes in their everyday routine, ultimately leading to the reception of health benefits elicited from these changes. Moreover, stress management strategies should be included in future interventions, as stress might be seen as a barrier in increasing non-exercise physical activity.

Keywords: non-exercise physical activity, sedentary parents, occupational stress, TPB, HRV

TABLE OF CONTENTS

Lack of activity destroys the good condition of every human being, while movement and methodical physical exercise save it and preserve it. – Plato

Walking is man's best medicine. – Hippocrates

1 INTRODUCTION

According to the World Health Organization (WHO) sedentary behaviour has been found as one of the biggest risk factors for global mortality (2015, January) retrieved from http://www.who.int/mediacentre/factsheets/fs385/en/. Although much research has been done in studying physical activity and its health benefits, inactive behaviour has obtained little attention. However, studying behaviour of physical inactivity in depth is recommended (Biddle et al., 2004). It has been claimed that physical inactivity is one of the most important public health problems in the 21st century (Blair, 2009), especially since occupational activities have been changing over the years. There is less high intensity physical activity occupations due to an increase in total time spent in screen technologies (Brownson, Boehmer & Luke, 2005). Considering barriers to pursuing physical activity such as lacking time, non-exercise physical activity could be a smaller and more effective step to take in stimulating people to healthier lifestyle. Non-exercise physical activity can be seen as light intensity physical activity such as standing or doing household chores.

Simultaneously, levels of stress have been increasing which has a major impact on absenteeism on the work floor (Cox, 2000; Elkin & Rosch, 1990). It seems that demands at work are getting higher and do not seem to match with available resources. Research in the relationship between avoiding sedentary behaviour and stress has not been studied yet, thus having a closer look to this link could give us better understanding in the field of occupational health. Heart rate variability (HRV) is used as an objective measurement and the time-domain method root mean square of successive difference (RMSSD) is used to analyse HRV data.

The theory of planned behaviour is one of the most used theoretical frameworks in the field of exercise. In order to have a better understanding of non-exercise physical activity, the theory of planned behaviour may be a useful framework to investigate the behaviour change of reducing sedentary behaviour. An extended TPB model was used to research occupational sedentary behaviour. Intention and perceived behavioural

control were the constructs from the original model that were used. Attitude strengths, self-identity and perceived knowledge were added to the model.

Moreover, it has been shown that the intention-behaviour relationship gets weaker by high occupational stress levels (Payne, Jones & Harris, 2002). Our behaviours predict our health outcomes, and that is the reason why prevention can function as an opportunity to influence health outcomes via behaviour change. In our current society it is possible to quantify and model real behaviour in a context. The present study focuses on the attitude towards changing non-exercise physical activity in working parents with a sedentary job. Specifically, an intervention has been done to decrease sitting time among the working parents. This population group seems to be at risk since these adults are sitting many hours during their work time and on top of that, raising children which make the barrier of a lack of time bigger for being active.

The main purpose of this study is testing how well the theory of planned behaviour predicts intention and actual behaviour of non-exercise physical activity in both the experimental and control groups separately. A secondary aim is exploring whether stress indexes are mediating the link between intention and sedentary behaviour.

2 LITERATURE REVIEW

2.1 Sedentary Behaviour and Non-Exercise Physical Activity

In this modernized life, development in technology has been growing fast. Computer use increased rapidly over the years in our society and consequently sitting time during working day has been rising as well (Jensen, 2003). Sedentary behaviour has been most often studied as a lack of moderate-to-vigorous exercise, rather than studying the actual time of sedentary behaviour. This kind of behaviour concerns awaking activities where energy expenditure is not above the level of resting. This can include, for example, lying or sitting down and watching screens (Pate, O'Neill & Lobelo, 2008). The activities are characterized by energy expenditure lower than 1.5 metabolic equivalent units (METs). Sitting time has been proved to have negative health outcomes. It predicts obesity (Katzmarzyk, Church, Craig & Bouchard, 2009), type 2 diabetes (Hu et al., 2001) and cardiovascular disease (Healy et al., 2008). Although evidence showed beneficial health outcomes for basic small amounts of physical activity, most research has been targeting moderate-to-vigorous physical activity on a regular basis. Moderate-to- vigorous physical activity can be defined by activities that burn 3 to 5.9 METs for moderate and more than 6 METs for vigorous physical activity (Pate et al., 2008). A study assessed the effect of performing a minimum amount of exercise. They found that even 15 minutes each day could reduce the risk for all-cause mortality by 14% and raised the life expectancy by three years (Wen et al., 2011). In contrast, it has been shown that sedentary behaviour such as watching TV is associated with increased all-cause mortality (Dunstan et al., 2010). Although it is not always clear how to differentiate sedentary behaviour from light activity and more moderate-to-vigorous exercise, in a more recent study researchers noted that sedentary behaviour and physical activity can be seen as independent concepts (Burton, Khan, Brown & Turrell, 2011). Researchers found a higher risk for cardiometabolic diseases when higher sedentary behaviour was reported (Stamatakis, Hamer & Dunstan, 2011). Even when physical guidelines were met, the risk for cardiometabolic diseases was still present (Katzmarzyk et al., 2009). Moreover, inactivity physiology differs from activity physiology (Hamilton, Healy, Dunstant, Zderic & Neville, 2008). Therefore, studying light intensity activity throughout the day in order to reduce sedentary behaviour can be useful to target a healthier lifestyle, besides focusing on stimulation of physical activity

(Finni, Sääkslahti, Laukkanen, Pesola & Sipilä, 2011). A review showed that interventions aiming to decrease sedentary behaviour can be effective in health behaviour change (DeMattia, Lemont & Meurer, 2006). By making active decisions such as taking the stairs instead of taking the elevator, physical activity can be integrated into routines within a healthy lifestyle. Walking is another good example of non-exercise physical activity and can be promising for interventions to promote active lifestyle in the long term. Walking is the basic activity that is the most commonly performed in life. It is easy to perform and no special skills, materials or financial investment are needed, so people can access this kind of activity easily. Therefore, walking can be a main focus in interventions in increasing non-exercise physical activity among a sedentary population (Morris & Hardman, 1997). Beneficial outcomes have been reported in a meta-analysis, indicating that sedentary people who increased their levels of walking improved their fitness, decreased body weight, BMI, percentage of body fat, and resting diastolic blood pressure (Murphy, Nevill, Murtagh & Holder, 2007). Furthermore, research has found beneficial affective outcomes through walking. Brief walks in both laboratory and natural settings improved affective responses, although intention to participate in the future was more linked to outdoor walking. This research suggested an increase in enjoyment when more positive affective responses were experienced in outdoor walking, which can lead to more strong intention to walk in the future (Focht, 2013). Overall, the interventions that were targeting this kind of behaviour seemed to result in a decrease in sedentary behaviour and in weight control. This behaviour change has been measured by self-reported TV/video use. Most research has been done in exploring the relationships between watching television and physical activity while few studies have been exploring other types of non-exercise behaviours in leisure time (Burton et al., 2011). Even fewer studies focus on occupational sedentary behaviour. The researchers Carr, Walaska and Marcus (2011) tried to reduce sedentary time at the work place through a portable pedal exercise machine. They found the machine as a feasible tool for reducing sitting time while at work. It would be interesting to reduce sitting time without help from tools just by stimulating people to make active decisions in engaging in basic physical activities.

In recent years, there has been a shift in focus for research on physical activity to research on sedentary behaviour. Sedentary behaviour does not necessarily mean that there is a lack of physical activity. A sedentary lifestyle has been interpreted in different

ways. In many studies, people were considered sedentary when they did not meet the recommended levels of moderate or vigorous physical activity, often based on self-reported results. Subsequently, exercise studies have been focusing on high intensity physical activity and long-lasting in duration. These studies have been shown that regular exercise has beneficial health-related physiological and psychological effects (Penedo & Dahn, 2005). The so-called 'lifestyle' physical activity gained more importance since the focus was on health benefits of doing activities such as garden work and brisk walking. Next to sedentary behaviour, light physical activity should be seen as a distinct construct. Activities such as cleaning, cooking, and slow walking are considered to belong in this group of physical activity; it includes energy expenditure from 1.6 to 2.9 METs. For all levels of physical activity, whether it is light, moderate or vigorous, accelerometry can be used as an objective measure to study health effects from the different levels. Different levels of physical activity should be seen as possible independent influences on health outcomes (Pate et al., 2008). Therefore, the variables should be defined and measured more specific. Reducing sedentary behaviour has a close relationship with light physical activity, which we name non-exercise physical activity in the current thesis. Non-exercise physical activity can be seen as activities that are standing with a metabolic equivalent value between 1.6-2.9 METs (Pate et al., 2008). Research has shown that by increasing non-exercise physical activity such as walking for transportation, sedentary behaviour decreased (De Cocker, De Bourdeaudhuij, Brown, & Cardon, 2008).

One of the barriers for not participating in physical activity is a lack of time. Parents with a sedentary job are at risk; they have a job that requires more than 50% of sitting time and moreover, having children which means that parents have less time being active. For those perceiving a lack of time to be physically active as a barrier, there could be an option to be less sedentary during the day, the so-called lifestyle activity. This is in line with research done in comparing a lifestyle physical activity intervention with a structured exercise intervention (Dunn et al., 1999). They compared two groups receiving either a structured exercise intervention or a lifestyle intervention. Participants were randomly assigned to the intervention groups. Structured exercise involved a traditional exercise prescription in the gym; the lifestyle programme aimed for non-exercise physical activity for at least 30 minutes, preferably each day. They found both groups were comparable and significantly effective. In both interventions, beneficial

changes in physical activity, cardiorespiratory fitness, blood pressure, and percentage of body fat were observed. This seems to be good news for sedentary adults facing different barriers such as lacking time, disliking going to the gym, money issues and lacking access to facilities. Furthermore, they found that increasing physical activity via everyday chores weakened the barriers to regular exercise (Silva et al., 2010) and reducing sedentary behaviour is associated with moderate physical activity (Gilson et al., 2009).

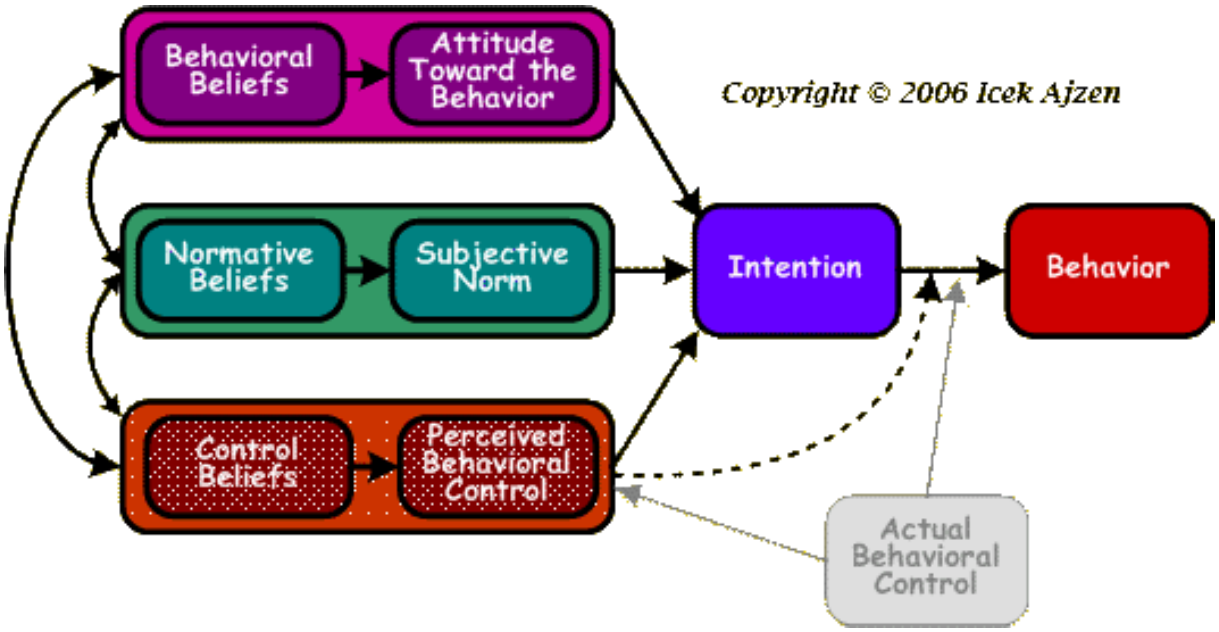
2.2 Sedentary Parents

Sedentary parents are a target group that deserves more attention. Especially when parents have a sitting job, they are considered as a group at risk. Earlier studies have been focusing on the role as a parent in order to stimulate the children to be more physically active. Another research line that particularly focused on parents and their own physical activity behaviour was regarding mothers and exercising. Canadian studies found that the least likely group to exercise are mothers with young children (Verhoef, Love, & Rose, 1992). Another study completed in Australia revealed that young mothers were less active to participate in physical activity than women of the same age without children (Brown, Mishra, Lee, & Bauman, 2000). These studies focus on the fact that mothers have less leisure time to be physically active. It was suggested to change self-efficacy and partner support in interventions for increasing physical activity (Miller, Stewart, Trost, & Brown, 2002). Therefore, family based intervention could be useful but are very scarce in the literature (Finni et al., 2011; van Sluijs, Kriemler, & McMinn, 2011). Family obligations, lack of time and tiredness can be personal obstacles to be more physically active (King et al., 1992).

2.3 Theory of Planned Behaviour (TPB)

To effectively set up an intervention to stimulate non-exercise physical activity behaviour, a framework is needed in order to understand the different components of certain behaviour. Hence, we use the theory of planned behaviour (TPB; Ajzen, 1991). This theory functions as a model in understanding, predicting and changing behaviour. It is an extended version, based on the theory of reasoned action (Ajzen & Fishbein, TRA, 1980). According to this social cognition theory, *intention* is the key determinant of behaviour and refers to how much effort people are willing to put in performing certain behaviour. Intention is determined by attitude, subjective norm and perceived behavioural control (PBC). *Attitude* includes behavioural beliefs and can be considered

as the evaluation of the effects of that behaviour. This can be positive or negative. *Subjective norm* is determined by normative beliefs and can be explained by the social pressure that is perceived to carry out certain behaviour. Each normative belief can be judged as important or unimportant. *Perceived behavioural control* can be seen as control beliefs of factors that may facilitate or hinder performing that behaviour. Previous research revealed the importance of PBC. PBC can be considered as a direct predictor of behaviour where PBC reflects actual behavioural control (Ajzen, 1991). More specifically, PBC can give a good prediction of physical activity (Motl et al. 2005) and has been seen as the biggest contributor to intention (Scott, Eves, French & Hoppe, 2007). As Ajzen (1991) suggested, self-efficacy (the extent of strength of performing a behaviour) and controllability (the way a person has control over his own behaviour) are two components that are influencing PBC.



TPB as a model has the ability to predict behaviour (Connor & Sparks, 2005). It has been widely studied and is the most commonly used theory in health psychology (Ogden, 2003). Research has been done in order to explain and understand the behaviour of physical activity (Hagger, Chatzisarantis & Biddle, 2002). Although it has been claimed that intention is the most proximal predictor of the actual behaviour, it is not automatically affecting the behaviour. Instead, the strength and quality of intentions should be taken into account (Dimmock & Banting, 2009). There is still a need for objectively measured behaviour where TPB can describe causal relationships between an intervention and the actual behaviour change (Hardeman et al., 2002). In previous

research on non-exercise physical activity, a study evaluated the extent to which TPB constructs mediates changes in walking (Darker et al., 2010). They found that PBC was the construct of the TPB that was most strongly related to walking intention. This means that people who felt they had more sense of control over their walking behaviour intended to walk more, which could lead to actually walking more. Scott et al. (2007) examined the prediction of walking behaviour and found that the TPB could predict self-reported intention to walk, but the prediction of objectively measured behaviour of walking was not supported. In other words, self-reported measures and objective measures did not correlate which could suggest that people are not aware of their walking behaviour. The objective measure was assessed by pedometers, measuring the actual amount of time walking. This observation can be due to the fact that walking is an unplanned behaviour while TPB has the purpose to looking at planned behaviour (Scott et al., 2007). Walking can be seen as an ideal activity to promote public physical activity, but needs to be better understood.

Additional variables can be added to the theory of planned behaviour in order to predict the studied behaviour. These added predictors should contribute to the explained variance in predicting intention or behaviour (Ajzen, 1991). In this thesis, the extended model of the theory of planned behaviour consists of three additional variables: attitude strength, self-identity and perceived knowledge.

Attitude strength

Attitude strength as a predictor captures how strong and important attitudes are towards a given behaviour. The study of Theodorakis (1994) included attitude strength in predicting exercise behaviour. Results of this study show that attitude strength should be included into the TPB in predicting exercise behaviour. Including this variable raised the predictive ability of the model in planned behaviour. Therefore, attitude strength is included in this study.

Self-identity

People tend to categorize themselves into socially meaningful groups. According to the identity theory (Thoits & Virshup, 1997), they do this in order to describe themselves answering the question ‘Who am I?’. This research focuses on social types related to sitting behaviour and physical activity. In previous research, self-identity has been suggested to be included in the TPB, next to the other predictors, in predicting specific

behaviour (Sparks & Shepherd, 1992). Self-identity in context of this thesis is the perception of people of their own sitting behaviour and physical activity (e.g. it is in my character to be a lazy sitting person). A meta-analysis revealed a significant contribution of self-identity as a concept, explaining additional variance in intention, besides the other TPB predictors (Rise, Sheeran & Hukkelberg, 2010). Consequently, this thesis included self-identity as an additional predictor into our model of TPB.

Perceived knowledge

Research showed that people who believed that they need more physical activity than experts' recommended amount reported more actual time of physical activity than people who thought they need the same amount or less as recommendations made by experts (Heinrich, Maddock & Bauman, 2011). In the past, research has been focusing on whether participants are meeting the recommendations of physical activity. Assessing knowledge has rarely been taken into account (Heinrich et al., 2008) although this could provide useful information about predicting behaviour. Recommendations such as physical activity guidelines are created with the intention that this influences knowledge. Having knowledge about physical activity is not sufficient to change health behaviour but are helpful in developing health and physical activity promotion and interventions (Morrow, Krzewinski-Malone, Jackson, Bungum, & FitzGerald, 2004).

2.4 Stress/Occupational stress

Stress is a widely studied concept and can be described as the perceived imbalance between the psychological and/or physiological demands put on a person and the capacity of that person's response. Especially, when there are meaningful outcomes and the person fails to meet the demands (McGrath, 1970).

When it comes to occupational stress, occupational health psychology offers many theories about stress and therefore many definitions can be given (Cox, 2000). According to The World Health Organization (WHO), work-related stress occurs as a response style when there is an imbalance between: a) job demands and pressures, and b) the knowledge and abilities people have, which challenge their ability to cope. Both work and individual characteristics are involved in the contribution to work-related stress (Finnish Institute of Occupational Health). This kind of stress can have an impact on a person's mental and physical health. It has been shown that stress increases the risk for cardiovascular diseases and musculoskeletal disorders. Furthermore, stress can negatively influence behavioural outcomes such as a decrease in performance (Glass &

Singer, 1972). Stress levels tend to increase over the years (Kinnunen, 2005). Generally speaking, work has switched from more physically demanding to more mentally demanding (Rahkonen, Laaksonen, Lallukka & Lahelma, 2011). There is less high intensity physical activity occupations due to an increase in total time spent in screen technologies (Brownson, Boehmer & Luke, 2005). This involves more sitting; however, different occupations require other activities. Also, this developing technology makes working time and leisure overlap more, which produces an increased level stress (Lehto & Sutela, 2008). Furthermore, working standards and load have become harder. This leads to, for example, more insecurity and time pressure.

Although stress has a negative connotation, it should be noted that it can be seen as positive as well and it should therefore be included in the definition of stress (Hynynen, 2011). They found that a certain level of stress can lead to maximal performance and can be beneficial for health. Stress is not easy to measure and it is a difficult concept to define. In the current research, a physiological objective measure of stress was used. In particular, a method called heart rate variability (HRV), instead of more traditionally subjective methods such as questionnaires, was utilized. HRV has been defined as 'the degree of fluctuation in the length of the intervals between heart beats (Malik & Camm, 1995). In other words, HRV reflects how regular heartbeats are. The more regular the heart beats are, the lower HRV is and the more variation in heart beats, the higher HRV. Decreased HRV indicates a disturbance in the balance of the autonomic nervous system (Horsten et al., 1999) and a relationship has been found between decreased HRV and mental stress in laboratory studies (Myrtek, Weber, Brüger & Müller, 1996). Long lasting effects of the autonomic nerves system under pressure, by means of being active or being disturbed, can increase the risk of cardiovascular disorders (Melamed, Shirom, Toker, Berliner & Shapira, 2006). It has been shown that people perceiving higher stress have a lower HRV than people lower in stress (Kim et al., 2008). Stress is related to higher sympathetic activity and higher recovery to higher parasympathetic activity (Hynynen, 2011). When stress becomes permanent is can be detrimental for both physical (cardiovascular disorders) and mental health. In the long term, chronic stress can include more severe symptoms and lead to exhaustion and depression (Sheline, Gado & Kraemer, 2003). Previous research has been well supported to the notion that HRV indicators are sensitive indices for work-related stressors (Ritvanen et al., 2006) and more specific for mental stress during computer work (Hjortskov et al., 2004). In

this thesis, Root Mean Square of the Successive Differences (RMSSD) of the rhythm-to-rhythm (RR) intervals was used as a parameter for HRV, which estimates the parasympathetic activity regulation of the heart. This variable is considered as a time domain technique to assess HRV and is measured in milliseconds (ms). This parameter looks at the short term variations, calculating successive RR interval differences. Lower values of RMMSD point out higher stress levels. Research conducted by Orsila et al. (2008) found lower RMSSD during the workday associated with higher stress. This was additionally confirmed when they perceived higher values of RMSSD during the night which was explained by experiencing less stress (Orsila et al., 2008).

2.5 Stress and physical activity

The association between, on one hand, stress, and on the other hand, physical activity and exercise, can be studied in two directions. First, the effect of exercise and physical activity on stress has been proven to have beneficial mental health effects (Salmon, 2001). Second, the association between stress and physical activity can be studied in the opposite direction, which has been less investigated. The main question is then: 'Does stress have an influence on physical activity and exercise behaviour?'. Studies have found stress as a significant predictor for unfavourable health behaviours (e.g. Wiebe & McCallum, 1986; Tucker, Weymiller, Cutshall, Rhudy, & Lohse, 2012). Exercise interventions have shown to be effective in lowering perceived stress levels (Norris, Carroll, & Cochrane, 1992). The study of Ng and Jeffery (2003), based on a transactional approach (Lazarus & Folkman, 1984), showed that there is a significant relationship between high perceived general stress and less frequent exercise. This study has been done in 26 workplaces in the US. People who failed to carry out their intentions to exercise had significantly higher work demands, as well as lower exercise self-efficacy levels. This was in comparison with people who implemented their intentions. This provides evidence that work stress may get in the way of implementing good intentions. A log study by Payne, Jones and Harris (2010) supports these findings. Finally, research has found reduced levels of physical activity among employees reporting work-to-family conflict (Roos, Sarlio-Lähteenkorva, Lallukka & Lahelma, 2007) and family-to-work conflict (Allen & Armstrong, 2006; Roos et al., 2007).

Payne, Jones and Harris (2011) found that employees considered convenient and free (or cheap) exercise facilities at work to be important in supporting exercise. Flexible working (e.g., flexible working hours) has also been linked to increased exercise

participation (Grzywacz, Casey & Jones, 2007; Payne et al., 2011). However, Payne et al. (2011) found that being too busy at work (i.e., time-based conflict) was perceived to be a barrier to exercise. Although many employees in this study acknowledged that this may be used as an excuse, long working hours have previously been found to be related to reduced exercise (Artazcoz et al., 2009; Jones et al., 2007).
On the contrary, no association has been found between occupational stress and exercise (Budden & Sagarin, 2007). However, these researchers found a relation between stress and perceived behavioural control for exercise, which consistently predicted intention to exercise. Intention was predicting actual exercise.

2.6 Operational definitions

- *Sedentary behaviour:* term used to describe a group of behaviour that involves awaking behaviour in a sitting or lying down position that is indicated by an energy expenditure ≤ 1.5 METs (Tremblay, 2012).

- *Intention:* key determinant of behavior and refers to how much effort people are willing to put in performing a certain behavior (Ajzen, 1991).

- *Attitude strength:* reflects the power of how a person evaluates the effects of a specific behavior (Liska, 1984).

- *Perceived behavioural control:* can be seen as control beliefs of factors that may facilitate or hinder performing that behavior (Ajzen, 1991).

- *Self-identity:* refers to the most important and lasting aspects of a person's self-identity (cf. Sparks, 2000). In this case, it is the perception of people on their own sitting behavior and physical activity.

- *Perceived knowledge:* is the reflection of the participants' knowledge. In this case on issues related to sitting behavior and physical activity (Heinrich et al., 2008).

- *HRV:* heart rate variability refers to the beat-to-beat alterations in heart rate (Malik & Camm, 1995).

- *RMSSD*: root-mean square of differences between successive RR-intervals. RMSSD is a measure of HRV used in time domain analysis. RMSSD refers to the changes in HRV in the short term. RMSSD estimates high frequency variation in HR and it is mainly

vagally mediated. RMSSD is measured in milliseconds. As a parameter of HRV, RMSSD is preferred in clinical use (Malik & Camm, 1995).

3 PURPOSE OF THE STUDY

People with a sedentary job are a useful target to focus on when studying decreasing physical inactivity, since it has been reported that in Finland 46% and 51% of the women and men, respectively, sit more than 6 hours each day (Sjöström, Oja, Hagströmer, Smith & Bauman, 2006). In previous studies, it has been shown that sitting time is considered as a health risk, independent from the absence of exercising (Burton et al., 2011). Thus, besides promoting physical activity, decreasing sedentary behaviour should be studied. Furthermore, it can be interesting to investigate which role stress plays in our intervention that aims at reducing sedentarism.

This study is part of a randomized controlled trial (Finni et al., 2011). Family-based tailored counselling has been conducted in order to increase non-exercise physical activity among parents with a sedentary job. The main contribution of this thesis is investigating the prediction of intention and actual behaviour of non-exercise physical activity according to the theory of planned behaviour in both the experimental and the control group.

4 METHODS

4.1 Subjects

Participants in this study were sixty-eight sedentary adults, both men (N = 29) and women (N = 39), (M = 37.8 years and SD = 5.8). These adults are parents of young children and were recruited from kindergartens and primary school through advertisements to get the parents involved. This has been done in Jyväskylä, Finland. The kindergartens and primary schools have been pre-randomized after balancing different socioeconomic and environmental regions within Jyväskylä. Healthy men and women, who are reporting that they are sitting more than 50% during their work time in their occupation, were chosen to participate to the study. Furthermore, there were exclusion criteria for participants such as: self-reported chronic long-term musculoskeletal disease or progressive neurological disease, diagnosed cardiovascular or metabolic disease with regular medication, pregnant women and people with a BMI larger than 35.

4.2 Measurements

4.2.1 Sedentary ratio

Sedentary behavior in the data analysis has been represented by sedentary ratio. In this study, post sedentary ratio was considered as the dependent variable, whereas pre sedentary ratio functioned as the independent variable. Sedentary ratio was calculated by dividing the sedentary time (in minutes) by the total measurement time (in minutes). These calculations were multiplied by 100, resulting in the sedentary ratio variable (in percentage). Sedentary time was collected by measuring the muscle activity. EMG was measured from quadriceps and hamstring muscles and EMG shorts are researched as accurate estimations of energy expenditure. The whole procedure explaining the data through EMG can be found in Pesola et al. (2014).

4.2.2 TPB measures

TPB measures functioned as independent variables. Participants had to indicate for every item with all the variables what described them the best. Items were developed according to the manual for health services researchers (Francis et al., 2004).

Intention. This variable has been assessed with three items. An example of an item is 'I intend to increase Non-Exercise Physical Activity during the next six months'. Participants had to answer on a 7-point scale from possible (1) to impossible (7). The score was calculated by summing all three answers and dividing by three, so the lower the total score was, the higher their intention to increase non-exercise physical activity. The reliability of this construct has been assessed through the *Cronbach's alpha* index and the value was satisfactory (α = .96).

Attitude strength. This variable reflects how strong their willingness is to increase non-exercise physical activity behavior. This has been evaluated by eight items where participants had to answer on a 7-option response format. An example of an item is 'Is it important to you to increase your non-exercise physical activity during the next 6 months?' where the persons had to answer on the scale from extremely important (1) to extremely unimportant (7). The score was calculated by summing all eight answers and dividing by eight. The lower the total score was, the stronger the attitude towards increasing non-exercise physical activity. The reliability on this construct was high (α = .90).

Perceived Behavioral Control (PBC). Four items assess how the participants see their control over increasing non-exercise physical activity in the next six months. An example is 'For me to increase non-exercise physical activity in the next six months is…'. On a 7-point scale, participants answered from 'easy' (1) tot 'difficult' (7). The total score was calculated by summing all four answers and dividing by four. The lower the total score, the more perceived behavioral control the participants have. The reliability between these items, on this construct, was satisfactory (α = .78).

Self-identity. This variable has been assessed with four items reflecting how a person views him- or herself concerning sedentary behavior/physical activity. An example of one of the asked statements is 'It is on my character to be a lazy sitting person'. Participants can answer on a 7-point scale with on the extreme left side 'strongly disagree' (1) and on the extreme right side 'strongly agree'(7). The four items were summed and dividing by four to become the total score. A higher total score means that a participant considers himself as more sedentary. The reliability, measured by *Cronbach's Alpha*, was satisfactory (α = .78).

Perceived knowledge. This variable used four questions, in order to research the perceived knowledge related to non-exercise physical activity. One of the questions was 'How informed you think you are on issues related to non-exercise physical activity?'. Answers were given on a 7-point scale format; for example, from 'no knowledge at all' (1) to 'very much knowledge' (7). Therefore, having a higher total score means that persons consider themselves as more informed about non-exercise physical activity. The reliability measure *Cronbach's Alpha* was high for this construct (α = .81).

4.2.3 HRV measures

To measure HR and HRV, participants had to wear an Alive HR monitor (Alive Technologies, Perth, Australia). On the two time points (baseline and end line) HR and HRV were measured for the following three days and two nights. In this study, only the average results of the daytime were used. Comparing these results between the two time points, the measurements should be done at the same time each day and should have the same length of time. Therefore, days were cut into 14-hour clips (starting from waking up) to analyze HR measures during the daytime. By doing so, the whole day can be described by HR and HRV measurements. In this study, RMSSD is analyzed as a HRV variable. This indicates vagal activity and therefore is an indicator for stress. Lower values are indications for higher stress levels. Differences between pre and post of these indicators were calculated. These HR and HRV measurements were done by Alive devices and later on, the results were analyzed with Firstbeat HEALTH–software (Firstbeat technologies, Finland, Jyväskylä). The measurements were extracted to digital form and then further analyzed by the Firstbeat HEALTH-software using Fast Fourier Transform and neural network modeling (Saalasti, 2003).

4.3 Procedure

4.3.1 Description intervention

This thesis is part of a larger project; the intervention has been done earlier (Finni et al., 2011). Tailored counselling based on social cognitive theories has been done by research personnel with the purpose of decreasing sitting time and increasing non-exercise daily activity. First, there has been a 30-minute lecture organized to give information about physical activity and sedentary behaviour. Second, there were face-

to-face discussions where participants described their way of living concerning their activity level. Later, personal goals were set and discussed how to improve non-exercise physical activity during work time and commuting to work. Additionally, participants had access to the website where extra motivational material was provided. The tailored counselling was reinforced by phone calls (after 1 and 5 months). Moreover, motivational e-mails were sent monthly. Overall, the reinforcement period lasted for six months where participants got individual feedback of their daily physical (in)activity. After that, researcher contact ended. The whole timeline is displayed in the figure 1. Ethics approval for the intervention study has been obtained from the Ethics Committee of Central Finland Health Care District on March 25, 2011.

4.3.2 Timeline

In this randomized controlled intervention (RCT) participants were divided in an intervention group and a control group. For the needs of the current thesis, two time points of measurements have been included: at the baseline, before participants received tailored counselling, and at the end line (at twelve months). At the baseline measurements, sedentary behavior and HRV were used to assess participant's everyday life physical activity behavior before the counselling period. Questionnaires were taken from the participants to measure their sedentary behavior. Next to that, stress was objectively assessed by HRV measurements for three days during day time. After these first measurements, the counselling period of six months was given by research personnel to the intervention group. The next six months was considered as the maintenance period that aimed to see if possible changes were retained. At the end of this maintenance period, at 12 months, the same measurements were repeated with the additional questionnaire assessing the main constructs of the Theory of Planned Behavior (TPB, Ajzen, 1991). The control group has been assessed with the same techniques as in the intervention group. All participants were told to live a normal life during all measurements.

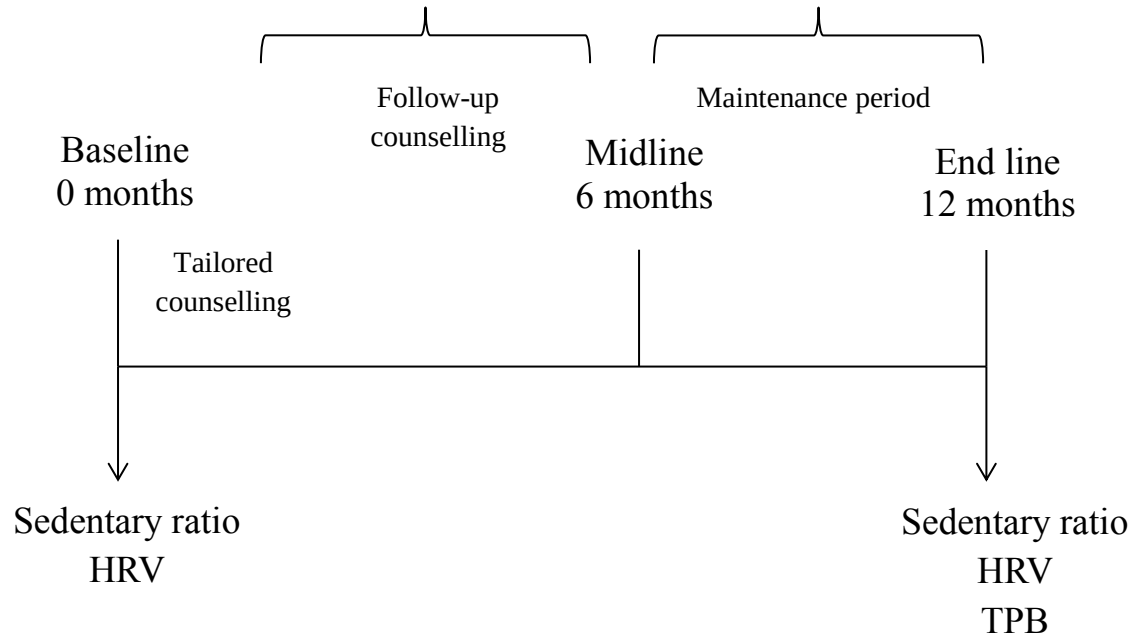
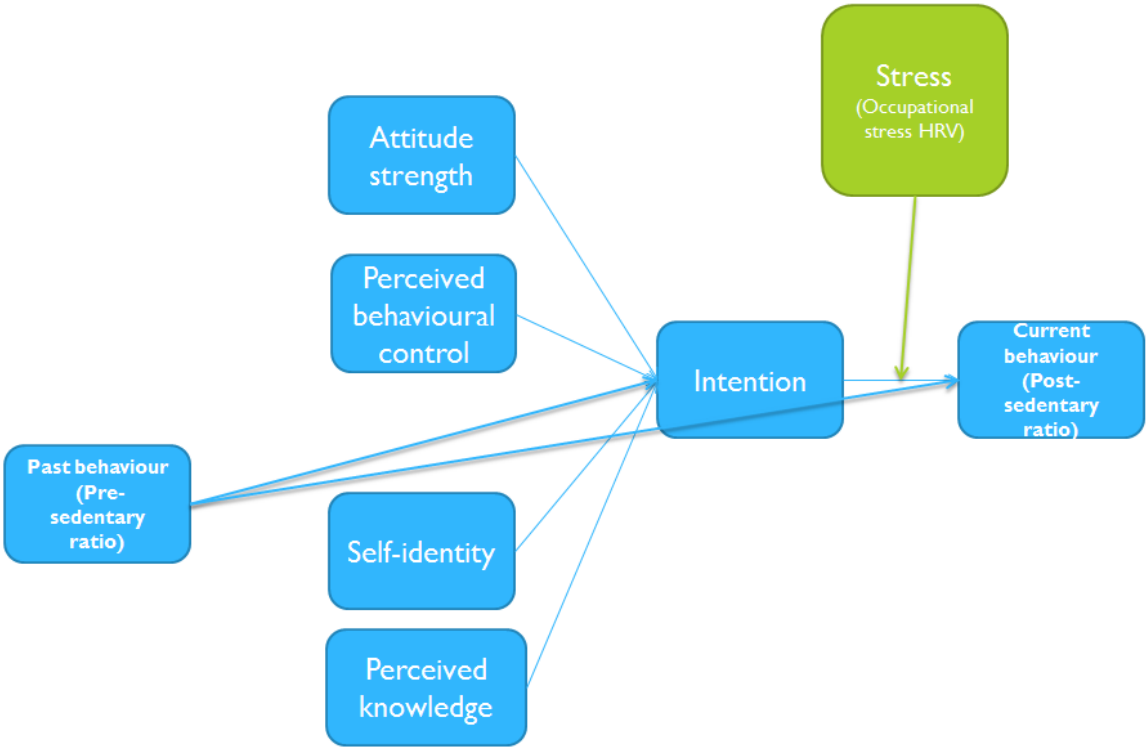


Fig. 1 The upper part represents the intervention time line with the period of tailored counselling, the follow-up period and maintenance period. The lower part represents the measures time line including questionnaires for testing sedentary ratio, and TPB variables and HRV measures.

4.3.2 Model to be tested



4.4 Statistical analyses

Microsoft Excel 2010 and IBM SPSS 20.0 software (SPSS Inc., Chicago, Illinois, USA) were used to analyze all data. To test how well the constructs of the TPB model predict intention in order to decrease sedentary behavior, we used multiple regression analysis. Therefore, the current behavior (post sedentary ratio) was considered as the dependent variable. Past behavior (pre sedentary ratio), constructs of the TPB model and HR and HRV measures, were seen as independent variables. Using within-subjects, the sample was divided into two groups: the experimental group and the control group. The two groups were created by randomization, done in the study of Finni et al.(2011).

5 RESULTS

Data was split by groups: the experimental group and the control group. All analyses have been done for each group separately.

5.1 Descriptive statistics

In the experimental group there were 38 participants, both men (*N* = 15) and women (*N* = 23). In the control group 30 persons participated (*N* = 14 for men and *N* = 16 for women). The means and standard deviations among all variables for both separate groups are presented in table 1.

Table 1

Variables with corresponding Mean and Standard Deviation for experimental group and control group

	Experimental group		Control group	
	M	SD	M	SD
Post sedentary ratio	.57	.11	.55	.06
Pre sedentary ratio	.57	.09	.56	.09
Attitude strength	2.46	1.06	2.65	.91
PBC	5.24	1.17	5.13	.97
Self-identity	5.75	1.14	5.27	1.29
Perceived knowledge	2.65	.81	2.74	1.00
Intention	5.28	1.32	4.47	1.83
RMSSD (post – pre)	-.67	6.83	.38	8.66

5.1 Correlations

Results in the experimental group of the correlation analysis revealed that post sedentary ratio was correlated significantly with all independent variables with higher value on pre sedentary ratio (r = .63, p < .01), intention (r = - .47, p < .05), attitude strength (r = .43, p < .01), self-identity (r = - .50, p < .01), and perceived knowledge (r = .48, p < .01) and lower value on PBC (r = - .40, p < .05) and on the difference between pre and post measures in RMSSD (r = .46, p < .05). In the control group, the post sedentary ratio was correlated only with the pre sedentary ratio (r = .41, p < .05) and no other variable.

Table 2

Correlation Matrix: experimental group

Variable		1	2	3	4	5	6	7	8
1	Post sedentary ratio	1.00							
2	Pre sedentary ratio	.63**	1.00						
3	Attitude strength	.43**	.12	1.00					
4	PBC	-.40*	-.05	-.77**	1.00				
5	Self-identity	-.50**	-.09	-.46**	.50**	1.00			
6	Perceived knowledge	.48**	.25	.42**	-.30	-.46**	1.00		
7	Intention	-.47**	-.05	-.87**	.69**	.38*	-.36*	1.00	
8	RMSSD (post - pre)	.46*	.36	.39	-.20	-.26	.38	-.47*	1.00

Note: ** p < .01, * p < .05

Table 3

Correlation Matrix: control group

Variable		1	2	3	4	5	6	7	8
1	Post sedentary ratio	1.00							
2	Pre sedentary ratio	.41*	1.00						
3	Attitude strength	.01	.11	1.00					
4	PBC	-.07	.41*	-.74**	1.00				
5	Self-identity	.17	.22	-.26	.45*	1.00			
6	Perceived knowledge	.05	.32	.11	-.36*	-.17	1.00		
7	Intention	-.03	.01	-.62**	.41	-.11	.12	1.00	
8	RMSSD (post - pre)	-.53	.11	.17	-.17	.26	-.12	-.24	1.00

Note: ** $p < .01$, * $p < .05$

5.2 Regressions: predicting non-exercise physical activity and the role of stress

Hierarchical regression analyses were used in order to investigate which variables better predict non-exercise physical activity for separate groups. Sedentary ratio has been used as an index for the non-exercise physical activity.

The explanatory (independent) variables were pre sedentary ratio, TPB measures (attitude strength, PBC, self-identity, perceived knowledge, and intention) and the stress parameter RMSSD, whereas the dependent variable was the post sedentary ratio.

Despite a small sample size, the assumptions of multicollinearity, linearity, normality and homoscedasticity were tested in preliminary analysis. All assumptions were met. Then, all independent variables were entered in four steps: 1) Pre Sedentary Ratio, 2)

Attitude strength, PBC, Self-identity and Perceived Knowledge, 3) Intention, 4) RMSSD (post-pre).

For the experimental group, the Step 1 of the hierarchical regression model explained 39% of the variance in Post Sedentary Ratio (R^2 = .42, *adjusted* R^2 = .39). Adding attitude strength, PBC, self-identity and perceived knowledge to the regression model in Step 2 an additional 29% of the variation has been explained and this change was significant (*F change* $_{(4, 18)}$ = 4.52, p < .01). Then, in Step 3 after the variable Intention was added, an additional 6% in the variance of Post Sedentary Ratio was explained. This change was marginally significant, (*F change* $_{(1, 17)}$ = 4.04, p = .06). Finally, in Step 4, the variable RMSSD (post-pre) was entered into the model. This resulted in 66% of total variance in sedentary behavior explained by the whole model with all independent variables included ($F_{(7, 16)}$ = 7.46, p < .00). There was no additional explanatory power in the variance, comparing to the model explored in Step 3 (R^2 *change* = .00, *F change* $_{(1, 16)}$ = .02, p = .88). In the final model, the variable that contributed to the explanation of the dependent variable post sedentary ratio was the pre sedentary ratio.

Table 4

Hierarchical Regression Analysis. Predictors for post sedentary ratio in four steps in the experimental group. R, R^2, adjusted R^2, R^2 change and the standardized Beta are reported.

Variable	R	R^2	Adjusted R^2	R^2 change	Beta
Step 1	.65	.42	.39	.42	
Pre sedentary ratio					.65**
Step 2	.84	.71	.63	.29	
Pre sedentary ratio					.44*
Attitude strength					.06
PBC					-.23
Self-identity					-.29
Perceived knowledge					.14

Step 3	.88	.77	.68	.06	
Pre sedentary ratio					.54**
Attitude strength					-.43
PBC					-.21
Self-identity					-.26
Perceived knowledge					.13
Intention					-.56
Step 4	.88	.77	.66	.00	
Pre sedentary ratio					.55*
Attitude strength					-.43
PBC					-.19
Self-identity					-.26
Perceived knowledge					.14
Intention					-.58
RMSSD (post - pre)					-.03

For the control group, the hierarchical regression model does not explain any significant variance in the first step (R^2 = .05, *adjusted* R^2 = -.05). The variables added in Step 2 did not add any significant changes to the regression model ($F_{(4, 6)}$ = .39, p = .81). This was also the case in Step 3 after adding intention ($F_{(1, 5)}$ = 1.50, p = .28). In the final step, RMSSD (post-pre) was added with explaining 40% of the variance in Post Sedentary Ratio of the model as a whole. The change was marginally significant, ($F_{(1, 4)}$ = 6.62, p = .06). In the final model the variable that approached significance (p = .06) was the RMSSD (post-pre) (*Beta* = -.64).

Table 5

Hierarchical Regression Analysis. Predictors for post sedentary ratio in four steps in the control group. R, R^2, adjusted R^2, R^2 change and the standardized Beta are reported.

Variable	R	R^2	Adjusted R^2	R^2 change	Beta
Step 1	.21	.05	-.05	.05	
Pre sedentary ratio					.21
Step 2	.49	.24	-.39	.20	
Pre sedentary ratio					-.03
Attitude strength					.32
PBC					-.11
Self-identity					.03
Perceived knowledge					.27
Step 3	.65	.42	-.29	.18	
Pre sedentary ratio					-.19
Attitude strength					.71
PBC					-.16
Self-identity					.64
Perceived knowledge					.07
Intention					1.02
Step 4	.88	.78	.40	.36	
Pre sedentary ratio					-.19
Attitude strength					.52
PBC					-.41
Self-identity					.90
Perceived knowledge					.12
Intention					1.02
RMSSD (post - pre)					-.64

Stress as an additional variable explains more variance when entered in the analysis in the control group, but not in the experimental group. The R^2 of the variable RMSSD, which is an indicator of stress, is bigger. This means that bigger proportion of the variance is explained by stress in the control group, but not in the experimental group. Although this result is not significant, it is still a good indication for further research.

Additionally, another important finding is that the same variables in the experimental group explain the post sedentary ratio whereas in the control group they do not. This means that the sedentary behavior is not a cognitively controlled behavior; that is, it cannot be explained through cognitive variables. In other words, people do not know that they are sedentary unless an intervention makes them realize that they are sedentary and activate them to change.

6 DISCUSSION

The main purpose of the present study was to test how well the constructs of the theory of planned behaviour (TPB, Ajzen) predict intention to decrease sedentary behaviour in a group of parents with small children and a sedentary job versus a control group. The secondary purpose of this study aimed to explore if stress explains additional variation when is entered as an additional variable between intention and sedentary behaviour.

An extended model of TPB was used to explore sedentary behaviour in parents. Three predictive variables such as attitude strength, self-identity and perceived knowledge were added to the original model. The main finding is that the extended TPB model explained the variance only in the experimental group. Although the influence of the intervention was not reflected in a decrease in sedentary behaviour, there was a bigger explained variance in the group who received the intervention when TPB variables were entered in the model. This could mean that the cognitive part is activated when experiencing an intervention, but this was not enough to change their behaviour as well. In other words, people tend to become increasingly aware after receiving an intervention to reduce their sitting time. Sedentary behaviour is not a cognitively controlled behaviour, but interventions can make them aware of their current behaviour. Even when a certain behaviour is a habit, there is always a component of cognitive load involved (Bamberg, Ajzen, & Schmidt, 2003). That might be the reason why pre sedentary behaviour was predictive for post behaviour in the experimental group but not in the control group; consciousness makes past behaviour a contributing factor in predicting future behaviour (Ouelette & Wood, 1998). Although there is an indication for cognitive awareness in the intervention group, perceived knowledge included in the extended TPB model has not been found significant. A possible explanation for this finding is that knowledge alone is not related to physical activity change (Morrow et al., 2004).

Next, we found that in the control group, TPB variables did not make a prediction for post sedentary behaviour. This means that without an intervention, the cognitive aspect is not activated; the people were less aware of their own sedentary behaviour.

Another possible explanation as to why no explained variance was found in the control group is because the subjects in this group might not have been aware of the differences

in terminology. Sedentary behaviour does not only involve a lack of moderate to vigorous physical activity (Pate et al., 2008).

The findings also highlight a gap between intention and real behaviour within the TPB model. Intention as a concept forms the core of health behaviour research. According to the TPB model, intentions are the most important predictors for performing the wanted behaviour. At the same time, this theory also acknowledges that there might be a lack of control to convert intentions into real behaviour. Many people tend to perform the desired behaviour, but often fail in following through. Furthermore, high occupational stress tends to decline the strength of the liaison between intention and behaviour (Payne et al., 2002). Previously, research has been done with working adults who varied in occupational stress levels to investigate the exercise intention-behaviour relationship with the TPB theory as a framework (Budden & Sagarin, 2007). They questioned how they can make the intention-behaviour link stronger. They implemented intention, but it seemed that this was counterproductive. Subjects who exercised more were the ones not forming an implementation intention in comparison with the subjects who formed an implementation intention.
Meta-analysis revealed that intention predicts behaviour better for a single action, rather than a goal (Sheeran, 2002). In this case, intention could predict one specific action such as taking the stairs better than generally decreasing sitting time, which taking the stairs is only one part of it.

The study of Prapavessis, Gaston and DeJesus (2015) researched the predictive ability of the TPB model for sedentary behaviour using five different models. They made the models based on leisure or non-leisure and weekdays or weekend sedentary time. Then, they compared the models. To capture sedentary behaviour, they used the Sedentary Behaviour Questionnaire (SBQ; Rosenberg et al., 2010), which differs from our method (i.e., measuring real behaviour). TPB has been seen as a good model to explain and understand sedentary intention and behaviour. TPB constructs explained 43% of the variance in the model that was meaningful for this study, namely sitting time during working weekdays. The results indicated that intention explained 33% of the variance of sedentary behaviour on weekdays while working. These results point out that sedentarism is not just a habit, but that cognitive processes are involved; they play a relevant role. In addition, PBC and subjective norms were found to be independent

explanatory predictors for sedentary behaviour during working hours on weekdays (Prapavessis et al., 2015).

In order to understand the gap between the intention-behaviour link, research has focused on the moderators within the relationship. Baron and Kenny (1986) claimed that when a link between an independent and dependent variable (such as intention and behaviour) is inconsistent, an additional factor might be responsible for the variation within the association. Amireault, Godin and Vézina-Im (2008) found that annual income was identified as a psychosocial moderator in both PBC-behaviour and intention-behaviour relationships. Furthermore, the TPB model assumes that PBC is an accurate reflection of the actual control people have in performing the wanted behaviour (Ajzen, 1991). Specifically for exercise, the same has been found in research from Sheeran, Trafimow, and Armitage (2003). When PBC is a realistic reflection then it explains more variance in the studied behaviour compared to unrealistic PBC. It is possible that in the present study stress functions as an influencing factor in the gap between intention and increasing non-exercise physical activity. That means that the higher the stress level of the person, the less actual control they have over their behaviour. It is possible that stressed people face more barriers or have more trouble in overcoming the barriers to increase non-exercise physical activity. This could explain why we find in the control group an influence from stress on the association between intention and the target behaviour (decreasing sitting time). People in the control group did not get any suggestions how to overcome barriers, whereas in the intervention group, people received that kind of information. Therefore, it is possible there was no influence of stress in the intervention group.

The results of the current study show that stress seems to be a factor that interferes between intention and behaviour in the control group, but not in the experimental group. Finding this association means that stress explained a large proportion of the variation for sedentary behaviour. Although the effect is not significant, it can be a good indication for further research. In the experimental group, this phenomenon has not been found. Stress does not explain changes in behaviour after receiving an intervention. This difference could be explained by the knowledge that has been provided to the experimental group on how to overcome barriers in decreasing sitting time. In the experimental group, participants were taught how to deal with barriers. Stress can be seen as a factor that blocks persons to get more physically active. Although a significant

explained variance change has been found in the control group, the predicting variables were not significant. This can be explained by low correlation values among the variables and a low number of cases included in the study. Furthermore, the small sample size in combination with the high set of predictor variables can lead to this phenomenon.

6.1 Limitations

Although the study was accurately planned, the current study had to face several limitations. First, the number of participants was too small. The results should be interpreted carefully due to a small sample size. An intervention based study with follow-ups can lead to missing data and drop out. Thus, we conclude that it was difficult to collect a complete data set for each participant. Although there were missing data for some participants, we did not exclude them from the analyses. Missing data might be due to the fact that the subjects filled in the questionnaires at home. Being busy could be a possible reason to not properly fill in the questionnaire. This could have influenced the current results.

Second, stress and sedentary time could have been assessed by self-questionnaires, next to objective measures. In this study, stress had been derived from HRV data. In a previous master thesis from Schildt (2013), both methods had been used to measure stress. This thesis was involved in the same project as the current study. The results on the association between perceived and objectively measured stress were inconsistent. While stress was decreasing according to the questionnaire, HRV revealed that stress was elevated. Therefore, we only used the HRV method rather than the self-reported questionnaires. In the research of Orsila et al. (2008), it has been claimed that more HRV studies were needed amongst healthy people. Moreover, different concepts get mixed, while there are distinctions between sitting, standing and light physical activity. Self-reports are often not sensitive enough to capture differences between sitting, standing and light physical activity (Oliver et al., 2010); therefore, the measure of sedentary ratio with EMG shorts is considered as a more accurate measure of non-exercise physical activity, according to previous research from Pesola et al. (2011) .

Third, in future research with more participants, it is suggested that the same model should be tested by splitting the participants to low and high stress levels. In the present study, this was not possible, because participants have been exposed to different treatments; moreover, stress has individual characteristics that have to be controlled for

in future designs.

Fourth, in this study the intervention content itself is not based solely on the TPB as a theoretical framework. Although there is a need for experimental testing for the theory, the TPB has been used to predict non-exercise physical activity rather than developing and evaluating the behaviour change intervention. To research which components of the TPB are effective in an intervention, the experiment should be based on this theory only. This could show which processes and mechanisms are at work (Darker et al., 2010). Nevertheless, the intervention was based on the broader theoretical framework of social cognitive theory where constructs of TPB are included (Finni et al., 2011). Another limit concerning the TPB model is the time TPB questionnaires were filled in by the participants. The TPB questionnaires were given to the subjects at the end of the maintenance period (at time point 12 months). It would have been more informative if TPB was assessed before and immediately after the intervention. That way, more accurate predictions could have been made.

6.2 Strengths

Despite these limitations, this study contributed to the research field because of its uniqueness. There was an urgent need for research in sedentary behaviour. This study focused on reducing sedentary behaviour as a concept rather than focusing on physical activity. This is of increasing interest in the field. The presented results can be a stepping stone for further research.

Another strength of this study is the use of real behavioural measures for occupational stress and sedentary behaviour. HRV as an objective measure has been used to measure occupational stress, which in previous research from Orsila et al. (2008) has been expressed to be needed. For sedentary behaviour, EMG data has been used and calculated to sedentary ratio and is considered as accurate (Pesola et al., 2011). Precise methods are required to assess sedentary behaviour, whereas self-report can be seen as limited (Atkin et al., 2012). Furthermore, another advantage of this thesis is the chosen population. The workplace is an ideal setting to target less sitting. Depending on the employment type, employees are sitting more and more due to an exponential increase of computer use. The relationship between physical activity in general and occupational variables are underrepresented in contemporary research.

6.3 Future research suggestions

Studying sedentary behaviour is a rather new area in the research field. Improvements can be made in exploring how this kind of behaviour influences health using consistent terminology. Research should be done in specific settings (such working places) and populations (such as parents and their children) where sedentarism is a frequent characteristic. Special attention should be paid to different kinds of sedentary behaviour (e.g. computer screen watching at work, car driving …).

Earlier research results indicated the beneficial effects of taking breaks between sitting time such as executing non-exercise physical activity (Healy et al., 2007; Dunstan et al., 2012). However, little is known about the factors influencing sedentarism. These should be identified in future research in order to improve the development of interventions. Therefore, longitudinal studies are needed. Moreover, for making research of possible predictors better, the TPB model can be extended. Although it has been suggested to let the TPB theory retire from research in health behaviour (Sniehotta, Presseau, & Araújo-Soares, 2014), the TPB model can be a useful starting point, considering what has been learned from this theory. Extended versions can build further knowledge of predicting and understanding sedentary behaviour. It can be suggested to studying components of affective processes involved in this topic. This has been absent in the TPB model (e.g. Conner & Armitage, 1998). The automatic processes as a habit can be an additional component that ought to be tested regarding sedentary behaviour. Both sedentary and non-exercise physical activities usually are automatic-habitual and non-cognitively controlled behaviours, unless interventions reveal them into cognitively controlled behaviours (Bamberg et al., 2003).

Furthermore, as indicated in this thesis, stress plays a role in the link between intention and lowering sedentary time. Results were not significant, but this is a stepping stone to more in-depth research to the role of stress. Most studies have been looking at the effects of exercise on stress (Atlantis, Chow, Kirby & Fiatarone Singh, 2004). Researching the role of stress on sedentary and physical activity behaviour can give deeper insight into the dynamics between those variables. It would be interesting in future studies to include the stage of change of participants in the intervention. It has been shown that people who are in a higher phase of change are more likely to exercise in times of stress (Lutz, Stults-Kolehmainen & Bartholomew, 2010). It is possible that

participants in a higher stage of change would be less sedentary.

Last, future research can make use of objective and subjective measurements for both stress and sedentary behaviour. This way, more complexity can be understood of both topics.

6.4 Implications for practice

Creating awareness of increasing non-exercise physical behaviour and the destructive effects of sedentary behaviour could lead to forming a habit of being more active, taking small steps. This is important, considering it has been found that in Finland 46% of the men and 51% of the women sit more than six hours each day (Sjöström et al., 2006). This problem of sedentary behaviour is related to health risks, both physiological and psychological. Recently, it has been suggested that health issues are more indicated by sitting time than moderate to vigorous physical activity (Henson et al, 2013). Therefore, more and more research should focus on how to do research and intervene in reducing sedentary time, rather than increasing regular moderate to vigorous physical activity. These types of behaviour can be seen as different concepts (Burton et al., 2011). Therefore, this requires a different approach for intervention. This thesis is based on an intervention targeting people working in offices to make them sit less and to make them slightly more active. The workplace setting seems to be an effective setting to stimulate behaviour change such as non-exercise physical activity. Since technology is developing rapidly and people tend to sit more, it is fruitful to target sitting time. Researching possible influencing factors such as stress can be used to develop more effective interventions in the future. Stress can be seen as an important factor influencing whether people engage in physical activity; stress can hinder people from committing to physical activity (Stults-Kolehmainen & Sinha, 2014). Overall, paying attention to diminishing sitting time should be beneficial for public health and increase health outcomes. If people would be able to change their sitting behaviour by taking small steps such as performing low intensity physical activity, then it can further develop into engaging in moderate to vigorous physical activity. All of this knowledge is essential in developing interventions to contribute to the overall health of people, especially for those who are involved in sedentary behaviours such as office work employees.

The major finding of this research as an implication for practice is that people need to be aware of the harming effects of their sedentary behaviour and how to increase their

non-exercise physical activity in order to be able to make small changes in their everyday routine, ultimately leading to the reception of health benefits elicited from these changes.

6.5 Conclusion

The purpose of this study was to explore the predictive ability of TPB constructs on decreasing sedentary behaviour and increasing non-exercise physical activity for parents of young children with a sedentary job. In light of developing interventions in order to change sedentary behaviour, it is important to effectively predict and explain this behaviour. Specifically, health-related behaviour such as sedentary time should be a focus, since it exhibits many health risks. Enough research has been completed for sedentary behaviour to be introduced in public health physical activity guidelines in the future (Hamilton et al., 2008). When behaviour is executed regularly, cognitive processes are less involved. However, the TPB model showed that interventions can make people aware of their behaviour. Furthermore, the role of stress was explored. It is suggested to take into account the stress level that might be a barrier when targeting people to decrease their sitting time.

7 REFERENCES

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50. 179–211.

Ajzen, I., & Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behavior*. Prentice-Hall, Englewood Cliffs, NJ.

Allen, T. D., Armstrong, J. (2006). Further examination of the link between work family conflict and physical health. *American Behavioral Scientist,* 49:1204 1221.

Amireault, S., Godin, G., & Vézina-Im (2013). Determinants of physical activity maintenance: a systematic review and met-analyses. *Health Psychology Review*, 7: 55-91.

Artazcoz, L., Cortès, I., Escribà-Agüir, V., Cascant, L. Villegas, R. (2009). Understanding the relationship of long working hours with health status and health-related behaviours. *Journal of Epidemiology and Community Health*, 63, 521-527.

Atkin, A. J., Gorely, T., Clemes, S. A., Yates T., Edwardson, C., Brage, S., … Biddle, S. J. H. (2012). Methods of measurement in epidemiology: sedentary behaviour. International Journal of Epidemiology, 41: 1460-1471. DOI:10.1093/ije/dys118.

Atlantis, E., Chow, C.-M., Kirby, A., & Fiatarone Singh (2004). An effective exercise based intervention for improving mental health and quality of life measures: a randomized controlled trial. *Preventive Medicine*, 39(2): 424-434.

Bamberg, S., Ajzen, I., & Schmidt, P. (2003). Choice of travel mode in the theory of planned behavior: The roles of past behavior, habit, and reasoned action. *Basic and Applied Social Psychology*, 25, 175-188.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6): 1173-1182.

Biddle, S.J.H., Gorely, T., & Stensel, D.J. (2004). Health-enhancing physical activity and sedentary behaviour in children and adolescents. *Journal of Sports Science*, 22:679 701.

Blair, S. N. (2009). Physical inactivity: the biggest public health problem of the 21st century. *British Journal of Sports Medicine*; 43: 1-2.

Brown, W. J., Mishra, G., Lee, C., & Bauman, A. (2000). Leisure time physical activity in Australian women: relationship with well-being and symptoms. *Research Quarterly for Exercise and Sport*, 71(3): 206-16.

Brownson, R. C., Boehmer, T. K., & Luke, D.A. (2005). Declining rates of physical activity in the United States: what are the contributors? *Annual Review Public Health*. 26:421 43. DOI: 10.1146/annurev.publhealth.26.021304.144437.

Budden, J. S., & Sagarin, B. J. (2007). Implementation intentions, occupational stress, and the exercise intention-behavior relationship. *Journal of Occupational Health Psychology*, 12(4): 391-401.

Burton, N. W., Khan, A., Brown, W. J., & Turrell, G. (2011). The association between sedentary leisure and physical activity in middle-aged adults. *British Journal of Sports Medicine*, DOI:10.1136/bjsm.2010.081430.

Carr, L. J., Walaska, K. A., & Marcus, B. H. (2012). Feasibility of a portable pedal exercise machine for reducing sedentary time in the workplace. *British Journal of Sports Medicine*; 46:430–435. DOI:10.1136/bjsm.2010.079574.

Conner, M., & Armitage, C. J. (1998). Extending the theory of planned behavior: A review and avenues for further research. *Journal of Applied Social Psychology*, 28, 1429-1464.

Conner, M., & Sparks, P. (2005). Theory of Planned Behaviour and Health Behaviour. In M. Conner & P. Sparks (Eds.), *Predicting health behaviour: Research and practice with social cognition models 2nd edition*. (pp 170-222). Mainhead: Open University Press.

Cox, T., Griffiths, A., & Rial-Gonzales, E. (2000). Research on Work-related Stress. *European Agency for Safety and Health at work*. Institute of work, health and organisations, United Kingdom.

Darker, C. D., French, D. P., & Eves, F. F. (2010). An intervention to promote walking amongst the general population based on an "extended" theory of planned behavior: a waiting list randomized controlled trial. *Psychology & Health*. 2010;25:71–8. DOI:10.1080/08870440902893716.

DeMattia, L., Lemont, L., & Meurer, L. (2006). Do interventions to limit sedentary behaviours change behaviour and reduce childhood obesity? A critical review of the literature. *Obesity reviews*. 8 , 69–81. DOI: 10.1111/j.1467 789X.2006.00259.x.

De Cocker, K. A., De Bourdeaudhuij, I. M., Brown, W. J., & Cardon, G. M. (2007). Effect of "10,000 steps Ghent": a whole-community intervention. *American Journal of Preventive Medicine.* 33(6): 455-63.

Dimmock, J., & Banting, L. (2009). The influence of implicit cognitive processes on physical activity: How the theory of planned behavior and self-determination theory can provide a platform for understanding. *International Review of Sport and Exercise Psychology*, 2, 3-22.

Dunn, A. L., Marcus, B. H., Kampert, J. B., Garcia, M. E., Kohl III, H. W., & Blair, S. N. (1999). Comparison of lifestyle and structured interventions to increase physical activity and cardiorespiratory fitness. *JAMA* – Vol 281, No. 4.

Dunstan, D. W., Barr, E. L. M., Healy, G. N., Salmon, J., Shaw, J. E., Balkau, B., Magliano, D. J., Cameron, A. J., Zimmet, P. Z., & Owen, N. (2010). Television viewing time and mortality: the Australian diabetes, obesity and lifestyle study (AusDiab) *Circulation*, 121:384-391.

Dunstan, D. W., Kingwell, B. A., Larsen, R., Healy, G. N., Cerin, E., Hamilton, M. T., Shaw, J. E., Bertovic, D. A., Zimmet, P. Z., Salmon, J., & Owen, N. (2012). Breaking up prolonged sitting reduces postprandial glucose and insulin responses. *Diabetes Care*, 35(5): 976-83. DOI: 10.2337/dc11-1931.

Elkin, A. J., & Rosch, P. J. (1990). Promoting mental health at the workplace: the prevention side of stress management. *Occupational Medicine State of the Art review*. 5(4), 739-754.

Finni, T., Sääkslahti, A., Laukkanen, A., Pesola, A., & Sipilä, S. (2011). A family based tailored counselling to increase non-exercise physical activity in adults with a sedentary job and physical activity in their young children: design and methods of a year-long randomized controlled trial. *BMC Public Health* 11:944.

Focht, B. C. (2013). Brief walks in outdoor and laboratory environments. *Handbook: Effects on affective responses, enjoyment, and intentions to walk for exercise* (pp. 611-620). DOI: 10.1080/02701367.2009.10599600.

Francis, J., Eccles, M. P., Johnston, M., Walker, A. E., Grimshaw, J. M., Foy, R., Kaner, E. F. S., Smith, L. & Bonetti, D. (2004). Constructing questionnaires based on the theory of planned behaviour: A manual for health services researchers. Newcastle upon Tyne, UK: Centre for Health Services Research, University of Newcastle upon Tyne.

Gilson, N. D., Puig-Ribera, A., McKenna, J., Brown, W. J., Burton, N. W., & Cooke, C. B. (2009). Do walking strategies to increase physical activity reduce reported sitting in workplaces: A randomized control trial. *The International Journal of Behavioral Nutrition and Physical Activity*, 6, 1-7.

Glass, D. C., & Singer, J. E. (1972) Urban Stress: Experiments on Noise and Social Stressors. *Academic Press*, New York.

Grzywacz, J. G., Casey, P. R., & Jones, F. A. (2007). The effects of workplace flexibility on health behaviors: A cross-sectional and longitudinal analysis. *Journal of Occupational and Environmental Medicine*, 49(12), 1302-1309.

Hagger, M. S., Chatzisarantis, N. L. D., & Biddle, S. J. H. (2002). A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity and the contribution of additional variables. *Journal of Sport & Exercise Psychology*, 24, 3-32.

Hamilton, M. T., Healy, G. N., Dunstan D. W., Zderic T. W., & Neville, O. (2008). Too little exercise and too much sitting: inactivity physiology and the need for new recommendations on sedentary behavior. *Current Cardiovascular Risk Reports 2(4): 292-298*. DOI: 10.1007/s12170-008-0054-8

Hardeman, W., Johnston., M., Johnston, D., Bonetti, D., Wareham, N., & Kinmonth, A. L. (2002). Application of the Theory of Planned Behaviour in Behaviour Change Interventions: A systematic review. *Psychology & Health.* 17:2, 123 158. DOI: 10.1080/08870440290013644a

Healy, G. N., Dunstan, D. W., Salmon, J., Cerin, E., Shaw, J. E., Zimmet, P. Z., & Owen N. (2008). Breaks in sedentary time: beneficial associations with metabolic risk. *Diabetes Care*, 31: 661-666.

Heinrich, K. M., Lee, R. E., Regan, G. R., Reese-Smith, J. Y., Howard, H. H., Haddock, C. K., Poston, W. S. C., et al. (2008). How does the built environment relate to body mass index and obesity prevalence among public housing residents? *American Journal of Health Promotions*, 22(3): 187–194.

Heinrich, K. M., Maddock, J., & Bauman, A. (2011). Exploring the relationship between physical activity knowledge, health outcomes expectancies, and behavior. *Journal of Physical Activity and Health*, 8, 404-409.

Henson, J., Yates, T., Biddle, S. J. H., Edwardson, C. L. Khunti, K., Wilmot, E. G., Gray, L. J., Gorely, T., Nimmo, M. A., & Davies, M. J. (2013). Associations of objectively measured sedentary behaviour and physical activity with markers of cardiometabolic health. *Diabetologia*. DOI: 10.1007/s00125-013-2845-9.

Hjortskov, N., Rissén, D., Blangsted, A. K., Fallentin, N., Lundberg, U., Søgaard, K. (2004).The effect of mental stress on heart rate variability and blood pressure during computer work. *European Journal Applied Physiology*, 92(1-2): 84-9.

Horsten, M., Ericson, M., Perski, A., Wamala, S. P., Schenck-Gustafsson, K., & Orth Gomér, K. (1999). Psychosocial factors and heart rate variability in healthy women. *Psychosomatic Medicine*, 61:49-57.

Hu, F. B., Leitzmann, M. F., Stampfer, M. J., Colditz, G. A., Willett, W. C., & Rimm, E. B. (2001). Physical activity and television watching in relation to risk for type 2 diabetes mellitus in men. *Archives of Internal Medicine*. 161:1542–8.

Hynynen, E. (2011). Heart Rate Variability in Chronic and Acute Stress. Jyväskylä, University of Jyväskylä. Ph.D thesis.

Jensen (2003). Development of neck and hand-wrist symptoms in relation to duration of computer us at work. *Scandinavian Journal Work Environmental Health.* 29(3): 197-205.

Katzmarzyk, P. T, Church, T. S., Craig, C. L., & Bouchard, C. (2009). Sitting time and mortality from all causes, cardiovascular disease, and cancer. *Medicine of Science and Sports Exercise*, 41:998-1005.

Kim, D., Seo, Y., & Salahuddin, L. (2008). Decreased Long Term Variations of Heart Rate Variability in Subjects with Higher Self Reporting Stress Scores. *Pervasive Healthcare.*

King, A. C., Blair, S. N., Bild, D. E., Dishman, R. K., Dubbert, P. M., Marcus, B. H., Oldridge, N. B., Paffenbarger, R. S., Jr, Powell, K. E., & Yaeger, K. K. (1992). Determinants of physical activity and interventions in adults. *Medicine and Science in Sports and Exercise*, 221–S236.

Kinnunen, M. L. (2005). Allostatic load in relation psychosocial stressors and health. Jyväskylä Studies in Education, *Psychology and Social Research*, 275.

Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping. *New York: Springer*.

Lehto, A. M., & Sutela, H. (2008). Suomen virallinen tilasto (SVT): Työolotutkimus. Työolojen kolme vuosikymmentä. Työolotutkimusten tuloksia 1977-2008. Helsinki: Tilastokeskus.

Liska, A. E. (1984). A critical examination of the causal structure of the Fishbein/Ajzen attitude-behavior model. *Social Psychology Quarterly*, 47, 61-74.

Lutz, R. S., Stults-Kolehmainen, M. A., & Bartholomew, J. B. (2010). Exercise caution when stressed: stages of change and the stress-exercise participation relationship. *Psychology and Sport and Exercise*. 11, 560–567. DOI: 10.1016/j.psychsport.2010.06.005.

Malik, M., Camm, A. J. (eds). (1995). Heart Rate Variability. Armonk, NY: *Futura Pub. Co. Inc*, 99-118.

McGrath, J. E. (1970). Major methodological issues. In J. E. McGrath (Ed.), Social and psychological factors in stress. *New York: Holt, Rinehart & Winston*, 19-49.

Melamed, S., Shirom, A., Toker, S., Berliner, S., & Shapira, I. (2006). Burnout and risk of cardiovascular disease: evidence, possible causal paths, and promising research directions. *Psychology Bulletin*, 132(3): 327-53.

Miller, Y. D., Stewart, G., Trost, & Brown, W. J. (2002). Mediators of physical activity behavior change among women with young children. *American Journal of Preventive Medicine*, 23(2), 98-103. DOI: 10.1016/S0749-3797(02)00484-1.

Morris, J. N., & Hardman, A. E. (1997). Walking to health. *Sports Medicine*, 24(2): 96.

Morrow, J. R., Krzewinski-Malone, J. A., Jackson, Bungum, T. J., & FitzGerald, S. J (2004).American adults's knowledge of exercise recommendations. *Research Quarterly for Exercise and Sport*, 75(3): 231-237.

Motl, R. W., Dishman, R. K., Ward, D. S., Saunders, R. P., Dowda, M., Felton, G. (2005). Perceived physical environment and physical activity across one year among adolescent girls: Self-efficacy as a possible mediator? *Journal of Adolescent Health*; 37: 403-408.

Murphy, M. H., Nevill, A. M., Murtagh, E. M., & Holder, R. L. (2007). The effect of walking on fitness, fatness and resting blood pressure: a meta-analysis of randomized, controlled trials. *Preventive Medicine*, 44(5): 377-85.

Myrtek, M., Weber, D., Brügner, G., & Müller, W. (1996). Occupational stress and strain of female students: results of physiological, behavioral and psychological monitoring. *Biological Psychology*, 42, 379-391.

Ng, D. M., & Jeffery, R. W. (2003). Relationships between perceived stress and health behaviors in a sample of working adults. *Health Psychology*, 22(6): 638-42.

Norris, R., Carroll, D., & Cochrane, R. (1992). The effects of physical activity and exercise training on psychological stress and well-being in an adolescent population. *Journal of Psychosomatic Research*, 36(1): 55-65.

Ogden, J. (2003). The Psychology of Eating: From Healthy to Unhealthy Behaviour. *Blackwell, Oxford.*

Oliver, M., Badland, H., Mavoa, S., Duncan, M. J., & Duncan, S. (2010). Combining GPS, GIS, and accelerometry: Methodological issues in the assessment of location and intensity of travel behaviors. *Journal of Physical Activity & Health*, 7(1), 102–108.

Orsila, R., Virtanen, M., Luukkaala, T., Tarvainon, M., Karjalainen, P., Viik J., et al. (2008).Perceived mental stress and reactions in heart rate variability – a pilot study among employees of an electronics company. *The International Journal of Occupational Safety and Ergonomics*, 14, 275–283.

Ouelette, J. A., & Wood, W. (1998). Habit and intention in everyday life: the multiple processes by which past behavior predicts future behavior. Psychological Bulletin, 124(1), 54-74.

Pate, R. R., O'Neill, J. R., & Lobelo, F. (2008). The Evolving Definition of "Sedentary". *Exercise Sport Science Reviews*, 36(4):173-178.

Payne, N., Jones, F., & Harris, P. (2002). The impact of working life on health behavior: The effect of job strain on the cognitive predictors of exercise. *Journal of Occupational Health Psychology*, 7, 342–353.

Penedo, F. J., Dahn, J. R. (2005). Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry*, 18(2): 189-193.

Pesola, A. J., Laukkanen, A., Tikkanen, O., Sipilä, S., Kainulainen, H., & Finni, T. (2014).Muscle inactivity is adversely associated with biomarkers in physically active adults. *Medicine & Science in Sports and Exercise*. DOI: 10.1249/MSS.0000000000000527.

Prapavessis, H., Gaston, A., & DeJesus, S. (2015). The theory of planned behavior as a model for understanding sedentary behavior. *Psychology of Sport and Exercise*, 19: 23-32. DOI: 10.1016/j.psychsport.2015.02.001.

Rahkonen, O., Laaksonen, M., Lallukka, T., & Lahelma, E. (2011). Työolot ja terveys onko ruumiillisella työllä enää merkitystä. Toim. Pietikäinen, *P. Gaudeamus Helsinki University Press*, Tallinna Raamatutrükikoda.

Rise, J., Sheeran, P., & Hukkelberg, S. (2010). The role of self-identity in the theory of planned behavior: a meta-analysis. *Journal of Applied Social Psychology*, 40(5), 1085-1105.

Ritvanen, T., Louhevaara, V., Helin, P., Väisänen, S., & Hänninen, O. (2006). Responses of the autonomic nervous system during periods of perceived high and low work stress in younger and older female teachers. *Applied Ergonomics*, 37(3), 311-318.

Roos, E., Sarlio-Lähteenkorva, S., Lallukka, T., & Lehelma, E. (2007). Associations of work family conflicts with food habits and physical activity. *Public Health Nutrition*, 10(3): 222-229.

Rosenberg, D. E., Norman, G. J., Wagner, N., Patrick, K., Calfas, K. J., & Sallis, J. F. (2010). Reliability and validity of the Sedentary Behavior Questionnaire (SBQ) for adults. *Journal of Physical Activity and Health*, 7: 697-705.

Salmon, P. (2001). Effects of physical exercise on anxiety, depression, and sensitivity to stress: a unifying theory. *Clinical Psychology Review*, 21(1): 33-61.

Schildt, K. A. V. (2013). Stress and physical activity during a 1-year couseling intervention. Master's thesis, University of Jyväskylä, Finland.

Scott, E. J., Eves, F. F., French, D. P., & Hoppe, R. (2007). The theory of planned behavior predicts self-reports of walking, but does not predict step count. *British journal of health psychology*, 12(4), 601.

Sheeran, P. (2002). Intention-behavior relations: a conceptual and empirical review. *European Review of Social Psychology*, 12(1): 1-36. DOI: 10.1080/14792772143000003.

Sheeran, P., Trafimow, D., & Armitage, C. J. (2003). Predicting behaviour from perceived behavioural control: tests of the accuracy assumption of the theory of planned behaviour. *The British Journal of Social Psychology*, 42(3): 393-410.

Sheline, Y. I., Gado, M. H., & Kraemer, H. C. (2003). Untreated depression and hippocampal volume loss. *American Journal Psychiatry*, 160(8): 1516-8.

Silva, M. N., Markland, D., Vieira, P., Coutinho, S., Carraça, E., Palmeira, A., … Teixeira, P. (2010). Helping overweight women become more active: Need support and motivational regulations for different forms of physical activity. *Psychology of Sport & Exercise*, 11(6), 591-601.

Sjöström, M., Oja, P., Hagströmer, M., Smith, B. J., & Bauman, A. (2006). Health enhancing physical activity across European Union countries: the Eurobarometer study. J*ournal of Public Health*, 14: 291-300.

Sniehotta, F. F., Presseau, J., & Araújo-Soares, V. (2014). Time to retire the theory of planned behaviour. *Health Psychology Review*, 8(1): 1-7.

Sparks, P. (2000). Subjective expected utility-based attitude–behavior models: The utility of self-identity. In: Terry DJ, Hogg MA (eds) Attitudes, Behavior, and Social Context: The Role of Norms and Group Membership. Hillsdale, NJ: Lawrence Erlbaum, pp.31–46.

Sparks, P., & Shepherd, R. (1992). Self-identity and the theory of planned behavior: Assessing the role of identification with green consumerism. *Social Psychology Quarterly*, 55, 388–399.

Stamatakis, E., Hamer, M., & Dunstan, D. W. (2011). Screen-based entertainment time, all-cause mortality, and cardiovascular events: population-based study with ongoing mortality and hospital events follow-up. *Journal of the American College of Cardiology. 57(3): 292-9.* DOI: 10.1016/j.jacc.2010.05.065.

Stults-Kolehmainen, M. A., & Sinha, R. (2014). The effects of stress on physical activity and exercise. *Sports Medicine*, 44(1): 81-121. DOI: 10.1007/s40279 013-0090-5.

Symons Downs, D., & Hausenblas, H. A. (2005). Applying the theories of reasoned action and planned behavior to exercise: A meta-analytic update. *Journal of Physical Activity and Health, 2*, 76-97.

Theodorakis, Y. (1994). Planned behavior, attitude strength, role identity, and the prediction of exercise behavior. *The Sport Psychologist*, 8, 149-165.

Thoits, P. A., & Virshup, L. K. (1997). Me's and we's: Forms and functions of social identities. In Self and identity: Fundamental issues. *New York: Oxford University Press.* 106–133.

Tremblay, M. S. (2012). Sedentary Behavior Research Network. Letter to the Editor: Standardized use of the terms "sedentary" and "sedentary behaviors*". Applied Physiology, Nutrion, and Metabolism*, 37(3): 540–542. DOI: 10.1139/h2012 024.

Tucker, S. J., Weymiller, A. J., Cutshall, S. M., Rhudy, L. M., & Lohse, C. M. (2012). Stress ratings and health promotion practices among RNs: a case for action. *The Journal of Nursing Administration*, 42(5): 282-92. DOI: 10.1097/NNA.0b013e318253585f.

van Sluijs, E. M., Kriemler S., & McMinn, A. M. (2011). The effect of community and family interventions on young people's physical activity levels: a review of reviews and updated systematic review. *British journal of sports medicine* 45: 914–922. DOI: 10.1136/bjsports-2011-090187.

Verhoef, M. J., Love, E. J., & Rose, M. S. (1992). Women's social roles and their exercise participation. *Women and Health*, 19(4), 15-29.

Wen, C. P., Wai, J. P., Tsai, M. K., Yang, Y. C., Cheng, T. Y., Lee, M. C., Chan, H. T., Tsao, C. K., Tsai, S. P., & Wu, X. (2001). Minimum amount of physical activity for reduced mortality and extended life expectancy: a prospective cohort study. *The Lancet*, 378(9798):1244-1253.

Wiebe, D. J., & McCallum, D. M. (1986). Health practices and hardiness as mediators in the stress-illness relationship. *Health Psychology*, 5(5): 425-38.

World Health Organization (January 2015). Physical activity, factsheet N°385, http://www.who.int/mediacentre/factsheets/fs385/en/.

APPENDIX

TPB Questionnaire

To be completed by the researcher:

Measurement Date: _____

Participants' name or ID NO.: _____

Measurements' time line: ☐ 0 ☐ 6 ☐ 12

Intention to increase NON-EXERCISE PHYSICAL ACTIVITY*

Put an X to the :---------- that best describes you								
I intend to increase Non-Exercise Physical Activity during the next 6 months:								
possible	:----------	:----------	:----------	:----------	:----------	:----------	:----------:	**impossible**
	Very much	much	little	Neutral	little	much	very much	
I am determined to increase Non-Exercise Physical Activity during next 6 months:								
Yes	:----------	:----------	:----------	:----------	:----------	:----------	:----------:	**No**
	Definitely	Probably	Possibly	Neutral	Possibly	Probably	Definitely	
I will try to increase Non-Exercise Physical Activity during next 6 months:								
Right	:----------	:----------	:----------	:----------	:----------	:----------	:----------:	**Wrong**
	Definitely	Probably	Possibly	Neutral	Possibly	Probably	Definitely	

ATTITUDE STRENGTH*

Put an X to the :---------- that best describes you

How certain you are that in any given chance *during the next 6 months* you will increase your NON-EXERCISE PHYSICAL ACTIVITY?

Certain	:---------	:---------	:--------	:---------	:--------	:---------	:-----:	**Uncertain**
	extremely	quite	slightly	neither	slightly	quite	extremely	

Is the right thing to you to increase your NON-EXERCISE PHYSICAL ACTIVITY *during the next 6 months*?

Right	:--------	:---------	:--------	:---------	:--------	:---------	:-------:	**Wrong**
	extremely	quite	slightly	neither	slightly	quite	extremely	

I am certain that I will increase my NON-EXERCISE PHYSICAL ACTIVITY *during the next 6 months!*

Totally agree	:-------	:---------	:--------	:---------:	:-------	:---------	:-----:	**Totally disagree**
	extremely	quite	slightly	neither	slightly	quite	extremely	

Is it important to you personally to increase your NON-EXERCISE PHYSICAL ACTIVITY *during the next 6 months*?

Important	:-----	:-------	:------	:---------:	:--------	:---------	:-----:	**Unimportant**
	extremely	quite	slightly	neither	slightly	quite	extremely	

How much interested you are to increase your NON-EXERCISE PHYSICAL ACTIVITY *during the next 6 months*?

Interested	:---------	:---------	:--------	:-------	:-------	:---------	:-----:	**Uninterested**
	extremely	quite	slightly	neither	slightly	quite	extremely	

For me to increase my NON-EXERCISE PHYSICAL ACTIVITY *during the next 6 months* is…

Certain	:---------	:---------	:--------	:-------	:-------	:---------	:-----:	**Uncertain**
	extremely	quite	slightly	neither	slightly	quite	extremely	

With the knowledge that I have now, I think/believe that I will increase my NON-EXERCISE PHYSICAL ACTIVITY *during the next 6 months.*

Agree	:-------	:---------	:--------	:--------	:-------	:---------	:-----:	**Disagree**
	extremely	quite	slightly	neither	slightly	quite	extremely	

Do you find interesting to increase your NON-EXERCISE PHYSICAL ACTIVITY *during the next 6 months*?

Interesting	:-------	:---------	:--------	:--------	:-------	:---------	:-----:	**Non-interesting**
	extremely	quite	slightly	neither	slightly	quite	extremely	

PERCEIVED BEHAVIOURAL CONTROL TO INCREASE NON-EXERCISE PHYSICAL ACTIVITY

Put an X to the :---------- that best describes you

For me to increase Non-Exercise Physical Activity during next 6 months is:

easy	:----------	:----------	:----------	:----------	:----------	:----------	:----------:	**difficult**
	Very much	much	little	neither	little	much	very much	

I am absolutely sure/certain that I will increase Non-Exercise Physical Activity during next 6 months:

right	:----------	:----------	:----------	:----------	:----------	:----------	:----------:	**wrong**
	Very much	much	little	neither	little	much	very much	

I can increase Non-Exercise Physical Activity during next 6 months:

possible	:----------	:----------	:----------	:----------	:----------	:----------	:----------:	**impossible**
	Very much	much	little	neither	little	much	very much	

I have complete control over whether or not I will increase my Non-Exercise Physical Activity during next 6 months:

right	:----------	:----------	:----------	:----------	:----------	:----------	:----------:	**wrong**
	Very much	much	little	neither	little	much	very much	

SELF IDENTITY*

Put an X to the :---------- that best describes you

I consider myself as not capable to be active

Agree	:----------	:----------	:---------	:----------	:----------	:----------	:----------:	**Disagree**
	Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly	

I do not think that I am the kind of person who will increase its Non-Exercise Physical Activity

Disagree	:----------	:----------	:---------	:----------	:----------	:----------	:----------:	**Agree**
	Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly	

It is on my character to be a lazy sitting person

Agree	:----------	:----------	:---------	:----------	:----------	:----------	:----------:	**Disagree**
	Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly	

In general I am the type of person who prefers to sit than to move

Disagree	:----------	:----------	:---------	:----------	:----------	:----------	:----------:	**Agree**
	Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly	

PERCEIVED KNOWLEDGE

Put an X to the :---------- that best describes you

How informed you think you are on issues related to NON-EXERCISE PHYSICAL ACTIVITY?

Informed	:----------	:----------	:---------	:----------	:---------	:----------	:----------:	**Uninformed**
	very much	much	little	neither	little	much	very much	
	1	2	3	4	5	6	7	

If someone asked you to write as much as you can on issues related to NON-EXERCISE PHYSICAL ACTIVITY how much you think you would write?

Very few	1	2	3	4	5	6	7	**Very much**

In comparison to your information to other issues do you consider yourself very well informed on issues related to NON-EXERCISE PHYSICAL ACTIVITY

Disagree	:----------	:----------	:---------	:----------	:---------	:----------	:----------:	Agree
	Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly	
	1	2	3	4	5	6	7	

How much knowledge do you think you have on issues related to NON-EXERCISE PHYSICAL ACTIVITY?

No knowledge at all	1	2	3	4	5	6	7	Very much knowledge

So and So