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2013

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*Citation for published version (APA):*

Sjögren, K. (2013). *Participation in physical activity in relation to different life-change events*. [Doctoral Thesis (compilation), Family Medicine and Community Medicine]. Family Medicine, Faculty of Medicine, Lund University.

*Total number of authors:*

1

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# Participation in physical activity in relation to different life-change events

Katarina Sjögren Forss



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AKADEMISK AVHANDLING

som med vederbörligt tillstånd från Medicinska fakulteten vid Lunds universitet för avläggande av doktorexamen i medicinsk vetenskap kommer att offentligen försvaras i Aulan, Clinical Research Centre, Malmö onsdagen den 28 augusti 2013, kl. 09.00.

*Fakultetsopponent*

Docent Anders Raustorp, Göteborgs universitet

Organization LUND UNIVERSITY Department of Clinical Sciences in Malmö, General Practice/Family Medicine	Document name DOCTORAL DISSERTATION	
Author(s) Katarina Sjögren Fors	Sponsoring organization	
Title and subtitle Participation in physical activity in relation to different life-change events		
<p><b>Abstract:</b> Regular physical activity is understood to be an essential prerequisite for human health for both psychological and physiological well-being. However, there are differences in participation in physical activity among different groups in society, and participation in physical activity can also change over a lifetime. The general aim of this thesis was to investigate how different life-change events may affect participation in physical activity. Life-change events studied are pregnancy, parenthood, getting older and living with a chronic disease (osteoarthritis). Paper I included 999 individuals and aimed to investigate the extent to which outdoor recreational physical activity was carried out during one year, and the factors influencing such activities from a gender perspective among individuals <math>\geq 60</math> years of age. Results showed that being independent physically and healthy enough to manage one's personal hygiene and having access to areas for country walks were the most important factors associated with the probability of engaging in outdoor recreational physical activity for both women and men, but more factors were associated with limitations for women. Paper II included baseline data from 432 individuals and aimed to investigate participation in outdoor recreational physical activity, and factors influencing participation among parents-to-be, with and without previous children, from a gender perspective. Participation in physical activity indoors and owning a dog or a horse emerged as the most important factors associated with the probability of participation in outdoor recreational physical activity. Men were affected by a greater number of factors than women. Paper III involved 270 individuals and aimed to follow changing physical activity patterns among women and men during pregnancy compared to before pregnancy. Changes in physical activity patterns during pregnancy compared to before pregnancy were seen among both women and men, as both groups were more physically active before than during pregnancy. Paper IV included 100 individuals and aimed to investigate how physical activity at different frequencies affects individuals with osteoarthritis. Individuals who were moderately physically active rated their health best, had the lowest Body Mass Index and best function of the lower and the upper extremity. Women used more drugs against their osteoarthritis than men and were more afraid that their joints would be harmed by physical activity. The main findings indicate that all four life-change events affect participation in physical activity among both women and men, but in different ways and to different extents. Thus, a gender perspective seems to be important to consider both in research and when planning health-promoting activities for different groups to make people become or stay physically active, but also age and socioeconomic factors need to be taken into account. In the studied populations, women were not less physically active than men, but overall, more factors were found to be associated with limitations for women to participate in physical activity, and fear was found to be one of the most limiting factors. Even accessibility is an important aspect to take into account when studying factors associated with physical activity since having access to areas for country walks was found as an important factor for participation.</p>		
Key words: Life-change events, physical activity, public health		
Classification system and/or index terms (if any)		
Supplementary bibliographical information	Language English	
ISSN and key title 1652-8220	ISBN 978-91-87449-45-1	
Recipient's notes	Number of pages	Price
	Security classification	

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# Participation in physical activity in relation to different life-change events



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Katarina Sjögren Forss



# Abstract

Regular physical activity is understood to be an essential prerequisite for human health for both psychological and physiological well-being. However, there are differences in participation in physical activity among different groups in society, and participation in physical activity can also change over a lifetime. The general aim of this thesis was to investigate how different life-change events may affect participation in physical activity. Life-change events studied are pregnancy, parenthood, getting older and living with a chronic disease (osteoarthritis).

Paper I included 999 individuals and aimed to investigate the extent to which outdoor recreational physical activity was carried out during one year, and the factors influencing such activities from a gender perspective among individuals  $\geq 60$  years of age. Results showed that being independent physically and healthy enough to manage one's personal hygiene and having access to areas for country walks were the most important factors associated with the probability of engaging in outdoor recreational physical activity for both women and men, but more factors were associated with limitations for women. Paper II included baseline data from 432 individuals and aimed to investigate participation in outdoor recreational physical activity, and factors influencing participation among parents-to-be, with and without previous children, from a gender perspective. Participation in physical activity indoors and owning a dog or a horse emerged as the most important factors associated with the probability of participation in outdoor recreational physical activity. Men were affected by a greater number of factors than women. Paper III involved 270 individuals and aimed to follow changing physical activity patterns among women and men during pregnancy compared to before pregnancy. Changes in physical activity patterns during pregnancy compared to before pregnancy were seen among both women and men, as both groups were more physically active before than during pregnancy. Paper IV included 100 individuals and aimed to investigate how physical activity at different frequencies affects individuals with osteoarthritis. Individuals who were moderately physically active rated their health best, had the lowest Body Mass Index and best function of the lower and the upper extremity. Women used more drugs against their osteoarthritis than men and were more afraid that their joints would be harmed by physical activity.

The main findings indicate that all four life-change events affect participation in physical activity among both women and men, but in different ways and to different extents. Thus, a gender perspective seems to be important to consider both in research and when planning health-promoting activities for different groups to make people become or stay physically active, but also age and socioeconomic factors need to be taken into account. In the studied populations, women were not less physically active than men, but overall, more factors were found to be associated with limitations for women to participate in physical activity, and fear was found to be one of the most limiting factors. Even accessibility is an important aspect to take into account when studying factors associated with physical activity since having access to areas for country walks was found as an important factor for participation.



*Till mor*

*Att våga är att förlora fotfästet en liten stund –  
att inte våga är att förlora sig själv.*

Søren Kierkegaard (1813–1855)





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# Abbreviations

ASES	Arthritis Self-Efficacy Scale
BC	Before Christ
BMI	Body Mass Index
CI	Confidence interval
EQ5D	Euro-Qol-5D
EU	European Union
IPAQ	International Physical Activity Questionnaire
MFR	Medicinska forskningsrådet
N/n	Number
NS	Not Significant
OA	Osteoarthritis
OR	Odds Ratio
PEPOA	Patient Education Programme for Osteoarthritis
SD	Standard Deviation
SEK	Swedish crowns
SNAC	The Swedish National Study on Ageing and Care
SNAC-B	The Swedish National Study on Ageing and Care – Blekinge
SPSS	Statistical Package for the Social Sciences
US	United States
WHO	World Health Organization



# List of publications

This thesis is based on the following publications, which will be referred to by their Roman numerals.

Sjögren, K. and Stjernberg, L. (2010) A gender perspective on factors that influence outdoor recreational physical activity among elderly. *BMC Geriatr*, 10:34.

Sjögren, K., Ekvall Hansson, E. and Stjernberg, L. (2011) Parenthood and factors that influence outdoor recreational physical activity from a gender perspective. *BMC Public Health*, 11:93.

Sjögren Forss, K., Ekvall Hansson, E., Troein, M. and Stjernberg, L. Patterns of physical activity among women and men before and during pregnancy. *Submitted*.

Sjögren Forss, K., Stjernberg, L., Troein, M. and Ekvall Hansson, E. Physical activity among individuals with osteoarthritis. *Submitted*.

Papers I and II are published in Open Access Journals, which permit unrestricted use, distribution, and reproduction in any medium.



# Introduction

Regular physical activity is understood to be an essential prerequisite for human health. The positive impact it has on both psychological and physiological well-being is well documented (US Department of Health and Human Services, 1996; Warburton et al., 2006; Lee et al., 2012). Studies also show that physical activity performed outdoors promotes health and well-being, and evidence has been found of a positive relationship between green space and self-perceived health (Maas et al., 2006; Mitchell and Popham, 2008; Maas et al., 2009; Bowler et al., 2010).

Previous research shows that there are differences in participation in physical activity among different groups in society. In general, adults' participation in physical activity is influenced by a diverse range of personal, social, cultural and environmental factors as well as age and gender (Burton et al., 1999; Sternfeld et al., 1999; Brownson et al., 2000; Burton and Turrell, 2000; Sallis et al., 2000; Leslie et al., 2001; Shibata et al., 2009; Bolívar et al., 2010). Continuous participation in physical activity throughout one's lifetime enhances the potential to live an active and healthy life. However, participation in physical activity can change over a lifetime, and life-change events may be associated with changes in health-related behaviour such as physical activity (King et al., 1998; Engberg et al., 2012). In the light of the value of physical activity for health, it is important from a public health perspective to get more knowledge about how participation in physical activity can change over a lifetime and how different life-change events could impact on participation in physical activity. Increased knowledge about this ought to be of interest for sciences and professionals working in the fields of public health and physical activity.





# Background

## Public health

This thesis is in the field of public health. According to the World Health Organization (WHO), public health refers to all organized measures (whether public or private) to prevent disease, promote health and extend life among the population as a whole. Activities in the field of public health aim to offer settings in which people can be healthy and focus on entire populations and not on individuals or diseases. Accordingly, public health is concerned with the total system and not only the eradication of a specific disease (World Health Organization, 2013a).

## Physical activity

### **Definitions of physical activity**

The terms physical activity and exercise are often used interchangeably. But even if they do have a number of common parts, for example both include any bodily movement produced by skeletal muscles, they are not synonymous (Caspersen et al., 1985).

**Physical activity** is defined as “*any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level*” (Physical Activity Guidelines Advisory Committee, 2008). Physical activity can be categorized in different ways, according to type, intensity and purpose. With regard to classification by “purpose”, physical activity is often categorized by the context in which it is performed (Physical Activity Guidelines Advisory Committee, 2008).

**Exercise** is a subcategory of physical activity and is defined as “*planned, structured, and repetitive and purposive in the sense that the improvement*

*or maintenance of one or more components of physical fitness is the objective”* (Physical Activity Guidelines Advisory Committee, 2008).

In this thesis the term **outdoor recreational physical activity** is also used. Outdoor recreational physical activity is defined as *“being outside in natural or cultural landscapes for the purpose of well-being and encounters with nature without any demand for competition”* (Fredman et al., 2008). This definition has much in common with the definition of physical activity, and according to Emmelin et al. (2010) outdoor recreational physical activity can in many cases border on the field of exercise. However, there are differences that are important to consider from a public health perspective. The definition of outdoor recreational physical activity includes the aspect of well-being and nature, and Engström (2010) emphasizes that it is not about performance; above all it is being outdoors and the experience that will be in focus.

Outdoor recreational physical activity is a major part of papers I, II and III in this thesis, but since it is a part of physical activity, the term physical activity is mainly used in this thesis.

### **Aspects of physical activity**

Historically, people were physically active to survive, for example to obtain food. From the point of view of our biological heritage, in our current lifestyles we do not live according to our natural way of life. Shifts from hunter-gatherer to agriculture and then to industry have changed the physical activity patterns of humans. Our bodies are designed for physical activity, but nowadays we live in an environment where the possibilities to be physically active are quickly disappearing (Åstrand, 1994).

Today, there is less and less room for movement as work often requires less physical effort than before and many people also choose not to be physically active during leisure time. Everyday physical activities, such as walking and cycling to and from work and school, are decreasing and the use of cars and buses is rising. The space for spontaneous physical activity is also decreasing due to planning undertaken for residential areas, the development of shopping centres that require a car and the disadvantage of bicycle and pedestrian traffic (Swedish National Institute of Public Health and Yrkesföreningar för fysisk aktivitet, 2008).

More than 2000 years ago Greek physicians recognized and emphasized the importance of physical activity for health and longevity (MacAuley, 1994). Hippocrates (fifth century BC), the father of medicine, wrote about the benefits of physical activity for many disorders, including mental illness, and recommended walking and other forms of moderate activities. Also in China and India, documents presenting the role of physical activity in promoting the health of mind and body and dated BC have been found (Bouchard et al., 2012). The modern epidemiology of physical activity began during the 1950s and today there is convincing evidence about a broad range of important health benefits associated with regular physical activity (U.S. Department of Health and Human Services, 1996).

The positive health effects of regular physical activity in the primary and secondary prevention for many chronic diseases have been found and documented for type 2 diabetes, hypertension, obesity, cardiovascular disease, some forms of cancer, depression and osteoporosis. Regular physical activity also promotes health by improved fitness, balance and strength in the muscles and it has also been found to increase well-being, mental health and quality of life (U.S. Department of Health and Human Services, 1996; Warburton et al., 2006; Physical Activity Guidelines Advisory Committee, 2008; Lee et al., 2012).

In recent years the health effect of physical inactivity and sedentary behaviour has attracted increasing attention. Both physical inactivity and sedentary behaviour are less clearly defined than physical activity. Physical inactivity represents the lower end of the activity spectrum and refers to low levels or absence of physical activity. Sedentary represents time spent sitting daily, for example in front of a screen or watching television. A sedentary lifestyle may also include some intentional exercise during a week, and sedentary is thus not the opposite of physical activity. It corresponds to a complementary dimension of behaviour (EU Platform on Diet, Physical Activity and Health, 2008).

A physically active lifestyle includes numerous health benefits, but it can also involve health risks. However, while the incidence of serious health problems among individuals that are moderately physically active in both intensity and amount is very low, participation in vigorous exercise can be risky. The most common documented risks are: musculoskeletal injuries, triggering of heart attack or sudden cardiac death in susceptible individuals,

i.e. those with existing cardiac disease. The benefits of physical activity, however, far outweigh the risks (Hardman and Stensel, 2009).

## **Recommendations of physical activity**

The well-documented health benefits of regular physical activity during the last few decades have resulted in public health recommendations (U.S. Department of Health and Human Services, 1996; Physical Activity Guidelines Advisory Committee, 2008). In the early 1970s Sweden provided guidelines for regular physical activity. The National Board of Health and Welfare stated: “Do moderate physical activity daily, in combination with more intense exercise two or three times per week” (EU Platform on Diet, Physical Activity and Health, 2008). Today, the best-known public health recommendation for regular physical activity was issued in 1995 by the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (U.S. Department of Health and Human Services, 1996; Physical Activity Guidelines Advisory Committee, 2008).

This recommendation is based on a two-day workshop that was organized by experts in physical activity from the Centers for Disease Control and Prevention and the American College of Sports Medicine. They invited 15 discussants on the basis of their research expertise in issues related to health implications of physical activity as well as several relevant professionals or scientific organizations and federal agencies. The workshop delegates reviewed the relevant research and review articles in the fields of physical activity based on epidemiological, physiological and clinical evidence. From this, they outlined the major issues related to physical activity and public health. Selected members drafted sections of the paper from this outline, which resulted in a draft manuscript that was reviewed by the delegates. The main attention was given to achieving group consensus concerning the recommended types and amounts of physical activity. The work of the delegates finally resulted in the recommendation that “every US adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week” (Pate et al., 1995). The health-related physical activity recommendations are based on a dose-response relation between physical activity (product of intensity, duration and frequency) and morbidity and mortality in, for example,

coronary heart disease (U.S. Department of Health and Human Services, 1996; Physical Activity Guidelines Advisory Committee, 2008).

The recommendation from 1995 was updated in 2007 by the American College of Sports Medicine (ACSM) and the American Heart Association (AHA). The updated version still emphasizes 30 minutes of moderate-intensity physical activity to be regularly performed on at least five days per week (the recommendations from 1995 stated “most, preferably all, days”), but also that the 30 minutes of moderate-intensity physical activity can be replaced by three occasions of 20 minutes of vigorous-intensity activity per week (Physical Activity Guidelines Advisory Committee, 2008). This recommendation has been adopted in many countries, Sweden included (Swedish National Institute of Public Health and Yrkesföreningar för fysisk aktivitet, 2008). The updated version has also separated healthy adults and older adults (> 64 years) or older adults (50–64 years) with chronic conditions. Also, there are specific guidelines for physical activity levels in children and adolescents, 6–17 years (Physical Activity Guidelines Advisory Committee, 2008).

Over the last decade it has been found that lower levels of physical activity have positive health effects provided that they are carried out regularly. Before 1995, recommendations for physical activity in general were focused on cardio-respiratory endurance and specified sustained periods of vigorous physical activity lasting at least 20 minutes on three or more days per week (Physical Activity Guidelines Advisory Committee, 2008).

### **Outdoor recreational physical activity**

In the hectic society we live in today, many people experience nature as a place where they can relax and recover from their daily life (Maas et al., 2006). However, nowadays more and more people live in cities and urban areas, far away from nature and with fewer green resources. In a global perspective, within the next 30 years, nearly two thirds of the world’s population will live in urban areas (Vlahov and Galea, 2002; Dye 2008). Cities have both health risks and benefits. On average, city dwellers are wealthier and receive improved sanitation, nutrition and health care. However urban living is also related to increased risk of chronic disorders, a more stressful social environment and greater social disparities (Dye,

2008). Mental health among city dwellers is more affected than among those not living in cities, as mood and anxiety disorders are more common among those living in a city (Peen et al., 2010).

Urbanization might lead to environmental unfairness with regard to access to public green space, since people from low socioeconomic groups without resources to move to greener areas outside the cities will be affected (Maas et al., 2006). From a public health perspective this is disquieting since it might contribute to inequalities in health between people.

The few epidemiological studies on the relation between nature and health have found positive relationships between green space and self-perceived health. A study from the Netherlands showed that people living in neighbourhoods with rich green space tend, on average, to enjoy better general health (De Vries et al., 2003). A longitudinal study from Japan showed that living in a neighbourhood with comparatively generous walkable green space was associated with lower mortality risk (Takano et al., 2002).

Participation in physical activity outdoors promotes well-being, and evidence has been found for a positive relationship between green space and self-perceived health (Maas et al., 2006; Mitchell and Popham, 2008; Maas et al., 2009). It has also been found to have restorative effects on human health and a reduction in mental fatigue (Kaplan and Kaplan, 1989; Frumkin, 2001; Bowler et al., 2010; Park et al., 2010; Ward Thompson et al., 2012).

### **The measurement of physical activity**

Physical activity is a wide-ranging term that includes a variety of activities that may occur in many different settings and modes and at varying frequencies and intensities. This complexity makes it difficult to measure and there is no internationally agreed definition or measure of physical activity. Over the last few decades, physical activity and related terms, e.g., exercise, have been defined somewhat inconsistently. The most valid assessment of an individual's level of activity remains a controversial and difficult area (World Health Organization, 2002; Ridloch, 2005). It is difficult to measure physical activity at population level, partly because of the complexity of the concept of physical activity and partly because it is difficult to find an accurate instrument for it. For measurement at the

population level, feasibility must be balanced with measurement accuracy (Hagströmer, 2007).

Even if it is difficult to measure, there are many methods for measuring physical activity, for example surveys (e.g., questionnaires and activity diaries), pedometers or accelerometers (Dishman et al., 2001; Warren et al., 2010; Swedish National Institute of Public Health, 2011b). Physical activity is commonly described by the following four dimensions: *frequency* (the number of events of physical activity during a specific time period; *duration* (time of participation in a single session of physical activity; *intensity* (physiological effort associated with participation in a special type of physical activity); and *type of activity* (Caspersen et al., 1985). Thus, any assessment of physical activity should ideally measure all of these dimensions (Armstrong and Welsman, 2006; Swedish National Institute of Public Health, 2011b ).

There has also been a lack of internationally standardized instruments to assess physical activity. To overcome such limitations, the International Physical Activity Questionnaire (IPAQ) was compiled in 1998. The objective was to develop a self-reported measure of physical activity suitable for assessing population levels of physical activity across countries (Craig et al., 2003).

This thesis is based on four papers, all including self-reported questionnaires for the measure of physical activity that is a common method of data collection at the population level. This study strategy is frequently employed for reasons of practicality, low costs, and general acceptance (Dishman et al., 2001). Self-reports are useful for gaining insight into physical activity patterns in populations, although there is always a risk of over- and underestimation of the answers. Other limitations of self-reports include for example difficulties in ascertaining the duration and intensity of physical activity. Indeed, the measurement method may have a significant impact on the observed levels of physical activity; self-reported measures of physical activity were both higher and lower than those measured directly. Subjective methods rely on subjective interpretation of the questions and the perception of physical activity behaviour by the participant. Self-reported physical activity may cause systematic errors and should be treated with caution (Sallis and Saelens, 2000; Prince et al., 2008).



## **The prevalence of physical activity**

Because of the difficulties in measuring physical activity it is hard to get a clear picture of the prevalence in the population, illustrated by the following: a study by Martínez-González et al. (2001) concluded that the Swedish and the Finnish populations were the most active in leisure-time physical activity compared to 14 other member states of the European Union (EU). However, the figures from the Eurobarometer study in 2006, a regularly administered survey assessing health status among the adult population in the EU, show that the Swedes were the least active based on the IPAQ measures. The differences between the activity constructs used can explain the differences between the studies (Sjöström et al., 2006).

According to the Eurobarometer 2010, 27% of the adult population in the European Union state that they are engaged in physical activity regularly. Sweden is above the European average with 40% of the population claiming to be regularly physically active. The countries in the northern part of the EU tend to be more physically active than countries in the southern part. This can be explained by the organization of society, especially the planning of working and leisure time as well as for economic reasons (European Commission, 2010).

Previous research shows differences in participation in physical activity among different groups in society. In general, adults' participation in physical activity is influenced by a diverse range of personal, social, cultural and environmental factors as well as age (Burton et al., 1999; Sternfeld et al., 1999; Brownson et al., 2000; Sallis et al., 2000; Shibata et al., 2009; Bolívar et al., 2010).

Other factors that have been found to affect individuals' participation in physical activity are socioeconomic status as well as educational and occupational status (Brownson et al., 2000; Salmon et al., 2000; Wilcox et al., 2000; Sequeira et al., 2011). Lower levels of physical activity are more common among individuals with lower education levels than among those with a higher level of education, and people with financial problems are more likely to be physically inactive (Lindström et al., 2001; Sjöström et al., 2006; Borodulin et al., 2008; Bolívar et al., 2010). Studies examining the association between marital status and participation in physical activity have found different outcomes. Some studies (King et al., 1998; Salmon et al., 2000; Pettee et al., 2006) have reported a positive relationship between marital status and participation in physical activity, while others (Brownson

et al., 2000; King et al., 2000; Hull et al., 2010) have not found any associations.

Gender differences in physical activity can also be seen. In several studies, women have been found to have lower rates of participation in physical activity than men throughout life (U.S. Department of Health and Human Services, 1996; Burton and Turrell, 2000; Leslie et al., 2001; Belcher et al., 2010; Bolívar et al., 2010). This might seem strange, since studies on gender and health behaviour show that women in general have a more positive health behaviour than men (LaPorte et al., 1984; Paffenbarger and Hyde, 1984; Pinkhasov et al., 2010). It is not easy to understand why women, who on average take more care of their health and body, should be less healthy when it comes to physical activity (Abel et al., 2001).

According to the way physical activity is measured, there might be significant gender-bias. A study by Hallal et al. (2003) using IPAQ, one of few instruments including household activities when measuring physical activity, showed no gender differences. This finding supports the fact that many studies have used measures of physical activity that are strongly associated with sport and exercise, traditionally activities performed by men (Abel et al., 2001).

According to Abel et al. (2001) and Bernstein et al. (2001), if no distinction is made between regular sport activity and habitual physical activity, an underestimation of the amount of the muscular activity has to be expected, particularly among women. Bernstein et al. (2001) conclude that women are not less physically active than men, but are active in a different way through other kinds of activities, e.g., housework and walking, and in lower exercise intensities. It is important that studies on physical activity cautiously consider and define their measures, taking into account conceivable gender biases and the gender specificity of indicators (Abel et al., 2001).

### **Physical activity and life-change events**

Life experiences that may significantly affect an individual's daily routine can be referred to as life-change events (Holmes and Rahe, 1967). A life-change event can be defined as "those occurrences, including social, psychological and environmental, which require an adjustment or effect a

change in an individual's pattern of living" (MeSH Database, 2013). Life-change events can for example include moving to a new environment, the death of a friend or a family member, and illness or injury (Engberg et al., 2012).

This thesis is about how four different life-change events – pregnancy, parenthood, getting older and living with a chronic disease (osteoarthritis) – may affect participation in physical activity. Participation in physical activity can change over a lifetime, and from a public health perspective it is important to understand how life-change events may impact on participation in physical activity. Life-change events may be associated with changes in health-related behaviour such as physical activity (King et al., 1998; Engberg et al., 2012).

Studies have found that life circumstances affect people's participation in physical activity and generally the effect is negative (Cooper and Thomas, 2002; Allender et al., 2006; Brown et al., 2009). A review about life-change events and participation in physical activity, by Allender et al. (2008), identified five life-change events that seemed to affect participation: change in employment status; change in residence, place and circumstance; change in physical status; change in relationships, and change in family structure. Allender et al. (2008) concluded that the research about life-change events and participation in physical activity is limited and that there is a need for more studies. Trost et al. (2002) likewise conclude that more knowledge about the role of pregnancy, childbirth and parenting as a barrier to participation in physical activity is required.

## **Physical activity and pregnancy**

Pregnancy is a life-change event associated with decreased physical activity (King et al., 1998; Symons Downs and Hausenblas, 2004; Rousham et al., 2005; Pereira et al., 2007), even if the benefits of participation could also extend to pregnant women. Historically, there have been concerns about the adverse effects of physical activity on pregnancy outcome. However, recent studies have found no adverse effects of regular, moderate-intensity physical activity during pregnancy (Clarke and Gross, 2004; Gavard and Artal, 2008). Instead, there are numerous health benefits, including reduced risk of gestational diabetes (Dempsey et al., 2004; Hegaard et al., 2007), preeclampsia (Sorensen et al., 2003; Hegaard et al., 2007), preterm birth (Hegaard et al., 2007; Juhl et al., 2007), excess pregnancy weight gain

(Polley et al., 2002; Stuebe et al., 2009) and post-partum weight retention (Pereira et al., 2007; Huang et al., 2011). According to this, most women can participate in a wide range of physical activities and maintain an active lifestyle during pregnancy, though those with medical or obstetrical complications may require modifications. Modifications may also be essential for women who regularly participated in strenuous activities before pregnancy.

In Sweden, the recommendations for pregnant women say that physical activity should take place at a moderate level of exertion during a total of approximately 30 minutes per day (Swedish National Institute of Public Health and Yrkesföreningar för fysisk aktivitet, 2008). Recommendations from the U.S. Department of Health and Human Services (HHS) advise healthy pregnant women to engage in at least 2.5 hours of moderate-intensity aerobic activity per week during and after birth (U.S. Department for Health and Human Services, 2008). However, there seems to be a discrepancy between the recommendations and what women actually do (Evenson et al., 2002; Petersen et al., 2005, Amezcua-Prieto et al., 2013). Factors that have been found to affect participation in physical activity negatively during pregnancy are lack of energy, lack of time, concern for the baby and discomfort caused by activity (Evenson et al., 2002; Clarke and Gross, 2004; Hegaard et al., 2010).

While pregnancy appears to be a life-change event associated with decreased physical activity among women, the effect on their partners seems to be unknown, and this is a relatively unexplored field. Therefore, studies are needed to find out how men's physical activity patterns and habits might change during pregnancy. This is important from a public health perspective, as women and men can support each other to be physically active during pregnancy, and both parents play an important role in shaping their children's routines (including physical activity habits).

### **Physical activity and parenthood**

Parenthood is a life-change event associated with decreased physical activity, especially among women (Allender et al., 2008; Bellows-Riecken and Rhodes, 2008; Hull et al., 2010; Berge et al., 2011). This conclusion might be based on the fact that most studies in this field have focused on women and not on men. In a review by Allender et al. (2008) about life-

change events and participation in physical activity, the category change in family structure showed that parenthood was associated with decreased participation based upon findings from three studies (Barnekow-Bergkvist et al., 1996; Brown and Trost 2003; Bell and Lee, 2005). In two of the studies (Brown and Trost, 2003; Bell and Lee, 2005) only women's participation was examined. The study by Barnekow-Bergkvist et al. (1996) aimed to investigate gender-related differences in physical activity patterns at the ages of 16 and 34 and to analyse factors that might contribute to an explanation of physical activity habits in adulthood. At the age of 34, having children increased the risk of being physically inactive in adulthood among women, but no such findings were seen among men.

A review of physical activity and parenthood by Bellows-Riecken and Rhodes (2008) shows a negative relationship between parenthood and participation in physical activity in 14 of the 17 studies examined. Brown et al. (2000) found that women with children performed less physical activity than women without children. Schmitz et al. (1999) found that parenthood resulted in reduced physical activity in women but not in men, with the biggest difference occurring during first parenthood. Also, Brown et al., (2009) found that decreasing levels of physical activity were associated with childbirth in women. Lack of time and social support, fatigue, childcare, and other obligations have been identified as factors that impacted negatively on parents' participation in physical activity (Miller et al., 2002; Fahrenwald and Noble Walker, 2003; Fahrenwald and Shangreux, 2006; Larouche et al., 2012).

Studies (Freedson and Evenson, 1991; Moore et al., 1991; Loprinzi and Trost, 2010; Zecevic et al., 2010) show a strong and positive relationship between parents' and their children's physical activity levels. The review by Bellows-Riecken and Rhodes (2008) also shows a need for more research focusing on physical activity among men during parenthood. Among the 25 independent samples reviewed, 17 focused on women, seven included both women and men and only one was based only on fathers. Findings from Shropshire and Carroll (1997) indicate that fathers' physical activity patterns may have a more important influence on both boys' and girls' participation in physical activities than mothers' as assessed by the children's perception of their physical activity behaviour. A review about parental influences on different types and intensities of physical activity in youth by Edwardson and Gorely (2010) confirm these findings. This also shows the need for more studies about men's physical activity patterns in

relation to parenthood, but also more studies about women and how they can become role models for their children in physical activity.

### **Physical activity and getting older**

The population in Sweden, as in the rest of the world, is getting older and older. Developed countries have the highest proportion of elderly people and the population of Europe is the oldest in the world (Hardman and Stensel, 2009). In 2002, 17.2% of the Swedish population were aged 65 or older, and in 2020 it is estimated to reach 21% (Statistics Sweden, 2012). In most countries, the oldest old, i.e. individuals aged 80 or over, are growing faster than any other age group in the population. The ageing population has a huge social and economic implication that includes growing age-related diseases and an increased amount of frail elderly individuals (Hardman and Stensel, 2009).

The positive health benefits of physical activity also apply to the elderly, where it has much to offer in terms of personal and public health. For example, physical activity in advanced years can improve fitness as well as endurance, balance, strength and mobility. It also appears to have a positive impact on various psychological factors and quality of life. Lower mortality rates occur among those who become physically active late in life as compared to those who were active in early life and then stopped. Although an increased vulnerability to chronic disease and disability is inherent in the ageing process, evidence suggests that being physically active can influence the course of many frequently occurring diseases among the elderly (Paffenbarger et al., 1986; Vogel et al., 2009).

According to the World Health Organization (2010), elderly should participate in least 150 minutes of moderate-intensity aerobic physical activity throughout the week. Those with poor mobility should participate in physical activity to enhance balance and prevent falls on three or more days per week. Accidental falls among elderly are a major public health problem and in Sweden alone, on average, more than three elderly people die every day as a result of accidental falls. This is more than double the number of people who die on the roads. It generates enormous costs to society, in Sweden approximately 14 billion SEK, and this figure is expected to increase to approximately 22 billion SEK by 2050 if the situation remains as at present (Gyllensvärd, 2009). Physical activity

appears to be essential in preventing the loss of bone mineral density and osteoporosis, above all in postmenopausal women. The benefits clearly outweigh the potential risks, especially among the elderly (Warburton et al., 2006).

Experience of pain or fatigue, lack of interest or daily access to a car are factors that have been found to influence whether or not elderly people engage in physical activity (Cooper et al., 2001; Crombie et al., 2004). Having a social network, including living with a partner has been found to affect participation in physical activity positively, while fear of falling and fear of violence have been found to have the opposite effect (Bruce et al., 2002; Friedman et al., 2002; Piro et al., 2006; Zimmerman et al., 2008). Another important factor affecting whether elderly are physically active or not is their health status (Piro et al., 2006; Paillard-Borg et al., 2009).

### **Physical activity and living with osteoarthritis**

Osteoarthritis is a common chronic degenerative disorder characterized by loss of cartilage, pain and stiffness and also impaired quality of life along with psychological stress. The cause is not known. However, current evidence indicates that it is multifactorial and it is considered to be one of the major public health problems in the world (Das and Farooqi, 2008; The Centers for Disease Control and Prevention and the Arthritis Foundation, 2010). Previously it was thought that osteoarthritis was a mark of old age and was a result of joints that were worn out. This approach is unfortunate because it implies that nothing can be done about osteoarthritis and that it is exacerbated by additional load. In recent years, the knowledge of the combination of osteoarthritis and physical activity has increased, which has led to a changing approach (Shrier, 2004). According to the current international guidelines, all forms of osteoarthritis should be treated with physical exercise aiming to enhance muscle strength around the affected joints. One of the elementary recommendations for the treatment of osteoarthritis is to increase the level of physical activity among affected individuals (Hochberg et al., 1995; Rosemann et al., 2006; Dunlop et al., 2011).

According to the World Health Organization (2013b) osteoarthritis is one of the ten most disabling diseases in the world. Although osteoarthritis is a common disease there are divergent data about the prevalence. This is

mainly because the disease is defined and diagnosed differently. In most cases osteoarthritis is defined in terms of changes that are visible radiographically but since the disease mostly develops very slowly it can take many years before it is visible radiographically (Cooper et al., 2000; Hannan et al., 2000; Schiphof et al., 2008). Osteoarthritis is strongly associated with increasing age and more common among women than among men. Worldwide estimates are that 18% of women and 9.6% of men aged  $\geq 60$  years have symptomatic osteoarthritis. Since the population of elderly is growing steadily, optimal management of osteoarthritis is of highest priority (Murray and Lopez, 1996; Roos, 2005; Dunlop et al., 2011; World Health Organization, 2013b).

Apart from age, susceptibility to osteoarthritis may be increased in part by genetic inheritance, ethnicity, and female gender (Heuts et al., 2004; Valdes et al., 2007; Jämsen et al., 2012). A strong correlation can also be seen between Body Mass Index and knee osteoarthritis and from a public health perspective, the strongest modifiable risk factor for knee osteoarthritis is body weight (Hart and Spector, 1993; Messier et al., 2004; Mounach et al., 2008). Besides all the individual suffering, the cost of osteoarthritis represents an enormous burden on the health care system. The total economic cost of osteoarthritis in Sweden in 2001 was over 12 billion SEK (Schmidt et al., 2003).





# Aims

In the light of the value of physical activity for health, it is important from a public health perspective to get more knowledge about how participation in physical activity may change over a lifetime and how different life-change events could impact on participation. Therefore, the general aim of this thesis was to investigate how different life-change events may affect participation in physical activity.

The specific aims were:

- To investigate the extent to which outdoor recreational physical activity was carried out during one year, and the factors influencing such activities from a gender perspective among persons  $\geq 60$  years of age (Paper I).
- To investigate participation in outdoor recreational physical activity, and factors influencing participation among parents-to-be, with and without previous children, from a gender perspective (Paper II).
- To investigate changes in physical activity patterns among women and men before and during pregnancy (Paper III).
- To investigate how physical activity at different frequencies affects individuals with osteoarthritis (Paper IV).



# Methods

## Design

In this thesis, quantitative designs have been used. Quantitative methods are suitable when the intention is to obtain a representative overview of general structures, as well as for understanding in a wide sense. The method allows connections between two or more variables to be investigated and identified (Halvorsen, 1998). Quantitative methods allow the researcher to become familiar with the problem or concepts to be studied, and also to create hypotheses to be tested. According to Bogdan and Biklen (2006) the emphasis is on data and causes of behaviour, the information is in the form of numbers that can be quantified and summarized, the mathematical process is the norm for analysing the numeric data. Then the final result is expressed in statistical terminology (Mertler and Charles, 2010). Table 1 shows sample size, design, data collection, measurements and analyses used in the studies.

**Table 1.** Sample size, design, data collection, measurements and analysis used in the studies.

	Paper I	Paper II	Paper III	Paper IV
Sample (n =)	999 individuals aged 60–96 years	432 parents and parents-to-be	280 parents and parents-to-be	100 individuals with osteoarthritis
Design	Longitudinal cohort study	Total survey	Longitudinal study	Part of a prospective randomized controlled trial
Data collection	Postal questionnaire survey	Postal questionnaire survey	Postal questionnaire survey	Questionnaire survey
Measurements	Questionnaire  The amount of regular light and/or intense outdoor recreational physical activity performed during the last year and the probability of performing physical activity as a function of 10 variables covering individual and socioeconomic factors were measured.	Questionnaire  Self-reported amount of outdoor recreational physical activity undertaken during the last year and the probability of participating in this physical activity using 25 variables covering individual and socioeconomic factors were measured.	Questionnaire  Self-reported amounts of physical activity performed outdoors and indoors during the 12 months before pregnancy and throughout the entire pregnancy were measured.	Questionnaire  Self-reported frequencies of physical activity. Individual and socioeconomic factors were measured. The EuroQol-5D and Arthritis Self-Efficacy Scale were used to measure self-perceived health and self-efficacy. Function was measured with SOLEO, SOLEC, one-legged jump and Grip Ability Test.
Analysis	Descriptive and comparative statistics. Multiple binary logistic regression. Pearson chi-squared test.	Descriptive and comparative statistics. Multiple binary logistic regression. Pearson chi-squared test. Fisher's exact test.	Descriptive and comparative statistics. Pearson chi-squared test.	Descriptive and comparative statistics. Mann-Whitney U test. Pearson chi-squared test.

## Study areas

Studies I, II and III were carried out in the municipality of Karlskrona. Karlskrona is an urban region with 62,900 inhabitants and is located in south-east Sweden on the Baltic Sea. Study IV was carried out in Malmö, located in the south-west of Sweden. It is the third largest city in Sweden with about 300,000 inhabitants.

## Sample and procedure

This thesis is based on data collection from three different samples.

### *A gender perspective on factors that influence outdoor recreational physical activity among elderly (Paper I)*

The data collection used in Paper I was taken from a Swedish longitudinal multi-centre cohort study, the Swedish National Study on Ageing and Care (SNAC), which included four centres in Sweden (Lagergren et al., 2004). In this study only data from one of the centres, Blekinge (SNAC-B), were used. The baseline survey started in 2001 and in this study data collected between April 2001 and May 2003 are included. This study included individuals 60–96 years of age. The purpose of the data collection design was to obtain a randomly selected sample, representing the old population in a broad variation of ages. Thus, those invited to participate were randomly selected, from the national Population Register, members of the cohorts aged 60, 66, 72 and 78. However, since the number of elderly decrease with increasing age, all surviving members of the cohorts aged 81, 84, 87, 90, 93 and 96 were invited. For data management and analysis the participants were divided into the following four age groups: 60–66, 72–78, 81–87, and 90–96.

The participants were invited by mail, on two occasions, by trained research staff, which included physicians and nurses. Those who had not replied after two weeks to the first invitation were contacted by telephone (three attempts). Those who agreed to participate were invited to the research centre; if they were unable to attend, a researcher visited them at their home.

In total, 2312 people were invited to participate and 1402 (61%) agreed to do so. Of the participants 817 were women and 585 were men. The response rate varied between 55% and 75% in the different age groups, with the younger age groups providing higher response rates. Of the 910 non-participants, 555 (61%) were women and 355 (39%) were men. The reasons given for not participating were unwillingness, 756 (83%), or considering themselves too sick to participate, 92 (10%). Contact could not be made with 62 people (7%). Of the 1402 persons who agreed to participate, 999 (71%) answered all of the questions in the questionnaire, and thus constitute the sample included in this study. Typically, those participants not answering all of the questions were  $\geq 81$  years of age and suffered from illness or functional impairment.

*Parenthood and factors that influence outdoor recreational physical activity from a gender perspective (Paper II)*

The data used in Paper II were collected in cooperation with two antenatal clinics, Lyckeby and Trossö, in the municipality of Karlskrona between March 2008 and February 2009. In Karlskrona, there are in total three antenatal clinics. Lyckeby and Trossö belong to the county council and the third, not cooperating in this data collection, is private. All parents-to-be who contacted one of the two antenatal clinics were invited by the midwife to participate in the study. The inclusion criteria were pregnant women who spoke Swedish. The exclusion criteria were women who had experienced miscarriage or other complications during previous pregnancies and deliveries or if the midwife did not consider it suitable to ask about participation in the study due to the woman's general state of health. During the study period, 669 women were registered at the clinics and 431 of these met the inclusion criteria. If they agreed to participate in the study, separate questionnaires (with different colours) were sent by post to the woman and her partner and were returned to the midwife at the initial meeting. If they had agreed to participate but did not return the questionnaire to the midwife, new questionnaires were sent as reminders. Reminders were sent with two attempts.

Of the 431 women that met the inclusion criteria, 224 responded to the questionnaire and 208 men, partners of the 224 women, also responded to the questionnaire. This study is the first part in a longitudinal study about how parenthood affects participation in physical activity. Figure 1 shows a flow chart of the study.

The reasons for non-participation were unwillingness 101/431 (23%), unsuitability for study inclusion 46/431 (11%) (as determined by the midwife) and non-compliance with the inclusion criteria 60/431 (14%).

*Patterns of physical activity among women and men before and during pregnancy (Paper III)*

The data used in Paper III are based on the data collection used in Paper II together with a new questionnaire that was sent out six to eight weeks after delivery, during the period January 2009 to January 2010. Of the 224 women and 208 men who participated in Paper II, 145 women and 135 men also participated in Paper III. The questionnaires were sent out after contact with the women's clinic at Blekingesjukhuset in Karlskrona. This was done to ensure that no questionnaire was sent to women who had experienced a miscarriage during pregnancy or who had complications during delivery affecting either the woman or the child, and where the midwife did not consider it appropriate to continue the study.

Excluded from the study were women who had experienced a miscarriage (n = 10) or who had complications during delivery affecting either the woman or the child and where the midwife did not consider it appropriate to continue the study (n = 17). Eighteen women were lost to follow-up since they had moved or delivered outside Karlskrona and 34 women did not respond to the second questionnaire (two reminders were sent by post). Figure 1 shows a flow chart of the study.

*Physical activity among individuals with osteoarthritis (Paper IV)*

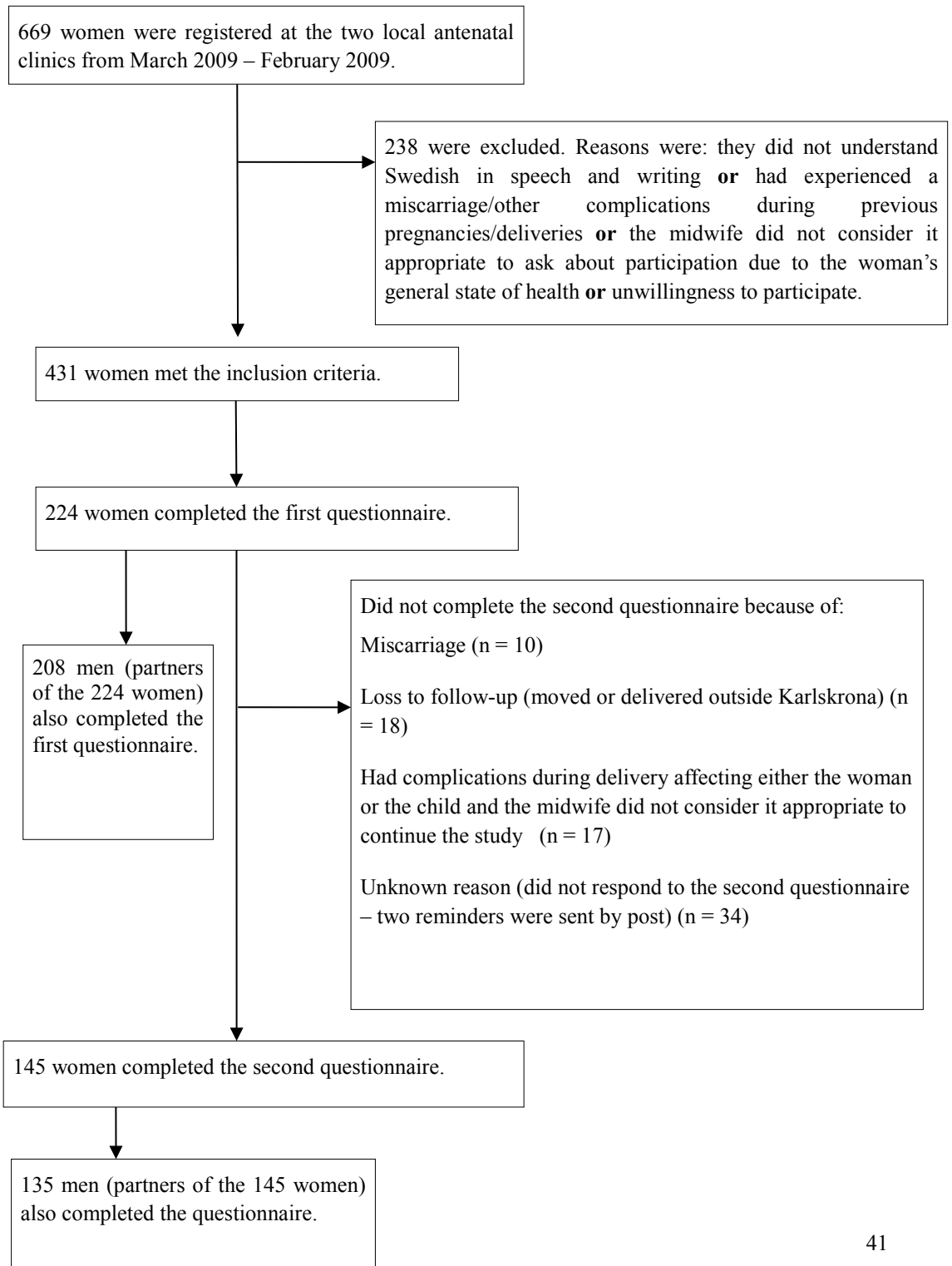
The data used in Paper IV were taken from a prospective randomized controlled trial that aimed to evaluate the effects of the patient education programme for osteoarthritis (PEPOA) in Primary Health Care in Malmö (Ekvall Hansson et al., 2010). Data collection was carried out during the period October 2007 to October 2008. Inclusion criteria were individuals of any age with osteoarthritis in the knee, hip or hand with pain, stiffness and limitation of movement in the affected joint. Exclusion criteria were inability to speak and understand Swedish. The participants were referred to PEPOA by their general practitioner, orthopaedic specialist, physiotherapist or occupational therapist.



A total of 120 individuals were assessed for eligibility in the study, and of those 114 agreed to participate at first. However, 14 then discontinued. Reasons for this were unwillingness to participate (n = 9), moved (n = 1), deceased (n = 1), other disease (n = 1) and unknown reason (n = 2). The 14 individuals who dropped out were between 47 and 81 years old, 13 women and one man.

This study includes 100 individuals, 83 women and 17 men. All individuals were tested at baseline and follow-up, but here only baseline data were used. At the first meeting at the PEPOA the participants answered a questionnaire and function was measured with three different tests for the lower extremity and one for the upper extremity. The tests were performed by either a physiotherapist or an occupational therapist.

**Figure I.** Flow chart of papers II and III.



## Data collection

### *A gender perspective on factors that influence outdoor recreational physical activity among elderly (Paper I)*

The SNAC study used in Paper I consists of two parts, one studying population and the other care and service. The data used in Paper I are from the population part of SNAC-B, which includes questions about economic and social situation, functional and cognitive ability, health status, life habits, life satisfaction and perceived quality of life, personality, use of drugs, aids, and receipt of formal and informal care and service (Lagergren et al., 2004). However, in Paper I, only questions about physical activity, ability to bathe or shower independently, economic and social situation, fear of falling and fear of violence, smoking habits, access to areas for country walks, education level and smoking habits were included.

### *Parenthood and factors that influence outdoor recreational physical activity from a gender perspective (Paper II)*

The questions used in Paper II about living status, living conditions, level of education, personal financial situation, number of children, tobacco and alcohol consumption and health status are based on questions that have been used and validated in Sweden's national public health survey, "Health on equal terms", a survey that has been conducted every year since 2004 (Swedish Institute of Public Health, 2011a).

The question about outdoor recreational physical activity concerned activities during the previous 12 months (calculated from one month before pregnancy), and has been applied in a national survey dealing with outdoor life and nature tourism in Sweden (Fredman et al., 2008). From this survey questions about what kind of activities the participants had performed and how often, as well as the questions about reasons for participation (i.e. to benefit for physical and/or social reasons and/or the adventure and/or restorative effects and also to attain well-being) were retrieved. The validation of the questions was first made by twenty people who were asked to answer the questions and then state how they interpreted the various issues and identify issues that were difficult to answer. After corrections another 16 randomly selected people answered the survey and then further adjustments were made before it was launched (Fredman et al., 2008).

From this survey we also used questions about obstacles to participating in outdoor recreational physical activity (refraining from outdoor activities

during the evenings due to fear of violence, costs, the experience of activities being too demanding physically, limitations due to the family situation, illness/functional disorder) as well as other considerations (lack of appropriate areas to perform it in; lack of equipment; lack of time; lack of courage; lack of interest or too little knowledge about how to perform activities). Questions about outdoor recreational physical activity for well-being, physical activity performed indoors, and dog or horse ownership were also used in Paper II.

### *Patterns of physical activity among women and men before and during pregnancy (Paper III)*

As Paper III is based on longitudinal data, the questions used are from the same questionnaires as in Paper II. From the questionnaire that “Health on Equal Terms” (Swedish Institute of Public Health, 2011a) is based on, questions were used about living status, living conditions, level of education, personal financial situation, number of children, tobacco and alcohol consumption and health status. From the national survey dealing with outdoor life and nature tourism in Sweden (Fredman et al., 2008) the questions about outdoor recreational physical activity, what kind of activities the participants had performed and how often, as well as the questions about physical activity performed indoors were used. The questions about physical activity performed outdoors and indoors were about participation throughout the entire pregnancy.

Two questions about fatigue during pregnancy and whether fatigue limited participation in physical activity during pregnancy were added. Those questions were tested in a pilot study (n = 10) and no adjustment before using was needed.

### *Physical activity among individuals with osteoarthritis (Paper IV)*

In Paper IV questions about self-perceived health and self-efficacy were asked. Self-perceived health was measured by the generic instrument Euro-Qol-5D (EQ5D) (Fransen and Edmonds, 1999; EQ5D), which has been widely used because of its reported reliability and validity (Brazier et al., 1993; Hurst et al., 1997; Barton et al., 2009). The EQ5D comprises five dimensions: mobility, self-care, usual activities, pain or discomfort, and anxiety or depression, each with three levels: no problems, some problems, or extreme problems. By placing a cross in the box for the most appropriate statement, the participant indicates his/her state. These results in a one-digit

number and the digits for the five dimensions can be combined in a five-digit number that can generate 243 possible combinations of responses. The EQ5D can be used as a global health index or as a health profile. The values range from no problems on any dimensions (value = 1.0) to most severe impairment on all 5 (− 0.594) (Dolan and Roberts, 2002). The EQ5D also involves a Visual Analogue Scale (EQ5D-VAS). On this scale, participants are asked to rate their health on a vertical scale, where 0 is worst possible health state and 100 is the best. All over the world, EQ5D is used for monitoring health status among different groups, for example individuals with osteoarthritis (Jubb et al., 2008), and with chronic conditions (Richardson et al., 2008).

Self-efficacy was measured by the generic instrument Arthritis Self-Efficacy Scale (ASES), which is a valid and reliable instrument developed to measure self-efficacy in individuals with rheumatic diseases (Brekke et al., 2001). The questionnaire was designed by Lorig et al. (1989) and contains five items regarding coping with pain, nine items regarding function and six items regarding other symptoms (e.g. fatigue, dejection and being able to handle disappointment/frustration that diseases cause). Each item presents a statement with which the individual may agree or disagree. Answers are given on a visual analogue scale, where 10 represents the lowest possible self-efficacy level and 100 the highest. The mean value for each item is calculated.

In Paper IV the function of the lower and the upper extremity was measured. The function of the lower extremity was measured with three different tests. Balance was measured by standing one leg eyes open (SOLEO) and standing one leg eyes closed (SOLEC). During both SOLEO and SOLEC the participants stood with their arms crossed (Jarnlo and Thorngren, 1991). The time up to 60 seconds was measured. Both SOLEO and SOLEC are considered to be statistical balance measures with an initial dynamic phase (Jonsson et al., 2004). In one-legged jump (Thorstensson et al., 2004) the distance from heel in starting position to heel in landing position was measured.

The function of the upper extremity was measured by the Grip Ability Test (GAT) (Dellhag and Bjelle, 1995). GAT includes three items: putting a flexigrip stocking over the non-dominant hand, putting a paper clip on an envelope and pouring water from a jug. For each item, time is measured and calculated in a total score. A high score corresponds to a decrease in hand function. GAT has been used for individuals with rheumatoid arthritis

(Björk et al., 2007) and has also been tested for reliability and internal consistency (Dellhag and Bjelle, 1995).

The participants were also asked questions about what kind of physical activity they participated in and how often. They were also asked about their marital status, level of education, smoking habits, weight and height and whether they were afraid that their joints would be harmed by physical activity. These questions were constructed by the research team and have not been validated.

## Statistical analyses

Descriptive statistics were computed to evaluate the data for sample characteristics in all four papers. Also, in all four papers, chi-squared test (four-fold table) was used to test the significance of differences between groups. In papers I and II binary logistic regression analysis was used to evaluate the associations between the dependent variable, participation in outdoor recreational physical activity and various independent variables. The simultaneous relationships between the dependent variable and all independent variables were modelled using stepwise backward regression. The relationships between each independent variable and the dependent variable controlling for all other variables were evaluated by determining odds ratios (ORs). In paper IV the non-parametric Mann-Whitney U test was used for calculating differences between the independent groups.

In all four papers, the statistical analyses were conducted using the Statistical Package for Social Science for Windows (SPSS) versions 17.0, 20.0, and 21.0 (SPSS Inc. software location Blekinge Institute of Technology and Lund University). The level of statistical significance was set at  $p$ -value  $< 0.05$  in all papers.

In paper I, the Pearson chi-square test was used to evaluate gender differences in variables covered in the questionnaire and to evaluate differences in characteristics between groups that performed outdoor recreational physical activity (light and/or more intense) in relation to all the other variables covered in the questionnaire. Stepwise multiple binary logistic regression analysis was used (backward conditional) to evaluate the probability associations between various independent variables and the performance of outdoor recreational physical activity. The dependent

variable was measured by combining answers to the two questions about outdoor recreational physical activity (light and/or more intense during the last 12 months) on a binary scale, as follows: 0 = never to 1–3 times/month, and 1 = several times per week to every day. Thus, the relative input of light and intense activities was the same. Simultaneous relationships between the dependent variable and all independent variables were modelled and evaluated using odds ratio (OR). Two different models were separately tested for both women and men. In the first model, all independent variables from the questionnaire were included. The next model included variables for which a significant impact on the probability of performing outdoor recreational physical activity existed between the independent variables that included more than 5 participants in each combined group, and also evaluated association for interaction between these variables, with a  $p$ -value  $< 0.05$ . The statistical significance of the variables was determined using a 95% confidence interval (CI).

In paper II, a chi-squared test was used to compare proportions between groups. When the expected frequencies were  $< 5$  in any group, Fisher's exact test for the comparison of two proportion was used. Multivariate analyses were carried out by means of logistical regression models (method: backward conditional) with participation in outdoor recreational physical activity as the dependent variable. Participation in outdoor recreational physical activity was dichotomized into "active" (if a person participated in activities several times ( $> 3$  times per month to every day) and "not active" (if a person never participated in activities or up to 2–3 times per month). Simultaneous relationship between the dependent variable and all independent variables were modelled and evaluated using odds ratios (ORs).

Two different models were tested separately for (1) women with children, (2) women without children, (3) all women, (4) men with children, (5) men without children, and (6) all men. In the first model, all independent variables from the questionnaire were included. The second model included variables from the first model for which a significant impact on the probability of participation in outdoor recreational physical activity existed between the independent variables that included more than five participants in each combined group. The second model also evaluated the interactions between these variables, with a  $p$ -value  $< 0.05$ . The statistical significance of the variables was determined using a 95% confidence interval (CI).

In paper III, a chi-squared test was used to compare proportions between groups. The participants were asked to mark their outdoor recreational physical activity from a list of 24 activities. For the analysis, the 24 activities were categorized into six groups: *strolling/walking* (including strolling, walking, Nordic walking, golf), *exercising* (including jogging, rollerblading, cycling, orienteering, cross-country riding) *aquatic sports* (including canoeing, diving, bathing) *winter sports* (including cross-country skiing, skating, downhill skiing, tobogganing), *participation in non-strenuous activities* (including hunting, sunbathing, angling, camping, bird-watching, motorboating, sailing) and *gardening*. *Physical activity performed indoors* was another group based on the participants' responses and included aerobics, gymnastics, swimming and weight training. Participation in the 24 different forms of outdoor recreational physical activity as well as indoor physical activity was separated into "active" (if a person participated in activities several times (> 3 times per month to every day) and "not active" (if a person never participated in activities or up to 2–3 times per month).

In paper IV, the participants were categorized into three different groups according to their answers about their participation in physical activity. The three groups were *physically active* (participation in physical activity more than two times per week to daily); *moderately physically active* (participation in physical activity one or two times per week), and *physically inactive* (no participation at all in physical activity). The non-parametric Mann-Whitney U test was used for calculating differences between the three groups in the proportions of levels in EQ5D, ASES, SOLEO, SOLEC, one-legged jump, GAT and BMI. In the Mann-Whitney U test, differences between the independent groups were compared and since the study sample was small, this test was used. A chi-squared test was used to compare proportions between the groups. Also, the Mann-Whitney U test and the chi-squared test were used to compare differences between women and men.





# Ethical considerations

In this thesis, the ethical principles of respect of autonomy, beneficence, non-maleficence and the principle of justice (MFR, 2000) have guided the work. The Regional Ethical Review Board, Lund, approved studies I–IV. All the collected data were treated confidentially. The participants' autonomy was respected by means of confidentiality, informed consent and respect for their privacy. Code lists and questionnaires were kept in different places and were only available to the research team. The statistical analyses were made at group level and, accordingly, it is not possible to identify any participant through the descriptions of the results in the papers.



# Results and comments

## A gender perspective on factors that influence outdoor recreational physical activity among elderly (Paper I)

### *Results*

The sample for paper I included 999 people, 548 women (55%) and 451 men (45%) with a mean age of 74.

As seen in table 2 and table 3, the main findings of this study indicate that being independent and physically healthy enough to manage one's personal hygiene and having access to areas for country walks are the most important factors associated with the probability of performing outdoor recreational physical activity for both women and men. Even if no interaction was seen between age and gender, the probability for activities decreased with advancing age in all age groups among women. Increasing age seems to affect activities among women negatively to a higher extent than men. Educational level among women and smoking habits among men were also important factors affecting the probability of engaging in outdoor recreational physical activity. Living alone, being unable to cover an unexpected cost, fear of violence, and fear of falling were factors that negatively affected the performance of outdoor recreational physical activity among women. Thus, there were more factors associated with limitations for women to perform outdoor recreational physical activity than for men, even if the performance was almost equal between the groups. Two-thirds of both women and men had performed outdoor recreational physical activity during the preceding year.

**Table 2.** Differences between women and men and factors that were significantly associated with the performance of outdoor recreational physical activity.

Factors	Women <i>p</i> -value	Men <i>p</i> -value
Being able to bathe or shower independently	<b>0.000</b>	<b>&lt; 0.001</b>
Being a non-smoker	<b>0.031</b>	0.170
Having access to areas for country walks	<b>0.002</b>	<b>&lt; 0.001</b>
Cohabiting or not	0.232	<b>&lt; 0.001</b>
Level of education <sup>1</sup>	0.880	<b>&lt; 0.001</b>
Being able to cover an unexpected cost within a week <sup>2</sup>	0.214	<b>0.014</b>
Being part of a social network or not	0.576	0.076
Having fear of violence or not	0.888	<b>0.015</b>
Having fear of falling or not	0.116	<b>&lt; 0.001</b>

<sup>1</sup> Completion of university education.

<sup>2</sup> Being able to cover an unexpected cost of SEK 14,000 (approximately EUR 1,400) within one week.

Statistically significant *p*-values are shown in bold figures.

**Table 3.** Binary logistic regression predicting independent factors significantly associated with the probability of performing outdoor recreational physical activity among elderly women and men.

	Factors	Odds Ratio*	Confidence interval	<i>p</i> -value
Men	90–96 years <sup>1</sup>	0.291	0.101–0.841	0.023
	Being a non-smoker	1.941	1.105–3.409	0.021
	Being able to bathe or shower independently	11.057	2.398–50.991	0.002
	Having access to areas for country walks	2.220	1.191–4.138	0.012
Women	72–78 years <sup>1</sup>	0.469	0.274–0.804	0.006
	81–87 years <sup>1</sup>	0.411	0.235–0.717	0.002
	90–96 years <sup>1</sup>	0.200	0.081–0.498	0.001
	Being able to bathe or shower independently	6.820	2.831–16.432	0.000
	Having a higher level of education <sup>2</sup>	2.293	1.121–4.690	0.023
	81–87 years and having access to areas for country walks <sup>3</sup>	4.388	2.145–8.976	0.000

<sup>1</sup> Versus the 60–66-year-old age group.

<sup>2</sup> Completion of university education.

<sup>3</sup> Interaction variable measuring age group 81–87 years as compared to age group 60–66 years and having access to areas for country walks.

\* Covariates were adjusted to each odds ratio.

## *Comments*

The findings indicate that elderly women and men seem to have different opportunities and needs to perform outdoor recreational physical activity. It is important not to view the elderly as being one homogeneous group. These considerations might not be sufficiently taken into account today and could be improved, i.e., in the health-promoting activities suggested to elderly people by healthcare personnel, as well as in public spatial planning. As there were more factors associated with limitations for women to perform outdoor recreational physical activity than for men, it is important to pay attention to the situation of elderly women. For example, since fear of falling and violence were two factors that affected participation negatively among women, it is important to create environments that enable them to dare to go out and also, for example, to start walking groups where they can support each other and also have social contacts. This might be extra important for women living alone, as this was a factor that negatively affected participation in outdoor activities. However, despite more limitations, the women were not less physically active than the men. A possible explanation for this is that the women in this study were interested in physical activity and in their health and they had found areas where they could participate, for example, in physical activity indoors.

## Parenthood and factors that influence outdoor recreational physical activity from a gender perspective (Paper II)

### *Results*

The sample for paper II included 432 people, 224 women (52%) and 208 men (48%) with a mean age of 31.

Of the women included, 171/224 (76%) had participated in outdoor recreational physical activity several times per month to every day during the last 12 months up to one month before pregnancy, and 135/208 (65%) men had participated several times per month to every day during the same period. Women strolled and walked significantly more ( $p = 0.017$ ) than men, but in all other activities studied no significant differences were seen between the groups. As regards age, 132/224 (59%) of the women were 20–30 years old and 92/224 (41%) were > 30. Among the men, 90/208 (43%)

were aged 20–30 and 118/208 (57%) were > 30. Among both women and men, no significant differences were seen between the age groups and participation in outdoor recreational physical activity, women ( $p = 0.694$ ) and men ( $p = 0.904$ ). Tables 4 and 5 show factors that were associated with age.

**Table 4.** Number and significant p-values between the age groups of women.

Factors	Women 20–30 years n = 132 (%)*	Women > 30 years n = 92 (%)*	<i>p</i> -value
Higher education <sup>1</sup>	59 (45)	68 (74)	0.001
Personal financial situation <sup>2</sup>	106 (80)	84 (91)	0.024
Smoking habits <sup>3</sup>	35 (27)	8 (9)	0.001
Not able to participate in as much outdoor recreational physical activity as desired due to lack of time	74 (56)	69 (75)	0.004
Not able to participate in as much outdoor recreational physical activity as desired due to family situation	14 (11)	32 (35)	0.001
Not able to participate in as much outdoor recreational physical activity as desired due to lack of appropriate areas	19 (14)	5 (5)	0.033
Not able to participate in as much outdoor recreational physical activity as desired due to lack of equipment	14 (11)	3 (3)	0.041

<sup>1</sup> Completed university education.

<sup>2</sup> Able to cover an unexpected cost of SEK 14,000 (approximately EUR 1,400) within one week.

<sup>3</sup> Smokes regularly/sometimes.

\*Number participating and percentage.



**Table 5.** Number and significant p-values between the age groups of men.

Factors	Men 20–30 years n = 90 (%)*	Men > 30 years n = 118 (%)*	p-value
Higher education <sup>1</sup>	39 (43)	80 (68)	0.001
Not able to participate in as much outdoor recreational physical activity as desired due to costs	13 (14)	5 (4)	0.004
Not able to participate in as much outdoor recreational physical activity as desired due to lack of appropriate areas	16 (18)	6 (5)	0.003
Not able to participate in as much outdoor recreational physical activity as desired due to lack of interest	22 (24)	13 (11)	0.010

<sup>1</sup> Completed university education.

\*Number participating and percentage.

As seen in table 6 for both women and men, having a dog or horse seemed to be the most important factor associated with the probability of participation in outdoor recreational physical activity. The economic situation and participation in physical activity indoors were also significantly associated with participation in outdoor recreational physical activity among women. For men improved physical condition, staying power and vigour played a significant role, as well as having a family situation that allowed physical activity.

When studying differences between women and men *with and without* children, some significant differences in activity patterns were seen. Women and men *without children* participated more in physical activity indoors than those who had children ( $p = 0.001$  and  $p = 0.006$  respectively). Women and men *with children* participated in more gardening than those without children ( $p = 0.009$  and  $p = 0.001$  respectively) and women *with children* also participated in more winter sports than women without children ( $p = 0.013$ ). Significantly more women than men ( $p = 0.001$ ) abandoned outdoor activities during the evenings due to fear of violence.

**Table 6.** Binary logistic regression predicting independent factors significantly associated with the probability of participating in outdoor recreational physical activity.

Factors	Women			Men		
	OR	CI (95%)	<i>P</i> -value	OR	CI (95%)	<i>P</i> -value
Dog or horse ownership	3.419	1.167–10.019	0.025	24.523	3.220–186.778	0.002
Permissive family situation <sup>1</sup>	3.084	1.206–7.884	0.019	n.s.	n.s.	n.s.
Dog or horse ownership and physical reasons <sup>2</sup>	5.570	2.405–12.904	0.001	n.s.	n.s.	n.s.
Dog or horse ownership and economy <sup>3</sup>	n.s.	n.s.	n.s.	2.705	1.021–7.168	0.045
Indoor activities <sup>4</sup>	n.s.	n.s.	n.s.	4.047	1.929–8488	0.001

<sup>1</sup> Having a family situation that allowed participation in outdoor recreational physical activity.

<sup>2</sup> Interaction variable measuring dog or horse ownership and participation in outdoor recreational physical activity for physical reasons.

<sup>3</sup> Interaction variable measuring dog or horse ownership and ability to cover an unexpected cost of SEK 14,000 (approximately EUR 1,400) within one week.

<sup>4</sup> Participation in physical activities indoors.

## *Comments*

These findings indicate that becoming a parent is a life-change event that affects participation in physical activity. Midwives and health promoters have an important role to play, both to improve the parents' own health and to help them model healthful behaviour for their children. This can be done e.g. by talking with new parents about their personal barriers to participating in physical activity and to identify ways to overcome these barriers and integrate physical activity into their new lifestyle. New parents may be especially open and interested in concepts to increase their physical activity that allow them to model healthful behaviour for their children.

## Patterns of physical activity among women and men before and during pregnancy (Paper III)

### *Results*

The sample for paper III included 280 people, 145 women (52%) and 135 men (48%) with a mean age of 32.

As table 7 shows, changes in activity patterns can be seen among both women and men during pregnancy compared to before pregnancy. Both women and men were more frequently physically active before pregnancy than during pregnancy, but both groups strolled/walked significantly more during pregnancy than before. The activity patterns were similar between the groups.

Of the women, 90% (131/145) stated their health status as excellent/very good before pregnancy as compared to 80% (116/145) during pregnancy ( $p = 0.013$ ). The corresponding figures for the men were 97% (131/135) before and 93% (126/135) during pregnancy. Of the women, 59% (85/145) stated that they suffered from fatigue during pregnancy, as compared to 22% (32/145) before pregnancy ( $p = 0.001$ ). Forty per cent (58/145) stated that fatigue limited their physical activity during pregnancy. Among the men, no differences in fatigue were seen before or during pregnancy of the woman, although the men became still less physically active. Significantly more women than men ( $p = 0.001$ ) abandoned outdoor activities during the evenings due to fear of violence.

As seen in table 8, significantly more women and men among the dropouts had a lower level of education and significantly more of the men were smokers compared to the cohort as a whole. During the 12 months preceding one month of pregnancy, the women in this study had performed significantly more strolling/walking ( $p = 0.001$ ), aquatic sports ( $p = 0.004$ ), winter sports ( $p = 0.001$ ), non-strenuous activities ( $p = 0.001$ ) and physical activity indoors ( $p = 0.001$ ) than the women in the dropout group. Among the men, those included in this study had performed significantly more winter sports ( $p = 0.001$ ) and non-strenuous activities ( $p = 0.001$ ) than those in the dropout group.

Factors significantly associated with outdoor recreational physical activity among women before pregnancy were participating in activities indoors ( $p = 0.018$ ) and having a family situation that permitted outdoor recreational physical activity ( $p = 0.035$ ). During pregnancy a factor that was significantly associated with outdoor recreational physical activity was having a family situation that permitted those kind of activities ( $p = 0.001$ ).

Factors significantly associated with outdoor recreational physical activity among men in the last 12 months up to one month before pregnancy were participating in activities indoors ( $p = 0.005$ ), having a dog or horse ( $p = 0.018$ ) and not having children ( $p = 0.018$ ). During the whole pregnancy no significant factor was found to be associated with outdoor recreational physical activity.

**Table 7.** Outdoor and indoor physical activities carried out during the 12 months up to one month before pregnancy<sup>1</sup> and during pregnancy<sup>2</sup> and the *p*-values for the differences.

Factors	Women <sup>1</sup> n = 145 (%)*	Women <sup>2</sup> n = 145 (%)*	<i>p</i> - value	Men <sup>1</sup> n = 135 (%)*	Men <sup>2</sup> n = 135 (%)*	<i>p</i> - value
Strolling/walking <sup>3</sup>	113 (78)	136 (94)	<b>0.001</b>	86 (64)	122 (90)	<b>0.001</b>
Exercise <sup>4</sup>	100 (69)	49 (34)	<b>0.001</b>	72 (53)	52 (39)	<b>0.015</b>
Aquatic sports <sup>5</sup>	103 (71)	58 (40)	<b>0.001</b>	75 (56)	53 (39)	<b>0.007</b>
Winter sports <sup>6</sup>	51 (35)	24 (17)	<b>0.001</b>	23 (17)	24 (18)	0.872
Gardening	74 (51)	72 (50)	0.814	79 (59)	80 (59)	0.902
Indoor physical activity <sup>7</sup>	94 (65)	52 (36)	<b>0.001</b>	90 (67)	74 (55)	<b>0.046</b>
Participation in non-strenuous activities <sup>8</sup>	121 (83)	82 (57)	<b>0.001</b>	99 (74)	81 (60)	<b>0.020</b>

<sup>3</sup> Strolling, walking, Nordic walking, golf.

<sup>4</sup> Jogging, rollerblading, biking, orienteering, cross-country riding.

<sup>5</sup> Canoeing, diving, bathing.

<sup>6</sup> Cross-country skiing, skating, downhill skiing, tobogganing.

<sup>7</sup> Floorball, weight training, aerobics, swimming, gymnastics.

<sup>8</sup> Hunting, sunbathing, angling, camping, bird watching, motorboating, sailing.

\* Number participating in %.

Statistically significant *p*-values are shown in bold figures.

**Table 8.** Characteristics of the participants and the dropouts and *p*-values of the differences.

Variables	Women (included in the study) n = 145 (%)*	Women (dropouts) n = 79 (%)*	<i>p</i> - value	Men (included in the study) n = 135 (%)*	Men (dropouts) n = 73 (%)*	<i>p</i> - value
Mean age	30	29	-----	33	31	-----
Cohabiting <sup>1</sup>	144 (99)	78 (99)	0.944	135 (100)	71 (98)	0.650
Lower level of education <sup>2</sup>	55 (38)	44 (56)	<b>0.006</b>	47 (35)	42 (58)	<b>0.001</b>
Personal financial situation <sup>3</sup>	126 (87)	65 (82)	0.524	120 (89)	61 (84)	0.389
Living in the countryside <sup>4</sup>	54 (37)	29 (37)	0.739	51 (38)	25 (34)	0.989
Smoker <sup>5</sup>	13 (9)	18 (23)	0.314	14 (10)	20 (27)	<b>0.036</b>
Snuff user <sup>6</sup>	4 (3)	1 (1)	0.470	45 (33)	28 (38)	0.725
Drinks alcohol <sup>7</sup>	50 (34)	38 (48)	0.070	105 (78)	53 (73)	0.583

<sup>1</sup> Married/living with a partner.

<sup>2</sup> Completion of nine-year compulsory school and senior high school, compared to higher education, i.e. completion of a university education.

<sup>3</sup> Able to cover an unexpected cost of SEK 14,000 (approximately EUR 1,400) in one week.

<sup>4</sup> A small village in the countryside with many single-family houses compared to living in a town, i.e. in a densely built-up area, in an area of a town or in a suburb.

<sup>5</sup> Smokes regularly/sometimes.

<sup>6</sup> Uses “moist snuff” (a Swedish smokeless tobacco) regularly/sometimes.

<sup>7</sup> Drinks 1–9 glasses per week.

\* Number participating in %.

Statistically significant *p*-values are shown in bold figures.

## *Comments*

These findings indicate that pregnancy is a life-change event that affects participation in physical activity among both women and men when activity patterns during pregnancy are compared with pre-pregnancy. This study contributes new knowledge about changes in men's physical activity patterns from pre-pregnancy to pregnancy and are unique since, to the best of my knowledge, no earlier studies on this subject have been performed. It is important not to forget the men and what happens to their participation in physical activity during this life-change event. By finding activities, for example performed outdoors, that women and men can perform together during pregnancy they can encourage each other to be physically active. Since unhealthy behaviour seems to be more prevalent among the dropouts, they must be seen as a target group that needs to be focused on. It is likely that those who agreed to participate in this study are more interested in physical activity and health issues than the dropouts, and groups similar to the dropouts might be in even more need of support and health promotion efforts.

## Physical activity among individuals with osteoarthritis (Paper IV)

### *Results*

The sample for paper IV included 100 people, 83 women (83%) and 17 men (17%) with a mean age of 63.

Individuals who were moderately physically active rated their health and self-efficacy best, had the lowest BMI and best function of the lower extremity (except SOLEC where those that were physically active were better) as well as in the upper extremity. In total, 63/100 (63%) of the participants were physically active, 18/100 (18%) were moderately physically active and 19/100 (19%) were physically inactive. Of the women 55/83 (66%) were physically active, 13/83 (16%) were moderately physically active and 15/83 (18%) were physically inactive. Of the men 8/17 (47%) were physically active, 5/17 (29%) were moderately physically active and 4/17 (24%) were physically inactive.

Among all the participants, the most commonly osteoarthritis-affected joints were the knee and hand and 100/68 (68%) had BMI  $\geq$  25. Among the

participants who were physically or moderately physically active, walking outdoors was the most common physical activity ( $n = 38$ ).

As regards age, 47/83 (57%) of the women and 13/17 (76%) of the men were  $< 65$  years. Women  $< 65$  years had a significantly better SOLEO ( $p = 0.048$ ), SOLEC ( $p = 0.001$ ) and one-legged jump ( $p = 0.002$ ) than women  $\geq 65$  years. Men  $< 65$  had a significantly better SOLEC ( $p = 0.004$ ) than men  $\geq 65$  years. In the three groups, 40/63 (63%) in the physically active group, 10/19 (53%) in the moderately active group and 10/18 (56%) in the inactive group were  $< 65$  years. In the physically active group participants  $< 65$  had a significant better SOLEO ( $p = 0.009$ ), SOLEC ( $p = 0.001$ ) and one-legged jump ( $p = 0.002$ ) than those  $\geq 65$  years. In the inactive group participants  $< 65$  years had significantly better ASES function ( $p = 0.021$ ) than those  $\geq 65$  years. No significant differences according to age were seen among participants who were moderately physically.

No significant differences were seen between the three groups as regards age, marital status, level of education, smoking habits and whether the participants were afraid that their joints would be harmed by physical activity. As regards gender, the only significant difference found was that women were significantly ( $p = 0.008$ ) more afraid that their joints would be harmed by physical activity than men were.

As regards gender, 19/83 (23%) of the women and 7/17 (41%) of the men did not take any drugs against their osteoarthritis. In total, 26/100 (26%) did not take any drugs against their osteoarthritis. In the physically active group 16/63 (25%) did not take any drugs, among those that were moderately active 5/18 (28%) did not take any drugs and in the inactive group 4/19 (21%) did not take any drugs. As regards age, no significant differences were seen among women and men aged  $< 65$  and  $\geq 65$  years. Table 9 shows  $p$ -values for differences between the three groups. As regards gender, the only significant difference that was found was that women had significantly more ( $p = 0.028$ ) other symptoms according to ASES than men.



**Table 9.** P-values for differences between the groups.

	Physically active* vs moderately# physically active	Physically active vs physically inactive <sup>□</sup>	Moderately physically active vs physically inactive
BMI <sup>1</sup>	0.678	0.296	0.230
Age	0.625	0.376	0.738
ASES-Pain <sup>2</sup>	0.203	0.660	0.267
ASES-Function <sup>3</sup>	0.464	0.652	0.354
ASES-Other symptoms <sup>4</sup>	0.436	0.066	<b>0.024</b>
EQ5D-Index <sup>5</sup>	0.166	0.302	<b>0.018</b>
EQ5D-VAS <sup>6</sup>	0.593	0.424	0.286
GAT total <sup>7</sup>	0.474	<b>0.003</b>	0.064
SOLEO (sec) <sup>8</sup>	0.171	0.170	<b>0.038</b>
SOLEC (sec) <sup>9</sup>	0.486	0.304	0.342
One-legged jump	0.976	<b>0.045</b>	0.143

<sup>1</sup> Body Mass Index.

<sup>2-4</sup> Arthritis Self-Efficacy Scale.

<sup>5</sup> Euro-Qol-5D.

<sup>6</sup> Euro-Qol-5D Visual Analogue Scale.

<sup>7</sup> Grip Ability Test.

<sup>8</sup> Standing one leg eyes open.

<sup>9</sup> Standing one leg eyes closed.

\* Participation in physical activity more than two times per week to daily.

# Participation in physical activity one-two times per week.

□ No participation at all in physical activity.

Statistically significant p-values are shown in bold figures.

### *Comments*

The study shows that women were more afraid that their joints would be harmed by physical activity than men and that they were using more drugs against their osteoarthritis. Since osteoarthritis is twice as common among women as among men, this finding is important from both a personal and a public health perspective. The findings of this study also contribute knowledge about how physical activity at different frequencies affects individuals with osteoarthritis and indicates that moderate physical activity is beneficial for individuals with osteoarthritis.



# Discussion

In the field of public health, the aim of this thesis was to investigate how different life-change events may affect participation in physical activity. Life-change events studied were pregnancy, parenthood, getting older and living with a chronic disease (osteoarthritis). First, a short summary of the main findings is given. Then the results are discussed and finally some methodological aspects of this thesis will be considered.

## Main findings

The life-change events studied include different parts of a life, and both similarities and differences can be found. The main findings indicate that all four life-change events affect participation in physical activity among both women and men, but in different ways and to differing extents. Also, different life-change events may have different effects on behaviour in physical activity. A gender perspective thus seems to be important to consider both in research and when planning health-promoting activities for different groups to get people to become or stay physically active. The economic situation as well as age, education level and smoking habits were also factors that affected participation in physical activity in different groups. Thus, these factors also need to be taken into account in research as well as in the health-promoting work. In all four studies almost equal participation in physical activity has been found between women and men, but overall, more factors were found to be associated with limitations for women to participate in physical activity.

Pregnancy and parenthood are life-change events that affect participation in physical activity among women and men alike. Both women and men were more frequently physically active before than during pregnancy, and changes in activity patterns are similar. Both women and men without children were found to be more frequently physically active than those who had children.

Even accessibility is an important aspect to take into account when studying factors associated with physical activity, since having access to areas for country walks was found to be an important factor for participating in outdoor recreational physical activity.

Fear of different kinds was found to affect women's participation in physical activity to a much larger extent than men's. Both younger and elderly women abstained from outdoor physical activities during the evenings due to fear of violence. Among elderly women fear of falling was also seen as a psychological barrier to participation. Fear was also seen among women with osteoarthritis who were afraid that physical activity might harm their joints, and this affected their participation in physical activity negatively.

## Considerations of the results

The findings of this thesis show that women are not less physically active than men but that all the life-change events studied affect participation in physical activity for both women and men, but in different ways and to different extent. Women and men seem to have different opportunities and needs depending on which life-change event they are in. Findings from Allender et al. (2006) indicate that life-change events in general have a negative effect on participation in physical activity. As regular physical activity is a very important aspect of human health, all efforts that can be made to get people stay physically active or motivate them to start are important both for the individual and for public health as a whole.

In line with previous research (King et al., 1998; Symons Downs and Hausenblas, 2004; Rousham et al., 2005; Pereira et al., 2007; Allender et al., 2008; Bellows-Riecken and Rhodes; 2008; Hull et al., 2010; Berge et al., 2011), the findings from this thesis show that pregnancy and parenthood are life-change events affecting participation in physical activity. In paper II participants without children were more frequently physically active than those who had children. In paper III participants were found to be more frequently physically active before than during pregnancy. Also, more barriers to physical activity were seen among participants with children in paper II, especially among men. Here, for example, a family situation that permitted outdoor recreational physical activity was a factor significantly associated with an increased probability of participating in outdoor

recreational physical activity among men. Among women, age seemed to play a role since women aged > 30 stated that they were not able to participate in as much outdoor recreational physical activity as they desired due to the family situation and also due to lack of time compared to women aged 20–30. Also in paper I, increasing age was found as a factor that negatively affected women's participation in outdoor recreational physical activity to a higher extent than among men.

The findings of this thesis also give new input about changes in men's activity patterns from pre-pregnancy to pregnancy and indicate that pregnancy can be a life-change event even for men, associated with decreased levels in physical activity, that have previously only been associated with women. In the preventive work with women's health during pregnancy, it is important not to forget the partner, who can be an important player to help and support the women to be physically active during pregnancy. Physical activity is important both for the parents' own health and also for the child. As public health aims to prevent disease, promote health and extend life among the population as a whole (World Health Organization, 2013a) the long-term perspective is important to consider. Findings show that children of physically active parents were more likely to be active than children of inactive parents (Moore et al., 1991; Loprinzi and Trost, 2010; Zecevic et al., 2010). Parents were most likely to have physically active children if both were active themselves (Moore et al., 1991). Possible mechanisms for the relationship between parents' and children's activity levels include the parents' acting as role models, sharing activities by family members and enhancement and support by active parents of their children's participation in physical activity. This might be an important motivator for parents-to-be laying a foundation already during pregnancy for a physically active life both for them and for their coming child.

Here, outdoor recreational physical activities can be useful and recommended, as they includes a broad range of activities that should attract the majority of families. As physical activities performed outdoors have been found to have restorative effects on health and self-perceived health, this should be seen as a resource that ought to be highlighted by health promoters and midwives (Kaplan and Kaplan, 1989; Frumkin, 2001; Maas et al., 2006; Mitchell and Popham, 2008; Maas et al., 2009; Bowler et al., 2010; Park et al., 2010; Ward Thompson et al., 2012). This supports the findings of papers II and III, where the majority of the participants stated that outdoor recreational activities had a positive impact on their well-being. It is well-known that maternal prenatal and postpartum depression is

prevalent (10–20%) and has negative personal, family and child development outcomes, but paternal depression during this life-change event has received little attention (Andersson et al., 2003; Marcus et al., 2003; Adouard et al., 2005; Felice et al., 2006; Limlomwongse and Liabsuetrakul 2006; Paulson and Bazemore, 2010). However, a meta-analysis by Paulson and Bazemore (2010), including 43 studies about prenatal and postpartum depression in fathers, showed that depression during this life-change event was evident in about 10% of men and a moderate correlation with maternal depression could be seen. Previous studies show that physical activity may serve as a protective factor for depression and also can be used in the treatment of depression and anxiety disorders (Dunn et al., 2005; Singh et al., 2005; Uebelacker et al., 2013). However, the mechanisms responsible for this are not all known, and it is probably a complex interaction of psychological and neurobiological factors (Ströhle, 2009). In line with this, and also with the findings of this thesis showing a significant ( $p = 0.013$ ) decline in self-rated health among women before pregnancy as compared to during pregnancy, physical activity, preferably performed outdoors should be seen as an important factor in health-promoting work for expectant parents as well as for new parents.

Having access to areas for country walks was found in paper I to be an important factor for elderly women and men to participate in outdoor recreational physical activity. In paper II, significantly more women and men aged 20–30 years stated that, due to lack of appropriate areas, they were unable to participate in as much outdoor activity as they desired compared to those aged > 30. According to this, accessibility is an important aspect to take into account when studying factors associated with physical activity. Findings from a review by Humpel et al. (2002) show that access to recreation such as parks correlates with physical activity among adults. In paper IV the findings show that walking outdoors was the most common physical activity among the participants. Thus, it is important to integrate spatial planning in the work with public health to create opportunities and conditions for physical activity. Here, the safety aspect is fundamental to consider.

The findings of this thesis show that fear is something recurrent among all women in the four studies and this might affect participation in physical activity negatively. Both elderly and younger women stated that they had refrained from going outside during evenings because of fear of violence. Among elderly women fear of falling was also seen as a psychological barrier to participating in physical activity. Fear was also seen among

women with osteoarthritis who were afraid that physical activity might harm their joints, and that affected their participation in physical activity negatively. This has also been found in previous research (Bruce et al., 2002; Heuts et al., 2004; Scopaz et al., 2009). It is thus important to listen to women's voices about their feelings, beliefs and experiences and in different ways work out strategies that can eliminate this fear. This could include programmes to improve activity or walking groups, since brisk walking in general is safe for most people, with a trained leader. Since the population of elderly is growing steadily and osteoarthritis is strongly associated with both increasing age and female gender, elderly women and women with osteoarthritis must be seen as an important group in the work of promoting physical activity. Both accidental falls among elderly and osteoarthritis generate enormous costs to society, and from this perspective too it should get more attention (Schmidt et al., 2003; Gyllensvärd, 2009).

The findings also support previous studies that show that economy, level of education and smoking habits affect participation in physical activity and thus are important factors to consider in health-promoting work (Sjöström et al., 2006; Borodulin et al., 2008; Zimmerman et al., 2008; Bolívar et al., 2010). In papers I and II the results show that women (paper I) as well as men (paper II) with a higher education were more likely to be physically active than women with a lower education. Also in paper IV the results show that the highest proportion of participants with a university degree was found in the groups of physically and moderately physically active. A low level of education is often accompanied by inferior economic conditions in comparison with a higher education. In both papers I and II the economic aspect, i.e., being able to cover an unexpected cost in a week, was significantly associated with an increased probability of participation in outdoor recreational physical activity among women. A possible result of this can be seen in paper II, where women aged 20–30 stated that they were not able to participate in as much outdoor recreational physical activity as wished due to lack of equipment. Also, men aged 20–30 stated that due to costs they were unable to participate in outdoor activities as much as desired compared to men > 30. A negative correlation between smoking and physical activity has previously been seen (Varo et al., 2003; Zimmerman et al., 2008) and the results of papers I and II confirm these findings, although in paper I the effect was seen among men and in paper II among women.

It is also important to pay attention to non-participants and dropouts. Of the four papers in this thesis, little is known about non-participants in paper I, II and IV. However, in paper III, both women and men among the dropouts were more likely to have a lower level of education, there was a higher



proportion of smokers and the women drank more alcohol. Unhealthy behaviour therefore seems to be more prevalent among the dropouts, which also is a target group that needs to be focused on and that might be in even more need of support and health-promotion efforts. It is likely that those who agreed to participate in the studies are more interested in physical activity and health issues and this might explain the fairly high participation in physical activity in all four papers. The findings from paper II show that participation in physical activity indoors was associated with participation in outdoor recreational physical activity, for both women and men. A trend towards polarization can be seen, in which the population is divided into those who participate in physical activity and those who do not (Södergren et al., 2008). A study by Costello et al. (2011) showed that both physically active and inactive individuals shared some barriers to participate in physical activity, but those who were active had developed strategies to overcome the barriers. Consequently, this needs to be taken into consideration when evaluating and comparing the findings of this thesis with other studies.

For professionals who work in different health-promoting ways with physical activity, it must be a goal to create both social and individual conditions so that people in different life-change events can be physically active. Also, the individual is responsible for his/her health. A greater understanding of the context in which different life-change events occur as well as the different inactivity risks for women and men will facilitate the promotion of physical activity at different life-change events. This could be done by providing information about the health effects of physical activity and by stimulating participation in easily accessible activities that are attractive and affordable for the majority of women and men alike. Socioeconomic as well as other factors may produce a cumulative increase or decrease in physical activity in different parts of an individual's life. Thus, it is important to be familiar with individuals' attitudes and conditions in the health-promoting work. It is also important not to study a life-change event as a whole but also to study it from different aspects, such as gender, age and socioeconomic factors.

## Methodological considerations

Some methodological considerations need to be addressed to evaluate the strengths and weaknesses of this thesis. Some of these considerations are the result of choices made by the research team, while others are more related to the respondents. The quality of a study can be measured in different ways. It is important to check systematic errors as well as confounders that are variables related to both the outcome variable and to one or more of the other independent variables, with an impact on more examined variables. As this thesis is based on quantitative research there is always a risk of confounders (Kazdin, 2009). It is also important to check the validity and reliability. According to Golafshani (2003), validity refers to whether the means of measurement are accurate and if they really measure what they are intended to measure, while reliability refers to whether the result is replicable.

Validity can be referred to as internal and external. Internal validity reflects the degree to which the independent variables account for the result and to what extent other factors or influences can be eliminated. Related threats to the internal validity of a study are history, maturation and attrition (Kazdin, 2009). History refers to any common external process, for example in society or the environment, that may affect the daily life of the respondent and that cannot be ruled out as a factor in the result. Maturation refers to internal process within the respondents such as growing older. The risk that the participants' history or maturation affects the internal validity of the study is at its highest when data are collected repeatedly or in intervention studies (Kazdin, 2009). It might thus be difficult to evaluate whether the results are a consequence of the intervention or of changes in the respondent's situation. In papers I, II and IV, the data collection was done on one occasion, and this would minimize the risk that the history of the respondents could have affected the validity of the studies. However, in paper III, which is based on a longitudinal study, this risk occurs since the data collection was done at two different times.

Attrition refers to the loss of subjects from the study. Papers I–III had a rather high share of non-participants. According to Kazdin (2009), non-participants increase threats to the external validity, and generalization of the findings has to be done with caution. As participants drop out, the remaining participants can no longer be assumed to represent the original sample even if it originally was randomly selected. Non-response can affect the validity of epidemiological studies and introduce bias. Response quality

is also important in the sense that incomplete or incorrectly-answered questionnaires will have the same effects as a poor response. In all four papers, the questionnaires were completed very well by the participants and accordingly the internal validity was high, which must be regarded as a strength of the studies. A further strength is that the distribution according to gender was almost equal in papers I, II and III. In paper IV 83% of the participants were women and 17% men and the study sample was small ( $n = 100$ ) and generalization must be done with caution.

For all the life-change events studied, participation in physical activity does not change from one day to another. It can certainly be discussed whether getting older should be seen as a life-change event since ageing is a part of life. Also, it is difficult to say when osteoarthritis starts since it is a disorder with frequently insidious symptoms. However, definitions and interpretations of these can always be discussed, but according to the definition of life-change events used in this thesis pregnancy, parenthood, getting older and living with osteoarthritis are life-change events. In paper III, physical activity before and after the life-change event have been assessed which is a strength. However, this was not done in papers I, II and IV and this must be taken into account when discussing the findings of this thesis.

The results of this thesis rely on self-reported measures. Self-ratings could be considered to be subject to problems with response bias and the respondents answering in a socially desirable manner (Polit and Beck, 2008). However, self-reports are frequently employed for reasons of practicality, low costs, and general acceptance (Dishman et al., 2001). In all four papers self-reported questionnaires have been used for the measure of physical activity, as well as smoking habits (papers I–IV), alcohol habits (papers II–III), and height and weight (paper IV). Self-reports about such personal lifestyle factors may cause systematic errors and should be treated with caution since there always is a risk of over- and underestimation of the answers (Midanik, 1982; Connor Gorber et al., 2007; Prince et al., 2008; Connor Gorber et al., 2009).

The questionnaires that were used in papers I–III were fairly long ( $> 10$  pages), which might be one reason for the rather high share of non-participants. According to Edwards et al. (2002), questionnaire length has a negative influence on response. Long questionnaires do decrease response rate. A questionnaire experiment by Iglesias and Torgerson (2000) showed that a long questionnaire (comprising seven pages) had a significantly lower ( $p = 0.004$ ) response rate than a short questionnaire (comprising four

pages). However, lengthening a questionnaire does not seem to affect the quality of responses, and a short questionnaire might not give the depth and breadth of information that is needed.

The retrospective nature of papers I–III may offer bias. For many people, especially elderly, the memory of physical activity over a period of a whole year is very difficult, and will probably not offer adequate insight. On the other hand, as has been discussed above, there are advantages with investigations of physical activity over a period of a whole year. The seasonality of physical activity behaviour is of relevance for health-promotion practice. Thus, alternatives to outdoor recreational physical activities should be discussed for the winter months, especially with individuals who avoid activities during winter, to get people to continue to be physically active throughout the year.

As discussed earlier in this thesis, physical activity is difficult to measure because of its complexity. Instead of using self-reports to measure physical activity one possibility would have been to use IPAQ to get more information about intensity and time, which would also have made it possible to compare the results with other studies. It is a limitation of this thesis that only the frequency of physical activity has been measured. IPAQ can be used in two versions, one shorter and one longer, but both versions only measure physical activity during the last seven days. Since the intensities and types of activities can vary widely during a year and the seasons are likely to influence both the activity level and the activities chosen (Matthews et al., 2001) it might be difficult to make comparisons regarding when during a year the questionnaire is sent out. The advantage of using the kind of question that has been used here to measure physical activity is that activities that are seasonal and might be practised only part of the year are covered by the questionnaire. A wide spectrum of activities is included and it has been possible to obtain knowledge about what kind of activities people are engaged in (papers II–IV), which from a public health perspective can be interesting to study.

The response alternatives about the performance of physical activity were described in papers I–III as: never, 1 time per month, 2–3 times per month, several times per week and every day. The step from 1–3 times per month to several times per week is fairly high, and this could be a limitation of the studies. In paper IV, there were no set response alternatives but the respondents could answer how often they participated in physical activity. The survey question used to check physical activity should in all four papers be seen as a fairly simple measure of physical activity and may not

be as strong as more advanced and validated instruments of physical activity.

# Conclusions

The findings of this thesis showed that:

- All four studied life-change events affect participation in physical activity among both women and men but in different ways and to different extents. Therefore, it is important not to study a life-change event as a whole but also to study it from different aspects, such as gender, age and socioeconomic factors.
- In the studied populations, women were not less physically active than men were, but more factors were found to be associated with limitations for women to participate in physical activity.
- Fear of falling, violence or that physical activity can harm the joints is more common among women than men and can affect participation in physical activity negatively.
- Pregnancy and parenthood are life-change events that affect participation in physical activity among both women and men. Both women and men were more frequently physically active before than during pregnancy and changes in their activity patterns are similar. Both women and men without children were found to be more frequently physically active than those who had children.
- Accessibility is an important aspect to take into account when studying factors associated with physical activity since having access to areas for country walks was found to be an important factor for participation in outdoor recreational physical activity.
- A greater understanding of the context in which different life-change events occur as well as the different inactivity risks for women and men will facilitate the promotion of physical activity at different life-change events.

- To get individuals stay or become physically active during the life-change events studied, three aspects must be taken into account:

*Personal:* Individuals are responsible for their health.

*Professionals:* Having knowledge about how different life-change events affect individuals and being familiar with individuals' conditions in the health-promoting work.

*Society:* Integrate spatial planning in the work with public health to create opportunities and conditions for physical activity.

## Further research

Further research is needed to investigate the underlying pathways of how life-change events are associated with physical activity. It needs to consider the gender perspective since there are differences between women and men and studies with a qualitative approach might be useful. Also, age and socioeconomic aspects need to be taken into account. Longitudinal studies are needed to determine how pregnancy and parenthood affect participation in physical activity among men, since this is an unexplored field. Also, longitudinal studies from different countries and cultures are needed since these aspects also are unexplored. Studies with longer follow-ups are important to provide knowledge about how long the effects of life-change events affect participation in physical activity.





# Sammanfattning på svenska

Det finns god evidens inom den vetenskapliga forskningen för att regelbunden fysisk aktivitet medför flertalet hälsovinster, exempelvis minskar risken att drabbas av hjärt-kärlsjukdom, diabetes typ 2, benskörhet, besvär i rörelseorganen, vissa cancerformer samt psykiska besvär såsom oro, sömnproblem och mild depression. Forskningen visar dock även att det finns skillnader i utövandet av fysisk aktivitet i olika befolkningsgrupper, där exempelvis sociala och ekonomiska faktorer samt köns- och ålderskillnader spelar roll. Olika livsförändringar kan också påverka utövandet negativt. Livsförändringar kan definieras som händelser av exempelvis social eller psykologisk art, eller i omgivningen, som kräver anpassning eller medför en förändring i en individs livsmönster. Från ett folkhälsovetenskapligt perspektiv är det angeläget att öka kunskaperna om hur livsförändringar påverkar utövandet av fysisk aktivitet, då fysisk aktivitet är en viktig förutsättning för människors hälsa. Syftet med avhandlingen var att studera på vilket sätt olika livsförändringar inverkar på utövandet av fysisk aktivitet. De livsförändringar som studerades var att vänta barn, att bli förälder, att bli äldre samt att leva med en kronisk sjukdom (artros). Fyra kvantitativa delarbeten, som är baserade på enkäter, ligger till grund för denna avhandling.

Artikel I inkluderade 999 individer och syftade till att utifrån ett könsperspektiv studera i vilken omfattning kvinnor och män  $\geq 60$  år hade utövat friluftsliv och fysisk aktivitet utomhus under ett år samt vilka faktorer som påverkade utövandet. Resultaten visade att de viktigaste faktorerna för både kvinnors och mäns utövande av friluftsliv och fysisk aktivitet utomhus, var att ha tillgång till strövområde samt att vara oberoende, dvs. själv klara av sin personliga hygien. Fler faktorer begränsade utövandet bland kvinnor än bland män.

Artikel II inkluderade 432 individer och syftade till att utifrån ett könsperspektiv studera utövandet av friluftsliv och fysisk aktivitet under ett år bland blivande föräldrar, både bland dem som redan hade barn och dem som var förstagångsföräldrar. Resultaten visade att de viktigaste faktorerna för både kvinnors och mäns utövande av friluftsliv och fysisk aktivitet

utomhus, var att utöva fysisk aktivitet inomhus samt att ha hund eller häst. Fler faktorer begränsade utövandet bland män än bland kvinnor.

Artikel III inkluderade 270 av de individer som var med i artikel II och syftade till att studera förändringar i aktivitetsmönster hos kvinnor och män under graviditet jämfört med före graviditet. Resultaten visade att både kvinnor och män var mer fysiskt aktiva före graviditeten än under denna.

Artikel IV inkluderade 100 individer och syftade till att studera hur fysisk aktivitet vid olika frekvenser påverkade individer med artros. Resultaten visade att de individer som var måttligt fysiskt aktiva (utövade fysisk aktivitet en till två gånger per vecka) hade bäst självskattad hälsa, lägst Body Mass Index och bäst funktion i både övre och nedre extremiteterna. Kvinnor använde mer läkemedel för sin artros och var mer rädda att deras leder skulle ta skada av fysisk aktivitet än män.

Sammanfattningsvis visade studierna att samtliga fyra livsförändringar påverkade utövandet av fysisk aktivitet bland både kvinnor och män, men på olika sätt. Ett könsperspektiv, men även ålder och socioekonomiska aspekter, är viktiga faktorer att beakta både inom forskningen och vid planering av hälsofrämjande aktiviteter för en regelbundet fysiskt aktiv befolkning. Samtliga studier visade även att kvinnor inte var mindre fysiskt aktiva än män. Dock fanns fler faktorer, framför allt rädsla, som begränsade kvinnors fysiska aktivitet. Tillgång till strövområde var en betydelsefull faktor för utövande av fysisk aktivitet, och således är det viktigt att integrera fysisk planering i folkhälsoarbetet för att skapa förutsättningar för fysisk aktivitet.

Forskning om livsförändringars inverkan på utövandet av fysisk aktivitet är tämligen begränsad. Exempelvis har inga tidigare studier som undersökt mäns aktivitetsmönster före och under partners graviditet hittats, utan artikel II är den första inom området. Således behövs mer forskning med både kvantitativ och kvalitativ ansats, samt även longitudinella studier för att undersöka hur olika livsförändringar påverkar utövandet av fysisk aktivitet.

# Acknowledgements

I wish to express my sincere gratitude to all those who in various ways have contributed to this thesis, and particularly to:

Associate Professor Eva Ekvall Hansson, my supervisor, for always seeing the possibilities, not the obstacles, for pushing me into the right direction, for believing in me and for always being supportive and positive.

Dr Louise Stjernberg, my co-supervisor, for your profound commitment to my thesis work, and for your trusts in my ability to do research. For your rapid communication, always available by e-mail or telephone and for always giving of your time.

Professor Margareta Troein Töllborn, my co-supervisor, for your valuable comments and your skilled advice in academic matters.

The memory of Professor Anders Håkansson, my first supervisor. I always try to remember his wise words, not to make research more complicated than it is.

Professor Lennart Råstam, for constructive contributions to this thesis.

Professor Bo Haglund, for introducing me to the world of science.

All the participants in the studies.

Göran Larsson, operations manager at the women's clinic at Blekingesjukhuset Karlskrona, and Maria Sjögren, midwife and head of the maternal health centre in Trossö, for creating conditions to conduct paper II and III.

All the midwives at Trossö and Lyckeby antenatal clinics for their help with data collection for papers II and III.

Madeleine Sandell Bark at Blekingesjukhuset Karlskrona, for administrative help with paper III.

Malin Bruce, for never-ending support during these years and for your valuable comments on "kappan". I am so happy to have a friend like you.

All colleagues at the School of Health, Blekinge Institute of Technology, especially my PhD colleagues Ewa Andersson, Amina Jama, Ann-Christin Karlsson, Lina Nilsson and Ingrid Weiber for your support and encouragement during these years. Ylva Hellström, for giving me the opportunity to become a PhD student and also to work with the Welhops project, which was so much fun and so instructive. Marianne Lagerholm, for skilfully planning teaching hours. Ingela Silverflod Pettersson, for your kindness and always quickly helping me with practical things and for helping me find a place to live when I moved to Karlskrona.

Associate Professor Gunilla Borglin, for giving of your time and providing valuable comments and constructive criticism of paper I at a time when I needed it most.

Marie Andersson, for excellent proofreading.

Alan Crozier, for excellent performance in revising the English.

All of you that in different ways have been with me during the whole or parts of this journey in research, none mentioned, none forgotten.

My mother Kerstin and my father Stig, for all your love and encouragement, for all your support during the years and for always believing in me. Mother, I hope that I can be such a wonderful mother to my children as you are to me.

Ellinor, our beloved and fantastic daughter, you bring so much happiness and love into my life. It is a pleasure to see and experience the world with you. I love you!

Our new little baby who will very soon be here. You have motivated me to finish this thesis during the last couple of months. We so much look forward to meeting you.

Jonas, the love of my life and my soul mate, for all the love, happiness and fun and for always looking on the bright side of life. I love you!

This thesis was supported with grants from the Blekinge Research Council. Paper III was performed in collaboration with Blekinge Health Arena.

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