

# Green exercise for families – What is already known?

---

Literature review for the Naturkraft-project

## Contents

1. Introduction.....	2
2. The health benefits of green exercise .....	3
Mental, social and physical benefits .....	3
Rural and urban greenspaces.....	5
Child health and development .....	5
Family-based green exercise .....	6
2. Green exercise.....	7
Factors associated with spending time in the nature .....	7
Are children losing connection to nature?.....	8
Results from the DAGIS-study .....	10
3. Families with small children as a target group for the project .....	11
Stage of life – typical challenges and physical activity behavior.....	11
How to recruit and engage families to the project? .....	13
5. Green exercise interventions – what works?.....	15
National studies, projects and materials.....	15
International studies, projects and materials .....	18
6. Green exercise, technology and digital tools .....	24
Digital apps promoting green exercise.....	27
7. Theories and resource-oriented approaches for planning the project.....	28
Theories and models .....	28
Resource-oriented approaches .....	29
8. Summary.....	32
BIBLIOGRAPHY.....	33

### Terms

- Green exercise = Physical activity in nature and green spaces
- Green spaces = Forests and parks, natural outdoor areas including elements like trees, ponds and flowerbeds
- PA = physical activity

## 1. Introduction

Nature plays an important role in the lives of Finnish families. Adults and children commonly identify natural settings as their favorite places to be (Tyrväinen et al 2007; Korpela 2002). It is well known that spending time outdoors is beneficial to child development, health, and well-being in many ways. Nature offers a special playground for children (Chawla 2015), but concerns have been raised that children are losing connection to nature (Wells et al 2018; Sjöblom 2012; Skar & Krogh 2009; Natural England 2009), especially in urban areas (Laaksoharju & Rappe 2010). Many families live in urban areas and children's use of natural areas is more planned, organized and less self-initiated than before (Skar and Krogh 2009). There are also other competing activities such as screen time (Palmer 2015; Rideout et al 2010) and organized hobbies (Laaksoharju & Rappe 2010), which keeps children indoors instead of playing outdoors. Early childhood is an important period for developing a connection to nature (Kahn et al 2002), and actions are needed to encourage families of small children to be active outdoors. This literature review presents the findings based on studies and projects promoting green exercise among children and families, with a focus on how to design and implement a nature-based physical activity project targeting families with small children.

## 2. The health benefits of green exercise

### Mental, social and physical benefits

Physical activity (PA) has many short-term and long-term benefits on physical, mental health, and overall health (Liikunnan käypä hoito 2016). Studies have discovered that PA in natural environments (green exercise) has greater health effects in both psychological (Mitchell 2013; Korpela & Paronen 2011) and physical health (Pretty et al 2006; Hartig et al 2003) than PA in other environments (Thompson et al 2011).

Green exercise promotes mental health by increasing positive feelings and improving mood (Pretty et al 2006) and self-esteem (Barton & Pretty 2010) and reducing negative feelings (Thompson et al 2011; Tyrväinen et al 2007; Hartig et al 2003). According to Barton and Pretty's (2010) multistudy analysis, green exercise does not have to be high-intensity to produce benefits for mental health. A short time and low-intensity green exercise were found to be the most effective for improving mood (Barton & Pretty 2010). Studies have shown that walking is the most effective form of green exercise for mental health. (Marselle et al 2013; Thompson et al 2011; Barton & Pretty 2010). Tyrväinen et al. (2007) found out that regular visits to nearby green spaces five hours per month was enough for producing long-lasting benefits on mental health.

Walking in nature is also good for physical health. Gladwell et al. (2016) found that recovery after walking exercise was faster among those who walked in nature, compared to those who walked indoors, examined by looking at the heart rate variability (Gladwell et al 2016). Nature exposure decreases blood pressure through biological pathways (Pretty et al 2006; Hartig et al 2003) and has longer-term impacts on cardiovascular health (Barton & Pretty 2010). Meta-analysis by Twohig-Bennett & Jones (2018) affirmed that green exercise is associated with lower blood pressure, lower stress markers, and lower incidence of diabetes.

One significant benefit of green exercise is its restorative impact. Green exercise is more attentionally restorative compared than PA indoors, and it produces feeling of rest, mental recovery and pleasure (Korpela & Paronen 2011; Tyrväinen et al 2007) through neural

inhibitory mechanisms. Attention Restoration theory (ART), originally presented by Kaplan & Kaplan (1989), is among the most relevant theories explaining the restorative health benefits of nature (Berman et al. 2012). According to ART, the natural stimuli does not require much conscious attention, so the mind can recover (Berman et al. 2012). The stimuli of the built urban environment, in turn, puts a strain on the mind, because attention must constantly be focused on the noise, traffic and other visual stimuli (Berman et al. 2012). Due to the lower cognitive load (Berman et al. 2012) and the stress relieving effect (Kaplan 1995), nature environments are thought to be more restorative places than urban environments (Berman et al. 2012).

Green exercise can also contribute to mental health through social cohesion, which can strengthen when people go out and have social interactions with other people (Elands et al 2018). Neighborhoods' green spaces, forests, and parks can attract community members to meet and strengthen their social networks. However, social interactions in green spaces mostly occur between already existing social networks, like friends and family. Spontaneous interactions happen mostly due to children, dogs or other external cause, but they are generally valued positively, even though it is culture-bound and differs between persons how much interacting with new people is valued (Peters et al 2010) A stronger feeling of social cohesion in communities can lead to better mental and physical health in various ways. Maas et al. (2009) found that people in neighborhoods with more green spaces felt less lonely and reported better social support than their counterparts did.

Studies have shown that access to green spaces and positive health benefits correlated stronger among people from low-socioeconomic backgrounds compared to people from high-ses backgrounds, which might refer to that targeting green exercise interventions to low-ses families might be a way to diminish health disparities (Mitchell 2018; Twohig-Bennett & Jones 2018). Low-income mothers have identified that easy access to nature activities would have a great impact on their health, their family members health, and social interaction between family members (Izenstark et al 2016).

## Rural and urban greenspaces

Report from the Finnish Forest Research Institute (Tyrväinen et al 2007) showed that frequent use of urban green spaces (city parks etc.) and rural green spaces (forests etc.) were both associated with a greater amount of positive feelings. Frequent use of rural green spaces was associated with fewer negative feelings, but the use of urban green areas were not (Tyrväinen et al 2007). A report showed also that rural green spaces should be used frequently (six visits/month) to reduce negative feelings. A study by Marsellen et al. (2013) showed that walking in rural greenspaces was linked to lower perceived stress, compared to walking in an urban green space. Barton and Pretty (2010) state that all green spaces improve mood and self-esteem, but effects are greater near water. These findings are supported by Korpelan & Paronen (2011) and Sievänen & Neuvonen (2011) findings, which claim that forest and rural green spaces near water produce the strongest recovery experience. In addition, studies have also shown that a high level of plant, bird and animal biodiversity increases feelings of enjoyment (Dallimer et al 2012). A study by Berto et al. (2015) found that children's perceived restorativeness and attentional function was better after a peaceful walk in the woods than after a free play on the playground.

To conclude, both urban and rural greenspaces produce health effects. Still some studies show, that rural green spaces outside city areas have more favorable health effects than urban green areas, especially if lakes or other water elements are nearby. Forest and rural green spaces are also perceived as more pleasant outdoor environments than parks or other built green spaces (Tyrväinen et al. 2007). Peace, silence and flora and fauna biodiversity are more likely to be found in nature and forests outside the cities, which might explain the results.

## Child health and development

Physical and mental health benefits of nature, like mental recovery, also apply to children (Berto et al 2015; Chawla 2015; Duncan 2014). Exploring nature and playing outdoors is also beneficial to a child's development (Chawla 2015; Gill 2014). Playing in nature stimulates child's creativity and enables child to solve problems and practice cognitive and social skills, if child is playing with other children (Coyle 2017). Residential greenness and frequent use of nearby green spaces have found to be negatively associated with preschool children's emotional

and behavioral problems, like depression and hyperactivity (Coyle 2017; Balseviciene 2014, Flouri 2014; Well 2000), and perceived stress (Wells & Evans 2003). Playing in nature improves attentions spans and patience, compared to playing with screen devices at home (Coyle 2017). Playing in rich stimulated, diverse environment also increases physical activity, improves motor skills, and physical health (Boxberger & Reimers 2019). Playing outside is also associated with better eyesight and stronger bones, due to PA and vitamin-D formation (Coyle 2017). It is also known that more biodiverse living environment is associated with a well-regulated immune system, which defends against diseases and allergies (Chawla 2015; Lovasi 2008). Free play in the nature also strengthens children nature connection and sense of safety in the nature (Skar & Krogh 2009).

#### Family-based green exercise

Parents' physical activity promotes the well-being of the whole family, as the positive effects of PA also extend to children (Paananen & Gissler 2014). Children learn behavior, values and attitudes from their parents on early age, which affects the formation of their PA habits on long-term (Kaikkonen et al. 2012). Family members' engagement in mutual leisure time activities, like PA or green exercise, increases interaction and promotes family functioning and well-being in various ways (Izenstark & Ebata 2016). Family-based nature activities have more benefits to family functioning than activities in other environments (Cameron-Faulkner et al 2018; Izenstark & Ebata 2016). This is due to nature's restorative effects, which enables better attention, self-regulation and stress reduction, and leads to increased responsiveness and better communication among family members (Cameron-Faulkner et al 2018; Izenstark & Ebata 2016). Finnish studies have shown, that parents of preschool aged children have PA and outdoor PA together with their children usually three times per week (Laukkanen 2016; Sievänen & Neuvonen 2011).

## 2. Green exercise

### Factors associated with spending time in the nature

Behavior is shaped by individual factors, as well as physical, social and cultural environment (Sallis ym. 2008). Several studies have examined how individual and environmental factors are associated with green exercise.

Although many Finnish families live in urban areas, they still might live quite near to nature, as urban areas in Finland are greener compared to other European cities (Tyrväinen 2007). Finnish people have on average only 600 meters distance to the nearest forest (Sievänen & Neuvonen 2011). Short distance and easy access to nature are important factors for participation in PA and green exercise in both adults (Pyky et al 2019; Pietilä et al 2015; Sievänen & Neuvonen 2011; Bowler et al 2010) and children (Chawla 2015; Gill 2014).

Environment characteristics are also important for green exercise participation (Pyky et al 2019). Finnish people appreciate the outdoor activities, aesthetic experiences, peace, and silence nature offers (Tyrväinen et al 2007). Studies have also found that opportunities for activities (Flowers et al 2016; Tyrväinen et al 2007), attractiveness of landscape, water features (Karusisi et al 2012), species richness, size of area and relevant services (like parking lots and lighting) are factors that enhance green exercise among adults (Pyky et al 2019; Tyrväinen et al 2007). Similar factors, like peace, aesthetic experiences, and opportunities to be with friends and do different activities are appreciated among children (Andkjær et al 2016).

Older age, female gender, having minors or dog at home, good perceived health and low perceived stress level have found be positively associated with green exercise among Finnish people (Pyky et al. 2019, Husu et al 2011). International studies have also shown nonsignificant associations between age, gender and green exercise (Dallimer et al 2014). Danish study found that girls and younger children were more active outdoors than boys or older children (Andkjær et al 2016). Parents' own green exercise behavior and attitudes towards nature are important mediators of children's green exercise (Kaymaz et al 2019; Soga et al 2018; Hunt et al 2016; McFarland et al 2014) and connection with nature (Ahmetoglu 2019).



Association between household income level and green exercise have also shown mixed results. Pyky et al (2018) found that higher education level was negatively associated with green exercise among suburban adults, but income level was not. Skar et al. (2016, b) found that living in urban areas was associated with parents reporting more barriers for child's green exercise, but the household income level was not. According to Hunt et al (2016), children from high-ses family backgrounds visit nature sites more frequently compared to children from low-ses family backgrounds. Also Andkjær et al (2016) found certain correlations between children outdoor physical activity and their socio-economic backgrounds, but results may be related to the proximaty to attractive nature sites, and further studies are needed.

Skar et al. (2016, b) found that parents identified social factors, such as lack of time due to other activities like homework, as the main barrier for children's contact with nature. Unsafe green spaces, accessibility, or attributes in the green spaces were not identified as important barriers (Skar et al. 2016, b). Other international studies have identified, that concerns about children's safety in nature may limit parents willingness to allow children to explore nature independently (Fraser et al 2010). Many adults feel unease in nature due to lack of nature experiences, which can cause fears (Skar & Krogh 2009).

Are children losing connection to nature?

Finnish dissertation stated that young people are losing touch with nature due to changes in society during the last decades (Sjöblomin 2012). Study by Laaksoharju & Rappe (2010) among Finnish school-aged children found that children living in rural areas had better knowledge of plants and stronger contact to nature than children living in urban areas did. Children in rural areas reported outdoor activities that urban children did not report, such as berry picking or building huts in the forests. Children's independent mobility has decreased during the last decades in Finland (Kyttä et al 2015), which might inhibit children's nature connection.

International studies have also raised increasing concerns about children spending less time in natural environments than before (Wells et al 2018; Andkjær et al 2016; Hofferth 2009), especially in urban areas (Natural England 2009). Nearly half of Danish parents believe that their child is spending less time in nature than they did as a child, and think that their child is spending too little time in nature (Nygård 2012). Another Danish study found out that 31% of children aged 2-6 had not tasted a fruit/berry picked in nature, and only 61% of these children

had swam in the ocean in Denmark, 17 % in the lake (Friluftsradet 2018). Despite of this, children in Denmark consider that nature contact is important for them (Andkjær et al 2016). Studies also show that children prefer natural playgrounds and natural materials to play with (Wang 2018; Ward 2018).

International studies have claimed that children disconnection from nature is due to urbanization, parent's fears and lack of time due to other competing activities, such as screen time and scheduled leisure-time activities and hobbies (Wells et al 2018). A large Norwegian study found that social norms have changed, and parents value children's structured activities more, and children playing outside alone less than before (Skar & Krogh 2009). The study also found that instead of being free and self-initiated, children playing in natural environments is more planned, controlled by adults and dependent on parental transport than before (Skar & Krogh 2009). A study by Pilgrim et al. (2008) found that economic growth was associated with a decrease in ecological knowledge, which supports the theory that with urbanization comes the loss of connection to nature.

Children disconnecting from nature leads to weaker nature relatedness. Nature relatedness in children refers to a sense of connectedness and affiliation to nature. Children with a strong connection to nature feel the enjoyment of nature, empathy for living creatures and sense of responsibility (Cheng & Monroe 2012). Reduction of connection to nature in childhood can also lead to a fear of nature. If knowledge of nature is based on media information rather than personal experiences, an image of natural environments and its dangers can become distorted (Cohen & Horm-Wingerd 1993). Children need nature experiences for developing knowledge of nature and biology (Longbottom & Slaughter 2016).

Frequent nature experiences in childhood predict perceived nature connectedness and green exercise participation in adulthood (Rosa et al 2018; Calogiuri 2016; Lovelock et al 2016; Ward et al 2008). The pathway from childhood to adulthood nature connection is also important to consider from the perspective of climate change. Spending time outdoors in childhood affects environmental knowledge (Gill 2014), but also attitudes towards nature conservation and environmentalism in adulthood (Coyle 2017; Wells & Lekies 2006; Palmer 1993), which can have long-term effects for the future of our planet.

Results from the DAGIS-study

The Increased Health and Wellbeing in Preschool study (the DAGIS study) examined family green exercise among families of pre-school children. Children aged 3-6 years with their parents participated and parents filled in the cross-sectional survey in 2015-2016. The family green exercise was asked with the following question: **How often does your child go to nature/forest with at least one adult in the family?** Answer options were: less than once a month, 1–3 times per month, 1–2 times per week, 3–4 times per week, 5–6 times per week, and daily. Options three times per week or more often were combined as one. Frequencies are presented in table 1a. The correlations between family green exercise and parental factors are presented in table 1b.

**Table 1a.** How often does your child go to nature/forest with at least one adult in the family?

		Frequency (N)	Valid Percent (%)
Valid	Less than once a month	139	17
	1-3 times a month	305	38
	1-2 times a week	246	31
	3 times a week or more often	108	14
	Total	798	100

**Table 1b.** Correlations between family green exercise frequency and parents' self-reported mental health, self-efficacy, values and attitudes and environment factors (N=793-795)

**Parent's mental health**

1. How stressed out do you feel at the moment on a scale between 1-10 (1=not at all stressed out, 10= very stressed out)?:how stressed out **-.127\*\***
2. Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterization describe you?:Not at all - A great **.146\*\***

**Parent's self-efficacy**

3. How confident are you that you could do the following?:E. I can get my child to do something physically active no matter how busy his/her day is. **.232\*\***
4. I can get my child to be physically active: A. No matter what the weather is like. **.240\*\***
5. I can get my child to be physically active: D. Even when there are no other children playing outside. **.207\*\*\***
6. I can get my child to be physically active: C. Even if he/she wants to stay inside. **.165\*\***

### **Parent's values and attitudes**

---

7. It is important for me to make sure my child gets enough physical activity each day. **,236\*\***
- 
8. We are physically active together because it is quality time for our family. **,257\*\***
- 
9. I am pleased with my child's: A. physical activity level **,186\*\***
- 
10. I am pleased with my child's: B. screen time **,137\*\***
- 

### **Environment factors**

---

11. Poor weather limits my child's opportunities to play outside. **,-194\*\***
- 
12. The neighbourhood I live in has lots of good places (e.g. parks, fields, forest) for my child to play and be physically active. **,130\*\***
- 

Correlation is significant at \* <0,05, \*\*<0,01, \*\*\*<0,001

Strongest correlations were detected between family green exercise and parent's self-efficacy, values and attitudes towards physical activity. These factors should be taken into account when promoting family green exercise.

## 3. Families with small children as a target group for the project

Stage of life – typical challenges and physical activity behavior

Family life can be challenging with small children in the family. Demands of parenting, childcare, and home chores cause tensions (Lammi-Taskula & Salmi 2014). Tiredness due to lack of sleep, problems with the relationships, loneliness or financial situation cause stress and affect negatively on parents everyday coping (Paajanen 2005) and parenting (Centre for Community Child Health 2009). According to the Perhebarometri by Väestöliitto (Paajanen 2005), men are less likely to suffer from lack of sleep, fatigue, and loneliness than women are. Among young mothers (<25y) feelings of loneliness are more common than among mothers aged 30-35. Feelings of fatigue are instead more common among mothers aged 30-35 compared to younger mothers (Paajanen 2005).

The majority of mothers of children aged 3 to 6 are working (Suomen virallinen tilasto 2013), but only less than half of parents feel that combining work and family life is easy (Paajanen 2005). Inequality and poverty among families of small children are also increasing concerns in

Finland (Karvonen et al 2016). Despite all this, the majority of parents feel well (Kaikkonen et al 2014) and are satisfied with their life, health and relationships (Paajanen 2005).

Parents' time for PA is limited with young children in the family (Miettinen & Rotkirch 2012). Especially mothers report they would like to have more time for exercise, outdoor activities and other recreational activities (Miettinen & Rotkirch 2012). Only less than 40 percent of mothers with a child under 3 years of age are satisfied with their physical fitness (Paajanen 2005). Compared to mothers, fathers seem to be more satisfied with their physical fitness and opportunities for PA or other leisure time activities (Paajanen 2005).

In the Finnish study by Korkiakangas et al (2010), the parents of small children commonly reported the lack of time, childcare needs, and the fact that they valued family life and the time spent with children more than own PA, as a barrier for PA. Half of the parents also reported low physical fitness and fatigue as a barrier for PA. Some of the parents also reported economic reasons, weather conditions, distances to sports venues, the lack of a sports friend and laziness as a barrier. International studies have found similar results, and greatest barriers for parents PA are lack of time, fatigue, lack of child care, lack of interest, lack of social support, and responsibilities related to family life and work (Cramp & Bray 2011; Adachi-Mejia et al. 2010; Evenson et al. 2009; McIntyre & 2009; Bellows-Riecken & Rhodes 2008; Chang et al. 2008; Brown et al. 2001). People from lower socio-economic backgrounds more often report economic and transportation barriers for participating in PA, while those from higher socio-economic backgrounds report more time and interest constraints (McIntyre & Rhodes 2009; Bellows-Riecken & Rhodes 2008; Brown et al. 2001; Chinn et al. 1999).

In the study by Korkiakangas et al. (2010), the majority of parents of small children reported that maintaining and improving their physical fitness, health, and weight status motivated them to engage in PA. The good feelings and improved mood were also mentioned as motivators to PA. International studies support these results. In addition, based on international studies, mothers want to be active with their children (Laroche & Snetselaar 2011) and be a role model for children (Mailey et al. 2004).

How to recruit and engage families to the project?

Health promotion programs' practices need to meet target groups' needs and interest.

When designing health promotion programs to families of young children, families' household situations, backgrounds, and cultural aspects must be taken into account. As health promotion programs usually attract the ones who are already interested in the subject (Brown Cross 2013), it is challenging to encourage individuals with the greatest need to participate and engage in the intervention.

An acceptable and relevant intervention is established when targets groups attitudes, practices, and knowledge, among others, are detected through literature reviews, focus group interviews and other research methods (Lindenberg et al 2001). Qualitative methods can be used to better understand the social and cultural context in which individuals are making their everyday choices (Lindenberg et al 2001). To develop inspiring and meaningful activities for families, the needs of both children and parents should be taken into account (Kauravaara & Kantomaa 2018).

Multiple recruitment strategies are needed to raise awareness and recruit the target group. Use of social marketing strategies for recruitment (mass media, mass mailings, calls) has found to be successful (UyBico et al 2007). Recruitment adverts should include important, understandable benefits and requirements of the program (Barnes-Proby et al. 2017). Lindenberg et al (2001) successfully recruited low-income women with colorful flyers including simple and brief messages, distributed through various suitable places like centers, services and other areas where women were likely to be found. If intervention is targeted to low-income or other disadvantaged groups, the message is important to be delivered in a non-stigmatising way (Cortis et al 2009). Barnes-Proby et al. (2017) note that program marketing should not be only targeted directly to potential participants, but also to organizations and communities which can help to recruit families in need. Chu et al (2018) increased awareness of the program with a kick-off ceremony event, organized in a common neighborhood area.

Recruitment is more likely to be successful when invitations come from sources that are reliable and credible for potential participants (D'amore & Chawla 2017; Bonevski et al 2014; Lindenberg et al 2001). Lindenberg et al (2001) found out that personal interactions, with

recruiters' participants could identify with, was the most effective recruitment strategy to recruit low-income women. Personal contacts were perceived the most effective recruitment strategy also in a community-based program for families by Chu et al (2018). Door-to-door visits were perceived as an effective strategy to recruit less active, difficult to reach –families, even though this strategy was time-consuming and intensive. Collaboration with local organizations increased these families' interest to participate (Chu et al 2018).

For successful engagement and retention, building strong relationships is important (Cortis et al 2009; Lindenberg et al 2001). Lindenberg et al (2001) noted that strengthening relationships between leaders and participants takes time, but is established by listening and understanding target groups concerns and values, and by working as a team. Communication needs to be non-judgemental, authentic, warm and encouraging to increase feelings of mutual trust and respect (Cortis et al 2009). Incentives like coupons, free transportation, and little gifts can also be used to promote recruitment and retention (Lindenberg et al 2001), but the use of financial incentives is controversial, and effectiveness is unclear (UyBico et al 2007). Personal contacts through calls or messages can also be used (Lindenberg et al 2001). Lindenberg et al (2001) found out that the most important thing to promote low-income women's attendance was to provide intervention in a user-friendly format, which meant conducting the intervention in accessible environments near home. The location needs to be convenient for the participants (Cortis et al 2009). As many parents perceive lack of time and schedule problems as a barrier, organized meetings should be arranged at the same location, same time each time, schedules available well in advance (McConnell & Naylor 2016).

Applying strength-based approaches in interventions may enhance families' abilities to recognize and utilize their resources for health promotion, resulting in empowerment, which increases engagement and enhances outcomes (Barnes-Proby et al 2017; Cortis et al 2009). Empowering strategies include focusing on families' strengths, letting families take part in planning the intervention, and encouraging participants to take a leading or mentor role in the intervention (Cortis et al 2009). More about empowerment see chapter 7.

Toolkits for family recruitment:

[https://www.rand.org/content/dam/rand/pubs/tools/TL200/TL242/RAND\\_TL242.pdf](https://www.rand.org/content/dam/rand/pubs/tools/TL200/TL242/RAND_TL242.pdf)

## 5. Green exercise interventions – what works?

Several projects in Finland and across the world have been conducted to promote green exercise among families, but scientific research about nature-based, family physical activity is still scarce. This chapter introduces projects and materials promoting green exercise among families.

National studies, projects and materials

Investments have been made in Finland to promote family physical activity. About one-third of the annual funding by The Ministry of Education and Culture in Finland is invested into organizations promoting family physical activity, usually parent-child sport groups and other activities (Kauravaara & Kantomaa 2018). Kauravaara & Kantomaa (2018) conducted a literature review about Finnish projects promoting family physical activity. Based on the literature review, Finnish projects aimed to promote family PA, well-being and parents' everyday coping, but none of these projects aimed to promote particularly family green exercise, or nature connection (Kauravaara & Kantomaa 2018). Evidence on how family physical activity interventions succeed to promote health behavior change is still limited (Kauravaara & Kantomaa 2018).

For this literature review, one scientific Finnish study promoting family outdoor PA was found. Sääkslahti et al. (2004) conducted a tree year family-based intervention, based on social learning theory, to promote children outdoor play, and found out that intervention including parent meetings and physical activity sessions with children significantly increased preschool-aged children's outdoor play. Researchers concluded that parents of young children need concrete ideas and demonstrations of what to do outdoors (Sääkslahti et al. 2004).

Projects promoting green exercise have been conducted in Finland, but there is a lack of projects targeting families with small children. Luonto lisää liikettä –project (2017-2019) by Metsähallitus is promoting children's and youth's well-being and green exercise. Project is developing new actions for promoting children green exercise by conducting workshops and pilot groups. Metsähallitus has also conducted a variety of projects promoting green exercise



among other target groups. Suomen Latu organizes family outdoor events and activities and produces green exercise materials for families. The Guides and Scouts in Finland have voluntary-led family scout activities around Finland for children under school age and their parents. Mielenterveysseura and Sydänliitto have also produced materials promoting family green exercise. Table 2 presents national projects promoting green exercise and table 3 materials and toolkits for family green exercise.

**Table 2.** National projects/studies promoting green exercise, target group including children/families.

<b>Projects</b>	<b>Organization</b>	<b>Target group</b>	<b>Objectives</b>
Luonto lisää liikettä (2017-2019)	Metsähallitus	Children and youth	Promote green exercise, health and well-being
Hyvinvoiva luonto, hyvinvoiva ihminen 2025 –ohjelma (2017-2025)	Metsähallitus	All ages	Promote green exercise
Luonto liikuttamaan (2013-2015)	Metsähallitus	All ages	Promote green exercise
Luontoa toimintaan (2018-2020)	Metsähallitus	People at risk for social exclusion	Utilize nature for empowerment
Kansallispuistomatalla hyvinvointiin (2015–2016)	Metsähallitus	All ages	Develop nature-based tourism
Open air (2012-2014)	Metsähallitus	All ages	Promote green exercise in Oulu area
Naturemove (2016-2019), Green care -hankkeet	Luke	All ages	Research on green exercise
Perheliikunnan kehittämishanke (2016-2019), + Metsämörri-program, Muumien ulkoilukoulut	Suomen Latu	Families, children	Promote family green exercise
Skogsmulle	Finlands Svenska Idrottsförbundet	Children	Promote children's green exercise
Perhepartiot toiminta	Suomen Partiolaiset – The Guides and Scouts in Finland	Preschool children and their parents	Promote family green exercise and nature connection
Perhe edellä puuhun (2018-2020)	Leijonaemot, Green Care Finland	Families of children with special needs	Promote family green exercise
Luontoaskel hyvinvointiin (2018-2019)	Syke, Luke, THL, Green care Finland	Preschools	Promote nutrition and sustainable development

**Table 3.** National materials for green exercise promotion

<b>Organization</b>	<b>Link to materials</b>
Suomen Latu	<a href="http://www.suomenlatu.fi/ulkoile/perheliikunta.html">www.suomenlatu.fi/ulkoile/perheliikunta.html</a>
Mielenterveysseura	<a href="http://www.mielenterveysseura.fi/sites/default/files/materials_files/perhe_liikunnan_vinkkikortit.pdf">www.mielenterveysseura.fi/sites/default/files/materials_files/perhe_liikunnan_vinkkikortit.pdf</a>
Sydänliitto - Neuvokas Perhe	<a href="https://neuvokasperhe.fi/liikunta/ulkoillaan-ja-seikkaillaan">https://neuvokasperhe.fi/liikunta/ulkoillaan-ja-seikkaillaan</a>
Suomen Partiolaiset – The Guides and Scouters of Finland	<a href="https://www.partio.fi/lippukunnille/partio-ohjelma/perhepartio/toimintavinkkeja-perhepartioon/">https://www.partio.fi/lippukunnille/partio-ohjelma/perhepartio/toimintavinkkeja-perhepartioon/</a>  Brochure (scroll linked page down) presents ideas for family scout activities.
Suomen Luonnonsuojeluliitto	<a href="https://www.sll.fi/mita-me-teemme/kestava-elamantapa/askelia-eteenpain/luontokasvatus-2/">https://www.sll.fi/mita-me-teemme/kestava-elamantapa/askelia-eteenpain/luontokasvatus-2/</a>  Perheet takaisin luontoon!- folder includes practical tools for organizing environmental education for families. Tools are suitable also for children under school age. Folder can be ordered online.
<a href="https://mappa.fi">Mappa.fi</a>	<a href="https://mappa.fi/fi/etusivu">https://mappa.fi/fi/etusivu</a>
<a href="http://ulkoluokka.fi">Ulkoluokka.fi</a>	<a href="http://ulkoluokka.fi/materiaalit/">http://ulkoluokka.fi/materiaalit/</a>  Materials for environmental educations, learning outdoors etc., also for children under school age.

International studies, projects and materials

### Nature clubs - scientific studies

Nature clubs for families have been conducted worldwide, and some scientific studies have also been published. Children's Trekking Clubs were established by The Norwegian trekking association in 1999, and clubs have today 150 local groups around Norway and over 25 000 members. Children's trekking clubs aim to enhance children's nature connection by offering them joyful nature experiences. Local clubs organize a variety of outdoor events around the year (volunteers are mainly parents). Skar et al (2016, a) observed both 1) large, very organized and activity-oriented events and 2) smaller, less organized and more simple events. Researchers found, that larger activity-oriented events offered children fun and exciting experiences, but nature seemed to function as just a frame for activities. These events had little room for free play, and social interactions happened mainly between already known family members. Skar et al (2016, a) found that smaller and simpler events without many organized activities strengthened children's nature connection more, as there was time for free play in nature. Small events also made social interactions between families easier. For example, adults prepared meals together while children were playing together. Skar et al (2016, a) outlined the importance of providing children opportunities for self-initiated spontaneous play in nature. Skar et al (2016, a) stated that parents appreciate organized outdoor events, but to enhance children nature connection and interaction with other children, it is preferred that adults' roles are more low key, and children have sufficient time to free play (Skar et al 2016, a).

D'Amore & Gill (2017) presented a case study of a Family nature club, which applied the principles of Social marketing theory. Goals of family nature clubs were to enhance family members' nature connection, social cohesion, well-being, and environmental awareness. Outdoor activities included free play and exploration, hikes, planting trees, and much more. Several community-based social marketing tools were included. E-mails and Facebook-posts were used as *prompts* to remind participants of the events. Small *contests* were held to bring excitement to events. Prizes included field guides and names badges to events. The intention was to carry out *recruitment* via credible sources, and sources that participants could identify with. One local family acted as a "role model" family in webpage and Facebook page. Adverts were shared via libraries, mother's groups and local centers. Photos of the events were shared

via social media to encourage and inspire other families to participate. Most of the participants reported they had learned about the group via personal contacts or Facebook.

D'Amore & Chawla underline that participation should be made as easy as possible, following the principles of Social marketing theory (SMT). Meetings were held at the same time every time, so participants could plan their participation in advance. All relevant information about the meetings were shared in advance via email. *Incentives* like discount coupons were used to encourage participation. Evaluation revealed that parents participated because they wanted to *1) learn about places to take their children in nature (90%), 2) have fun (86%) 3) have quality time with their children (62%), 4) stay active as a family (59%), and 5) support their children's health and well-being (55%)*. After meetings *1) 100% stated that they learned something new, 2) 97% experienced an enhanced sense of connection with nature, 3) 80% felt a greater sense of connection with their family, 4) 76% said that they had opportunities to get to know new people*. In the meetings, children had time for free play. To conclude, researchers stated that the most successful theory principles used in the intervention were: *1) making desired behaviors as easy as possible, 2) offering incentives, 3) highlighting social norms and social modeling, and 4) providing educational activities*. (D'Amore & Gill 2017).

#### Other nature clubs –projects

Red Barned in Denmark organizes nature clubs with the help of volunteers for children and their families. Children meet once a week and parents are invited to join once a month for a trip, which typically includes a picnic, fishing, eating by the bonfire or other fun nature activities. One main aim is to involve children from vulnerable residential areas and increase the well-being of these families and communities. More: <https://redbarnet.dk/nyheder/naturklubber-er-gode-vitaminer-for-boern-i-boligblokke/>. Denmark's Naturfredningsforening organizes also nature clubs (Naturfamilier) around Denmark, starting in 2019. Clubs aim to be attractive, easy and social. Families interested can register online, so they receive information and are invited when clubs are established in their municipality. Clubs are inspired by Hike It Baby concept (USA). More: <https://www.naturfamilier.dk/>

In Sweden, Friluftsrämjandet organize Skogsmulle –program, which promotes children’s green exercise and nature connection. More: <https://www.friluftsrämjandet.se/lat-aventyret-borja/hitta-aventyr/skogsmulle-och-skogens-varld1/skogsmulle/> .

Hike It Baby is a non-profit organization which creates communities all around the USA and internationally to inspire families with small children to connect with nature and get outside. Hike It Baby charges a small fee based on membership type. Families register to online calendar for events and hikes, which are led by local ambassadors.

More: <https://hikeitbaby.com/>

#### Other scientific intervention studies promoting families’ outdoor activity and nature connection

Play & Grow –program in Hong Kong aimed to promote families’ of preschool children healthy routines through nature experiences, and enable parents and caregivers to develop their skills to support child’s health habits (Sobko et al 2016). The program included 12 group sessions and homework tasks. Two leaders led each session, and sessions included active nature playing and activities together with children, and educational components. Nature activities included discovering nature, practicing sensory awareness in nature and practicing recycling. Homework tasks included growing plants, collecting nature subjects and making art. Time constraints were main the barrier for not participating in the program. Authors suggest providing programs in a different format, for example on weekends, via online or intensively within a short period of time, instead of conducting program over a long period of time. (Sobko et al 2016).

The active families in the Great Outdoors (GO) –program successfully promoted family outdoor physical activity with a 4-week program, targeting parents’ self-efficacy, knowledge, support, and attitudes (Flynn et al 2017). The program, based on the Family Ecological Model, included weekly meetings and materials for processing key components with children at home. Family physical activity prescriptions were found to be effective, and the authors recommend utilizing prescriptions for health promotion. Outdoors Rx –program also utilized an exercise prescription program with guided activities in a health care setting (James et al 2017). The program provided free and accessible scheduled activities for families and attempted to lower barriers for participating. The program was perceived as successful by pediatrics (James et al 2017). Park prescriptions led to an increase in weekly park visits also in SHINE-study by Razani et al. (2016, 2018), targeting low-income parents.

The Active Families -program developed a community resource guide, which included relevant information about outdoor recreation areas, maps and a calendar of events, updated regularly (Davison et al 2011). List of events and maps of outdoor places were found to be frequently used among families.

The Tiny Taters –program provided nature play sessions with a therapy dog for families with children aged 0-5 (Ward et al 2019). The program aimed to promote nature connection, family connections, mental and physical well-being of families, and support the parent, as well as child’s development (Ward et al 2019). The program was free and available for all families. Program enhanced families’ emotional wellbeing, connections to nature and relationships with family members. Children and parents perceived the therapy dog’s calm presence positively (Ward et al 2019). Thurston Family Project improved the well-being of single-parent families with at-risk child, by an outdoor activity program, which included resilience training and learning new skills outdoors (McManus 2012).

An intervention by Finkelstein et al. (2013) conducted a pedometer assisted project for families with children aged 6-12. Families were encouraged to attend at least two hiking meetings per month, which were held on weekends at nature reserves and parks in Singapore, lasting 2-3-hours each. Participating children were pedometers daily. Incentives were used to encourage participation. Children reaching a certain amount of steps during the program received a gift voucher for a toyshop. Lotteries were also held at the sessions. Parents reported that incentives motivated their child to be active, and researchers concluded that pedometers and incentives increased step activity. This is in line with previous results showing that incentives, feedback, and tangible reinforcements motivate to sustain behavior change (Kang et al 2009).

NatureMoves –project by The University of Southern Denmark aims to promote children outdoor physical activity (Andkjær et al 2016). The project includes research part and intervention part. The research part is studying children outdoor physical activity habits and determinants associated with it. Intervention is developed based on results from the research part (Andkjær et al 2016).

Table 4 presents international scientific intervention studies promoting green exercise and nature connection among families. Table 5 presents international Family nature clubs and toolkits, and other relevant sites.

**Table 4. Scientific studies - family green exercise**

Project/Study	Country	Target group	Objectives	Intervention	Results	Conclusions
Skar, M., Gundersen, V., O'Brien, L. How to engage children with nature: Why not just let them play?. 2016.	Norway	Children aged 0-12 (observation of the participants during 13 different events ) and their parents	To compare how different event experiences enhance children nature connection	Large nature events with organized programs, smaller events without organized program	Small events without organized activities: more free play, social interaction, and nature connection. Large events with organized activities: more exciting activities, but less time for free play, no social interaction between families, and nature was just as a frame	Smaller events strengthen nature connection better than larger events
McManus, J. The Thurston Family Project: Working with families through outdoor activities and resiliency training. 2012.	England	Single-parent families with children (n=17) with well-being needs	To improve the well-being of families with at-risk children	A pilot program at outdoor education center in which resiliency training and outdoor activities were combined	Children had more positive attitudes towards school and their home environment and their teachers observed reductions in anxiety, less disruptive behavior, and higher levels of pro-social behaviors.	Residential program at outdoor education center helps families with at risk-children
D'Amore, C., Chawla, L. Many children in the woods: Applying principles of community-based social marketing to a family nature club. 2017.	USA	Families (baseline survey 81 parents)	A case study of a newly-formed family nature club (FNC), which aims to connect families to nature	CFIN leads families on free 2hour outings to nearby natural areas	CBSM principles applied to CFIN helped make it successful in encouraging and maintaining family involvement: (1) making desired behaviors as easy as possible, (2) offering incentives, (3) highlighting social norms and social modeling, and (4) providing educational activities.	This research suggests that the application of CBSM to a social movement organization can enhance that organization's ability to influence people's values and lifestyle behaviors
Razani, N., et al.. Effect of park prescriptions with and without group visits to parks on stress reduction in low-income parents: SHINE randomized trial. 2018.	USA	Low-income families, children 4-18y, (78 parents)	To compare the effect of 1) Independent park prescription group 2) Supported park prescription group	A physician's counseling about nature, maps of local parks, a journal, pedometer and independent or supported nature group	A significant decrease in stress, as well as improvement in park visits, loneliness, physical activity, physiologic stress and nature affinity over the three months of the trial.	Park prescriptions are a promising tool for addressing stress in low-income parents
Ward, T., Goldingay, S., Parson, J. Evaluating a supported nature play programme, parents' perspectives. 2019.	Australia	Young children (0-5y) and their parents	Promote positive family connections and to support the mental and physical health and well-being	Nature play sessions programme with therapy dog	Improvements in interpersonal relationships, connections to nature, and emotional wellness	A nature play program provided families with enriched connections with each other and with nature
James, A.K., Hess, P., Perkins, M.E., Taveras, E.M., Scirica, C.S.. Prescribing Outdoor Play: Outdoors Rx. 2017.	USA	Pediatric patients (age 2-13) and families	To increase physical activity among children	The Outdoors Rx program organizes weekly guided outdoor activities for children and their families in parks and nature preserves accessible by public transportation.	Most of the providers described the program as a useful counseling tool. The most common reasons for families to not being interested were lack of time and transportation	Exercise prescription programs, such as Outdoors Rx, can be a useful tool pediatricians can use to promote increased outdoor physical activity for their patients
Sobko, T., Jia, Z., Kaplan, M., Lee, A., Tseng, C-h.. Promoting healthy eating and active playtime by connecting to nature families with preschool children. Evaluation of pilot study "Play&Grow". 2016.	Hong Kong	38 preschoolers, mothers, and their domestic workers were recruited.	To promote age-appropriate dietary habits and playtime healthy routines through "connectedness to nature" experiences in Hong Kong families with young children	The families attended one workshop/week for a 4-mo period. Period 3 included nature-related outdoor activities to promote parental skills of how to provide safe outdoor and nature activity environments.	Mothers' vigorous active time during weekdays increased significantly. nature relatedness results in progress	The results are expected to add value to the existing recommendations on physical activity and diet in children and, by introducing an environmental factor, "connectedness to nature", to the healthy lifestyle recommendations.
Sääkslahti et al. Effects of a Three-Year Intervention on Children's Physical Activity From Age 4 to 7. 2004	Finland	Families of young children (228 children)	Increase children's physical activity (outdoors) with family-based intervention	Parents of intervention-group children received information and concrete suggestions on how, when, and where to encourage their child's physical activity.	Children in the intervention group spent more time playing outdoors (p = .041) than did children in the control group,	Our study showed that children's outdoor physical activity could be increased via family-based intervention.
Flynn, J. Active Families in the Great Outdoors: A family-centered program to increase physical activity levels, perceptions, and behaviors. 2014.	USA	25 parents and 27 children (16 families)	To promote family physical activity by educating parents on the importance of green exercise and increasing families' confidence in green exercise	4-week a family outdoor physical activity program with face-to-face meetings. Materials were provided to inform parents on ways to increase activity, where to be active, and ideas for activities the entire family would enjoy	At follow-up, knowledge of child physical activity guidelines increased. Parent support through encouragement by role modeling and enjoyment of exercise all were greater at follow-up. Family physical activity prescriptions were found to be effective	Novel use of family physical activity program to foster increases in knowledge and support appears to be effective
Davison KK, Edmunds LS, Wyker BA, Young LM, Sarfoh VS, Sekhobo JP. Feasibility of increasing childhood outdoor play and decreasing television viewing through a family based intervention in WIC. 2011.	USA	880 families (intervention, n=422, control, n=458) of preschool children	Promotion of outdoor physical activity in children	The Active Families -community resource guide included a list of outdoor venues, maps identifying locations, information on hours of operation, contact details, costs, and available facilities and a calendar of events.	The intervention children were more likely than the control children to accumulate greater than 60 minutes outdoor play.	The results of the program evaluation showed that the most frequently used aspects of the intervention were the list of community events and maps provided to find places to take their child to be active.
Finkelstein EA, Tan Y-T, Malhotra R, Lee C-F, Goh S-S, Saw S-M. A cluster randomized controlled trial of an incentive-based outdoor physical activity program. J Pediatr. 2013.	Singapore	285 children 6-12y from 212 families	Promotion of outdoor physical activity in children	The families of the intervention were encouraged to participate in at least 2 family activities a month, each of which lasted 2-3 hours each weekend.	The children in the intervention group met their 8000 step per day goal more frequently than the control group	The results of this study emphasize promising results from a pedometer based, outdoor physical activity program.

**Table 5.** International Family nature clubs and toolkits, relevant sites

Organization	Link
Danmarks Naturfredningsforening	<a href="https://www.naturfamilier.dk/">https://www.naturfamilier.dk/</a>
Red Barnet i Danmark	<a href="https://redbarnet.dk/nyheder/naturklubber-er-gode-vitaminer-for-boern-i-boligblokke/">https://redbarnet.dk/nyheder/naturklubber-er-gode-vitaminer-for-boern-i-boligblokke/</a>
Hike it Baby, non-profit organization, USA	<a href="https://hikeitbaby.com/">https://hikeitbaby.com/</a>
The Norwegian trekking association	<a href="https://english.dnt.no/dnts-activities/">https://english.dnt.no/dnts-activities/</a>
Center for boern og natur, Denmark	<a href="https://centerforboernognatur.dk/">https://centerforboernognatur.dk/</a>
NatureMoves –project, Denmark	<a href="https://www.sdu.dk/en/Om_SDU/Institutter_centre/Iob_Idraet_og_biomekanik/Forskning/Forskningsenheder/Active_living/Forskningsprojekter/NatureMoves">https://www.sdu.dk/en/Om_SDU/Institutter_centre/Iob_Idraet_og_biomekanik/Forskning/Forskningsenheder/Active_living/Forskningsprojekter/NatureMoves</a>
Friluftsförbundet, Sweden	<a href="https://www.friluftsförbundet.se/lat-aventyret-borja/hitta-aventyr/skogsmulle-och-skogens-varld1/skogsmulle/">https://www.friluftsförbundet.se/lat-aventyret-borja/hitta-aventyr/skogsmulle-och-skogens-varld1/skogsmulle/</a>
Children and nature network, non-profit organization, USA	<a href="https://www.childrenandnature.org/wp-content/uploads/2015/04/NCFE_En_2014.pdf">https://www.childrenandnature.org/wp-content/uploads/2015/04/NCFE_En_2014.pdf</a>  <a href="https://www.childrenandnature.org/wp-content/uploads/2015/08/FamilyBonding_En_20141.pdf">https://www.childrenandnature.org/wp-content/uploads/2015/08/FamilyBonding_En_20141.pdf</a>  <a href="https://www.childrenandnature.org/learn/tools-resources/">https://www.childrenandnature.org/learn/tools-resources/</a>
Association of Zoos and Aquariums (AZA), USA	<a href="https://www.speakcdn.com/assets/2332/aza_toolkit_final_aug31_web.pdf">https://www.speakcdn.com/assets/2332/aza_toolkit_final_aug31_web.pdf</a>
Department of Sport and Recreation and Department of Environment and Conservation, Australia	<a href="https://www.natureplaywa.org.au/library/file/Programs/family-nature-clubs/Family%20Nature%20Club%20Toolkit.pdf">https://www.natureplaywa.org.au/library/file/Programs/family-nature-clubs/Family%20Nature%20Club%20Toolkit.pdf</a>



## 6. Green exercise, technology and digital tools

Children are growing up in a digital age, living in an environment saturated with electronic media and technology (Vandewater et al 2007). The use of electronic devices in everyday life is becoming more common even in young age (Chassiakos et al 2016), and Finnish pre-school aged children spend approximately 76 min per day watching screens (DAGIS-study, unpublished). Concerns have been raised that screen devices keep children indoors, instead of playing outdoors (Palmer 2015; Rideout et al 2010). Can digital devices be used as a tool to enhance family green exercise and children's connection to nature? Digital games as a method for health promotion in children have found to be feasible and effective (Parisod et al 2014), but research is scarce on how to use family-based digital tools to promote family green exercise. Many Family Nature clubs use online platforms to ask parents to make a commitment to participate (NaturFamilies, Natural Start Alliance's Nature clubs). This helps parents to arrange a time for meetings.

Apps with maps and navigators are typical digital tools used in green exercise. Digitrail (<https://digitrail.fi/>), Tienoo (<http://tienoo.net/fi/>), Retkipaikka (<https://retkipaikka.fi/sovellus/>) and Mobiranger ([www.luontoon.fi/mobiranger](http://www.luontoon.fi/mobiranger)) are Finnish apps developed for green exercise. Apps that help users to identify flora, fauna, and stars are also popular (e.g. PlantSnap, iNaturalist, Skyview). Table 6 presents digital tools developed for green exercise and nature-based education.

A report and literature review by Coyle (2017) identified 12 key features, which are recommended to take into account when designing digital tools for children's nature connection promotion. Recommended features are 1) activate the senses (sight, smell, touch, taste, sound) by engaging children directly with nature experiences. 2) focus on animals, by observing or interacting with them, as especially younger children are fascinated by animals. 3) Create perceptions of safety in the natural world; give an understanding of safe-to-touch flora and fauna. 4) Encourage physical activity and incorporate PA, like walking, dancing and gaming into programs. 5) Provide space for imagination. Creative active playing can include adventures and role-playing, which enables children to use their imagination. 6) Include sharing features, which enables children and parents to engage with each other and share their experiences. 7) Adults should have clear roles in digital tools, like facilitators, companion or supervisor. 8) If the tool is used outdoors, make sure the

equipment is usable for a child, and think how it can be protected from rain, dirt, heat. 9) Provide opportunities to explore new ideas and new places, which lead to new experiences. 10) Collect and store observations, reflect them later. Outdoors can be brought to indoors by recording sounds, taking pictures or collecting flora. Findings can be identified at home. 11) If a tool is used by a child, it should enable a child to be active at the same time. Wearable hands-free, strap or harness tool would provide opportunities for active adventures. 12) Utilize technology's possibilities - recording, identification, geo-location, social media and so on. (Coyle 2017).

### Green exercise interventions utilizing digital tools among children

Narratives and reward systems, like points and levels, are typical game elements, which can be used in gamified interventions. Use of game design elements in health promotion interventions can increase enjoyment and attractiveness of the intervention (Pakarinen 2018; Hamari et al 2014). Pokemon Go is an example of how to successfully utilize digital technology, game elements and augmented reality for outdoor PA promotion (Nigg 2017). Balmford et al (2002) studied children's ability to identify Pokemon creatures and natural organisms. Researchers found that children (aged 8) identified less than 50% of common natural organisms, but 80% of a random sample of Pokemons drawn from 150 different pokemon creatures. Ability to identify pokemon creatures increased with age more than the ability to identify natural organisms. Researchers raised a question of whether conservationists should try to inspire children more to learn more about nature.

Get To Know -program among school-aged children aimed to increase children's nature connection using a digital gamified tool (Bruni et al 2017). Children were first introduced to the trail online at The Natural Treasure Adventure's website. After that, children followed a printed map to find checkpoints, based on clues on the map. Each checkpoint included different educational nature-based activity. After the trail, children entered checkpoint notes to the website to complete the treasure adventure. Completed treasure hunt unlocked fun features as a reward for achievement. Study results however showed that program did not increase children's nature connection. Researchers suggest, in line with the previous studies (Schultz and Tabanico 2007), that organized activities may shift the focus from nature to the activity itself, which might mitigate the nature experience. Digital tool was only used before and after the trail. (Bruni et al 2017). Link to game: <http://www.get-to-know.org/games/play/cleveland/>

Crawford et al (2017) conducted a study assessing how mobile application, used while visiting nature site, fostered nature connection among children (age 9-14, N 747). Mobile application Agents of Nature (free to download) included information about flora and fauna in each nature site. The mobile app was successful connecting children to nature (measured by Nature in Self -scale), and it was as effective as touring the site with a guide or alone with a map. No distractions due to use of screen device was detected, but instead, children had more fun and social interaction was greater compared to other strategies (Crawford et al 2017).

The DAGIS-study used digital Maptionnaire online app as a tool to encourage families to share their outdoor experiences and recommendations. The app included a map of the neighbourhood and its surroundings, and parents made notes on the map about the places they visited (unpublished, <https://maptionnaire.com/>, [www.dagis.fi](http://www.dagis.fi)).

Danish Natural Technology project (2018-2022) hosted by the Centre for Children and Nature at the University of Copenhagen aims to study how technology and social media affect children's to nature connection, and how it can be used to get children to be inspired to explore nature (Schilhab 2018a, 2018b) (<http://naturligteknik.dk/>).

In Sweden, Friluftsrämjandet has created the app "Skogsmulle og Naturboken", which is digital outdoor learning tool for children aged 4-6. More: <https://www.friluftsrämjandet.se/detta-gor-vi/forskolor-och-skolor/skogsmulles-naturbok/>.

## Digital apps promoting green exercise

Table 6. List of digital tools for green exercise

<b>Digital tools</b>	
Digitrail-app	DigiTrail mobile application works as a guide and navigator in nature. Includes information about nearby services, attractions, activities and history. <a href="https://digitrail.fi">https://digitrail.fi</a>
Retkipaikka.fi-app	Locations on the map and the details of over 3,000 outdoor places. User can choose a light road map or an exact terrain map as a map. Can be used offline. <a href="http://www.Retkipaikka.fi">www.Retkipaikka.fi</a>
Mobiranger – Suomen luonnonpuistot	A mobile guide and navigator in Urho Kekkonen National Park or Pyhä-Luosto National Park. Includes information in text, audio and video format. <a href="https://www.luontoon.fi/mobiranger">https://www.luontoon.fi/mobiranger</a>
Tienoo	App including maps, navigator and information <a href="http://tienoo.net/fi/">http://tienoo.net/fi/</a>
Maptionnaire	<a href="https://maptionnaire.com/">https://maptionnaire.com/</a>
Skogsmulle och Naturboken	<a href="https://www.friluftsframjandet.se/detta-gor-vi/forskolor-och-skolor/skogsmulles-naturbok/">https://www.friluftsframjandet.se/detta-gor-vi/forskolor-och-skolor/skogsmulles-naturbok/</a>
PlantSnap iNaturalist Skyview	Apps for Identification
<u>Read more:</u>	
List of tools	<a href="http://naturligteknik.dk/oversigt-over-naturlig-teknik/">http://naturligteknik.dk/oversigt-over-naturlig-teknik/</a>
List of tools	<a href="https://www.nwf.org/~media/PDFs/Kids-and-Nature/NWF_Role-of-Technology-in-Connecting-Kids-to-Nature_6-30_lsh.ashx">https://www.nwf.org/~media/PDFs/Kids-and-Nature/NWF_Role-of-Technology-in-Connecting-Kids-to-Nature_6-30_lsh.ashx</a> page.48.-54
List of apps	<a href="https://www.vihreaveraja.fi/@Bin/254584/Mobiilisovelluksia.pdf">https://www.vihreaveraja.fi/@Bin/254584/Mobiilisovelluksia.pdf</a>

## 7. Theories and resource-oriented approaches for planning the project

### Theories and models

Health promotion programs are more likely to be effective when the design and strategies are based on a theory (Ling et al. 2017). Use of theory can increase the likelihood that program design and strategies achieve a good fit between program and problems (Nutbeam et al 2010). Models like Bandura's social learning theory and social cognitive theory explain individuals health behavior and health behavior change (Nutbeam et al 2010), and they have been widely used in physical activity interventions for families of small children (Nixon et al 2012).

Theories for designing more effective, family-centered programs, have also been developed. The Family Ecological Model (FEM), developed by Davison and Birch (Davison et al 2012), describes the context and individual factors influencing family health behavior. The model has been successfully applied in a family-centered program to promote family PA levels (Rhodes et al 2010, Flynn 2014). Family-centered Action Model of Intervention Layout and Implementation (FAMILI) combines The Family Ecological Model (FEM) and aspects of the Empowerment Theory (Davison et al 2012). In FAMILI-model families are key stakeholders in deciding how to address the needs in the program (Davison et al 2012). FAMILI-model includes assessment of the daily family life to understand the context and participant needs, and participatory methods to involve families in the development and implementation process (Davison et al 2012).

Social marketing theory guides the use of practical communication strategies for health promotion (Nutbeam et al 2010), and it has been utilized as a frame for planning family nature clubs (D'Amore & Gill 2017). Social marketing theory emphasizes the importance of encouraging participants for desired behavior, rather than discouraging their undesired behavior. The theory presents practical communication strategies to influence behavior, norms and increase commitment to the program (Nutbeam et al 2010). More about SMT and its practical tools:

- <https://www.sustainability.upenn.edu/sites/default/files/Guide%20to%20Community-Based%20Social%20Marketing.pdf>
- <http://www.toolsofchange.com/en/programs/community-based-social-marketing/>

The behavior change wheel (BCW) comprises different frameworks and presents a practical guide for designing and selecting suitable behavior change strategies (Michie et al 2014). The purpose is to provide an overview of behavior science techniques to create behavior change. Key processes before selecting the strategies and implementing the program are to identify the precise aims of the program and to identify what needs to be done and how (taking into account target group's capability, opportunities and motivation). Program's acceptability, practicability, effectiveness, cost-effectiveness, affordability, safety/side-effects, and equity aspects should be noticed when deciding the strategies (Mitchie et al 2014).

### Resource-oriented approaches

Programs aiming to promote the well-being of families with everyday coping problems can apply resource-oriented, salutogenic approaches. Instead of deficiency-based approach, salutogenic approaches focuses on families' individual strengths and needs, which enhances families' autonomy and empowerment, acting for their own well-being (Antonovsky 1987). Taking an active role in designing and implementing the program, generates empowering experiences, and new skills to overcome the obstacles in everyday life.

The sense of coherence (SOC) is a core concept in health-oriented salutogenic theory, developed originally by Aaron Antonovsky's (1987), and it explains one's ability to deal with stressors and take advantage of the resources available. The stronger the sense of coherence, the more effectively an individual is able to utilize his/her resources to handle stressors and more able to act for his/her own well-being. The sense of coherence consists of three components. Comprehensibility refers to belief that life events are predictable and consistent, rather than being unexpected and random (Antonovsky 1987). Manageability refers to the feeling of having control over life situations. Instead of worrying about the injustice of life, those with a strong feeling of manageability either do something to change the difficult situation or accept the situation and adapt to it (Antonovsky 1987). Meaningfulness refers to motivation (Lindström & Eriksson 2005), seeing difficult life situations as challenges valuable to resolve, and are willing to invest time to resolve the situation. A strong sense of coherence prevents stress and protects against mental health problems (Eriksson and Lindström (2006), but it is also associated with a better subjective health (Hassmén et al. 2000; Suominen et al. 2001), and some studies show that it is also linked to healthier lifestyle behavior (Eriksson and Lindström 2006). The sense of coherence can be measured with a SOC-scale, which

contains 3 to 29 questions measuring the elements of the sense of coherence (Lindström & Eriksson 2005). Outdoor intervention by Schreuder (2014) positively contributed to youngsters feelings of meaningful and manageable life, but no interventions were found among families of small children.

Mindfulness-based methods can also be used in interventions promoting coping skills. Nature provides an ideal environment for mindfulness-based methods, as sensory experiences, such as sounds and scents of nature, strengthen the sense of being present.

Acceptance and commitment therapy (ACT) is a cognitive behavioral therapy based on mindfulness-type meditation, developed originally by Steven C. Hayes (2004). ACT-therapy promotes stress management skills and aims to raise one's awareness of own thoughts and feelings. Therapy is based on the idea that unconscious and negative thoughts lead to negative behavior, suffering and mental disorders (Hayes 2004; Ruiz 2010). Increased attention to presence aims to help to identify and accept one's own feelings. Emotions are recognized and accepted the way they are which leads to well-being (Hayes 2004). ACT-therapy aims to increase value-based behavior and psychological flexibility. Methods include mindfulness-type exercises, and reflecting own values and life goals. Psychological flexibility is central in ACT-therapy, and it can be measured by an internationally valid measure AAQ-II (Acceptance and action questionnaire) (Bond et al. 2011). Tracey et al (2018) conducted ACT in the outdoor -intervention to promote psychological wellbeing of school-aged children, which resulted in better self-calming skills, better committing to action, better teamwork skills and trust and respect for others. In a study by Wang et al (2016), mindful learning promoted connectedness to nature among students.

Table 7 presents scales for evaluating the program.

Table 7. Scales for evaluating the program

**Physical and mental health**

---

RAND-36 Item Health Survey (Aalto et al 1999) – subjective health and life quality

Soc - sense of coherence (Antonovsky 1987)

AAQ (Bond et al 2011)

Short Warwick–Edinburgh Mental Well-being Scale SWEMWBS (Haver et al 2015)  
(Permission for use is needed)

**Self-efficacy**

---

Tools to Measure Parenting Self-Efficacy questionnaire (Kendall & Bloomfield 2005)

Parental Self-Efficacy for Healthy Dietary and Physical Activity Behaviours in Preschoolers  
Scale (PDAP). (Bohman et al 2016)

**Nature connection**

---

NR6 nature relatedness (Nisbet & Zelenski 2013)

Nature in the Self Scale (Martin & Czellar 2016)

Connectedness to nature scale CNS (Mayer & McPherson Frantz 2004)

Environmental Identity (EID) scale (Clayton 2003)

Connectedness to nature in preschool children in an urban setting and its relation to  
psychological functioning (Sobko et al 2018)

---



## 8. Summary

- This literature review shows that being active outdoors has several favorable effects on health and well-being of children and families. Playing in nature increases child's physical activity, improves motor skills and physical health. Rich-stimulated natural environment is also beneficial to child's cognitive development and mental health. Nature's restorative and stress relieving effect enables better self-regulation and attention, which leads to better communication among family members and promotes family functioning. Family members' engagement in mutual nature-based activities affects the formation of child's physical activity behavior and nature connection in long-term.
- Promoting family green exercise is a cost-effective action for health promotion. It is particularly important now since urbanization, use of electronic devices and organized hobbies affect children's behavior and decrease free play in nature. Longitudinal studies are still needed to gain knowledge about how children's green exercise behavior has changed in Finland.
- Suomen Latu, Metsähallitus and Suomen Partiolaiset have organized nature-based projects and activities for families with small children in Finland. Sydänliitto, Mielenterveysseura and Suomen Luonnonsuojeluliitto among others have also produced materials for family green exercise promotion. Still, scientific research on the topic is limited. This review resulted in scientific intervention studies worldwide, but less from Nordic countries. Family nature club concepts are widely used around the world, and there is a need for a similar concept in Finland. Research shows that families need practical ideas and demonstrations of what to do outdoors.
- Involving parents and other family members in action planning may help to develop a project meeting target group's needs and interests, and to find solutions to tackle the most common barriers for family green exercise, like lack of time. Recruiting families with the greatest need is challenging, and recruitment is recommended to conduct also via personal sources, which are reliable, credible and identifiable for the families. Encouraging families to take a mentor role in recruitment could be an effective strategy.
- Digital tools/apps for green exercise have been developed. Apps can include maps and guides that help the user to navigate outdoors (DigiTrail, Tienoo, Retkipaikka, Mobiranger). Apps for nature-based learning can help the user to identify flora and fauna (PlantSnap, iNaturalist). If an app is used by a child, it is recommended that the app would encourage child to move and observe the environment, and activate the senses and creativity.
- Research suggests that health promotion programs are more likely to be effective when the design and strategies are based on a theory. Use of behavioral change theories may help to decide on how to affect desired behavior and behavior related determinants, like parents' norms and self-efficacy. Applying strength-based approaches in the project may enhance families' abilities to utilize their resources, resulting in empowerment, which increases engagement and enhances outcomes.

## BIBLIOGRAPHY

- Aalto, A-M, Aro, AR & Teperi J. 1999. RAND-36 terveyteen liittyvän elämänlaadun mittarina – Mittarin luotettavuus ja suomalaiset väestöarvot. Helsinki: Stakes, Tutkimuksia 1999: 101
- Adachi-Mejia, A., Drake, K., MacKenzie, T., Titus-Ernstoff, L., Longacre, M., Hendricks, K. 2010. Perceived intrinsic barriers to physical activity among rural mothers. *J Womens Health* 19(12), 2197–202.
- Ahmetoglu, E. 2019. The contributions of familial and environmental factors to children's connection with nature and outdoor activities. *Early Child Development and Care*, 189(2), 233-243.
- Amanda Brown Cross, Lisa H. Jaycox, Laura J. Hickman, Dana Schultz, Dionne Barnes-Proby, Aaron Kofner, and Claude Setodji. 2004. “Predictors of Study Retention from a Multisite Study of Interventions for Children and Families Exposed to Violence,” *Journal of Community Psychology*, Vol. 41, No. 6, 2013, pp. 743–757; Mary M. McKay and William M. Bannon, Jr., “Engaging Families in Child Mental Health Services,” *Child and Adolescent Psychiatric Clinics of North America*, Vol. 13, No. 4, 2004, pp. 905–921.
- Andkjær, S., Høyer-Kruse J. & Arvidsen, J. 2016. Børn og unges hverdagsfriluftsliv. NatureMoves spørgeskemaundersøgelse om børn og unges aktiviteter og oplevelser i naturen. Serie: Movements, 2016:2.
- Antonovsky, A. 1987. *Unraveling the Mystery of Health. How People Manage Stress and Stay Well*. San Francisco, London: Jossey-Bass.
- Balmford, A., Clegg, L, Coulson, T., Taylor, J. 2002. Why conservationists should heed Pokémon. *Science*, 295, 2367.
- Balseviciene, B., Sinkariova, L., Grazuleviciene, R., Andrusaityte, S., Uzdanaviciute, I., Dedele, A., Nieuwenhuijsen, M. 2014. Impact of residential greenness on preschool children's emotional and behavioral problems. *International Journal of Environmental Research and Public Health*, 11(7), 6757-6770.
- Barnes-Proby, Dionne, Dana Schultz, Lisa H. Jaycox, and Lynsay Ayer. 2017. *Five Strategies for Successful Recruitment and Retention of Children and Families in Human Service Programs*. Santa Monica, CA: RAND Corporation, 2017. <https://www.rand.org/pubs/tools/TL242.html>. Also available in print form.
- Barton, J. & Pretty, J. 2010. What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. *Environ Sci Technol*. 44(10) :3947-55.
- Bellows-Riecken, K. & Rhodes, R. 2008. A birth of inactivity? A review of physical activity and parenthood. *Prev Med* 46(2),99–110.

- Berman, M., Kross, E., Krpan, K., Askren, M., Burson, A., Deldin, P., Kaplan, S., Sherdell, L., Gotlib, I. & Jonides, J. 2012. Interacting with nature improves cognition and affect for individuals with depression. *Journal of Affective Disorders* 140 (2012) 300–305.
- Berto, R., Pasini, M., Barbiero, G., 2015. How does psychological restoration work in children? An exploratory study. *Journal of Child and Adolescent Behavior*, 3(3)
- Bohman, B., Rasmussen, F., Ghaderi, A. 2016. Development and psychometric evaluation of a context-based parental self-efficacy instrument for healthy dietary and physical activity behaviors in preschool children. *International Journal of Behavioral Nutrition and Physical activity*. 13:110.
- Bond, F. W., Hayes, S. C., Baer, R. A., Carpenter, K. M., Guenole, N., Orcutt, H. K., Waltz, T., & Zettle, R. D. 2011. Preliminary psychometric properties of the Acceptance and Action Questionnaire - II: A revised measure of psychological flexibility and experiential avoidance. *Behavior Therapy*, 42, 676-688.
- Bonevski B, Randell M, Paul C, Chapman K, Twyman L, Bryant J, Brozek I, Hughes C. 2014. Reaching the hard-to-reach: a systematic review of strategies for improving health and medical research with socially disadvantaged groups. *BMC Med Res Methodol*. 2014;14(1):42.
- Bowler, D., Buyung-Ali, L., Knight, T., Pullin, A. 2010. A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health*, 10, pp. 456-2458-10-456
- Boxberger, Karolina & Reimers, Anne. 2019. Parental Correlates of Outdoor Play in Boys and Girls Aged 0 to 12-A Systematic Review. *International Journal of Environmental Research and Public Health*. 16. 10.3390/ijerph16020190.
- Brown, P. Brown, W., Miller, Y., Hansen, V. 2001. Perceived Constraints and Social Support for Active Leisure Among Mothers With Young Children. *Leisure Sciences*, 23(3), 131–144.
- Bruni, C.M., Winter, P.L., Schultz, P.W., Omoto, A.M., Tabanico, J.J. 2017. Getting to know nature: Evaluating the effects of the Get to Know Program on children's connectedness to nature. *Environmental Education Research*, 23(1), 43-62.
- Calogiuri, G., 2016. Natural environments and childhood experiences promoting physical activity, examining the mediational effects of feelings about nature and social networks. *Journal of Environmental Research and Public Health*, 13(4)
- Cameron-Faulkner, T., Melville, J., Gattis, M., 2018. Responding to nature: Natural environments improve parent-child communication. *Journal of Environmental Psychology*, 59, 9-15.
- Centre for Community Child Health. 2009. The Impact of poverty on early childhood development (Policy Brief No. 14). Melbourne: Centre for Community Child Health.

- Chang, M-W., Nitzke, S., Guilford, E., Adair, C. & Hazard, D. 2008. Motivators and barriers to healthful eating and physical activity among low-income overweight and obese mothers. *J Am Diet Assoc* 108, 1023–8.
- Chassiakos, Y. L. R., Radesky, J., Christakis, D., Moreno, M. A., & Cross, C. 2016. Children and adolescents and digital media. *Pediatrics*, 138(5), e20162593.
- Chawla, L. 2015. Benefits of nature contact for children. *Journal of Planning Literature*, 30(4), 433-452.
- Cheng, J., Monroe, M. 2012. Connection to nature: Children's affective attitude toward nature. *Environment and Behavior*, 44(1), 31 - 49.
- Chinn, D., White, M., Harland, J., Drinkwater, C. & Raybould, S. 1999. Barriers to physical activity and socioeconomic position: implications for health promotion. *Epidemiol Community Health* 53, 191–2.
- Chu, J., Wan, A., Stewart, S. M., Ng, K. T., Lam, T. H., & Chan, S. S. 2018. Recruitment and Lessons Learned from a Community-Based Intervention Program: The Learning Families Project in Hong Kong. *Frontiers in public health*, 6, 16. doi:10.3389/fpubh.2018.00016
- Clayton, S. 2003. Environmental identity: A conceptual and an operational definition. In S. Clayton & S. Opatow (Eds.). *Identity and the natural environment* (pp. (pp. 45-65). Cambridge, MA: MIT Press.
- Cohen, S. & Horm-Wingerd, D. 1993. Children and the environment: Ecological awareness among preschool children. *Environment and Behavior*, 25 (1), 103-120.
- Cortis, N., Katz, I., & Patulny, R. 2009. Engaging hard-to-reach families and children (Occasional Paper No. 26). Canberra: Department of Families, Housing, Community Services and Indigenous Affairs.
- Coyle, K. 2017. Digital Technology's Role in Connecting Children and Adults to Nature and the Outdoor).
- Cramp, A. & Bray, S. R. 2011. Understanding exercise self-efficacy and barriers to leisure-time physical activity among postnatal women. *Maternal and Child Health Journal* 15, 642–651.
- Crawford, M.R., Holder, M.D., O'Connor, B.P., 2017. Using mobile technology to engage children with nature. *Environment and Behavior*, 49(9), 959-984.
- Dallimer, Katherine N. Irvine, Andrew M. J. Skinner, Zoe G. Davies, James R. Rouquette, Lorraine L. Maltby, Philip H. Warren, Paul R. Armsworth, Kevin J. Gaston. 2012. Biodiversity and the Feel-Good Factor: Understanding Associations between Self-Reported Human Well-being and Species Richness, *BioScience*, Volume 62, Issue 1, January 2012, Pages 47–55,
- Dallimer, M.; Davies, Z.G.; Irvine, K.N.; Maltby, L.; Warren, P.H.; Gaston, K.J.; Armsworth, P.R. 2014. What Personal and Environmental Factors Determine Frequency of Urban Greenspace Use? *Int. J. Environ. Res. Public Health* 2014, 11, 7977-7992.

- D'Amore, C., Chawla, L., 2017. Many children in the woods: Applying principles of community-based social marketing to a family nature club. *Ecopsychology*, 9(4), 232-240.
- Davison KK, Edmunds LS, Wyker BA, Young LM, Sarfoh VS, Sekhobo JP. 2011. Feasibility of increasing childhood outdoor play and decreasing television viewing through a family based intervention in WIC, New York State, 2007-2008. *Prev Chronic Dis*. May 2011;8(3):A54.
- Davison KK, Lawson HA, Coatsworth JD. 2012. The Family-centered Action Model of Intervention Layout and Implementation (FAMILI): the example of childhood obesity. *Health Promot Pract*. Jul 2012;13(4):454-461.
- Duncan, M. J., Clarke, N. D., Birch, S. L., Tallis, J., Hankey, J., Bryant, E., Eyre, E. L. 2014. The effect of green exercise on blood pressure, heart rate and mood state in primary school children. *International Journal of Environmental Research and Public Health*, 11(4), 3678-3688.
- Elands, B., Peters, K. & Vries, S. 2018. Promoting social cohesion –increasing well-being. (Nature and public health). Ed. Bosch, M, Bird, W. Bell & Bain LTD., Glasgow.
- Evenson, K., Aytur, S. & Borodulin, K. 2009. Physical activity beliefs, barriers, and enablers among postpartum women. *Journal of Women's Health* 18 (12), 1925–1934.
- Finkelstein EA, Tan Y-T, Malhotra R, Lee C-F, Goh S-S, Saw S-M. 2013. A cluster randomized controlled trial of an incentive-based outdoor physical activity program. *J Pediatr*. 2013.
- Flouri, E., Midouhas, E., Joshi, H. 2014. The role of urban neighborhood green space in children's emotional and behavioral resilience. *Journal of Environmental Psychology*, 40, 179 - 186.
- Flowers, E., Freeman, P. & Gladwell, V. 2016. A cross-sectional study examining predictors of visit frequency to local green space and the impact this has on physical activity levels. *BMC Public Health*, 16 (2016), pp. 420-016-3050-9
- Flynn, J.I., Bassett, D.R., Fouts, H.N., Thompson, D.L., Coe, D.P. 2017. Active Families in the Great Outdoors: A program to promote family outdoor physical activity. *Journal of Adventure Education and Outdoor Learning*
- Flynn, J. 2014. Active Families in the Great Outdoors: A family-centered program to increase physical activity levels, perceptions, and behaviors. PhD diss., University of Tennessee, 2014. [https://trace.tennessee.edu/utk\\_graddiss/2821](https://trace.tennessee.edu/utk_graddiss/2821)
- Fraser, J., Heimlich, J, & Yocco, V. 2010. American beliefs associated with encouraging children's nature experience opportunities. Institute for Learning Innovation. Viitattu 27.2.2018
- Friluftsrådet nulpunktsmaling. 2018. Børn Gror i Natur Friluftsrådet, 2018. <https://centerforboernognatur.dk/viden/publikationer/> )
- Gill, T. 2014. The benefits of children's engagement with nature: A systematic literature review. *Children, Youth and Environments*, 24(2), 10-34.

- Gladwell, V., Kuoppa, P., Tarvainen, M., & Rogerson, M. 2016. A Lunchtime Walk in Nature Enhances Restoration of Autonomic Control during Night-Time Sleep: Results from a Preliminary Study. *Int J Environ Res Public Health*. 2016 Mar; 13(3): 280.
- Hamari, J., Koivisto, J., & Sarsa, H. 2014. Does gamification work? -a literature review of empirical studies on gamification. In *System Sciences (HICSS), 2014 47th Hawaii International Conference on* (pp. 3025-3034). IEEE.
- Hartig, T., Evans, G.W., Jamner, L. D., Davis, D.S. & Gärling, T. 2003. Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology* 23: 109–123.
- Hassmén, P., Koivula, N. & Uutela, A. 2000. Physical exercise and psychological well-being. A population study in Finland. *Preven Med* 30(1),17–25.
- Haver, A., Akerjordet, K., Caputi, P., Furunes, T. & Magee, C. 2015. Measuring mental well-being: A validation of the Short Warwick– Edinburgh Mental Well-Being Scale in Norwegian and Swedish. *Scandinavian Journal of Public Health*. 43.
- Hayes, SC. 2004. Acceptance and Commitment Therapy, Relational Frame Theory, and the third wave of behavior therapy. *Behavior Therapy*,35, 639-665.
- Hofferth SL. 2009. Changes in American children's time - 1997 to 2003. *Electron Int J Time Use Res*. 2009;6(1):26–47.
- Hunt, A., Stewart, D., Burt, J. & Dillon, J. 2016. Monitor of Engagement with the Natural Environment: a pilot to develop an indicator of visits to the natural environment by children - Results from years 1 and 2 (March 2013 to February 2015). *Natural England Commissioned Reports, Number208*.
- Husu, P., Paronen, O., Suni, J. & Vasankari, T. 2011. Physical activity and fitness of Finns in 2010. *Curr. Status Chang. Health-enhancing Phys. Act.*, 15 (2011)
- Izenstark, D, Oswald, R.F., Holman, E.G., Mendez, S.N., Greder, K.A. 2016. Rural, low-income mothers' use of family-based nature activities to promote family health. *Journal of Leisure Research*, 48(12), 134-155.
- Izenstark, E., Ebata, A.T. 2016. Theorizing family-based nature activities and family functioning: The integration of attention restoration theory with a family routines and rituals perspective. *Journal of Family Theory & Review*, 8(2), 137-153.
- James, A.K., Hess, P., Perkins, M.E., Taveras, E.M., Scirica, C.S. 2017. Prescribing Outdoor Play: Outdoors Rx. *Clinical Pediatrics*, 56(6), 519-524.
- Kahn PH, Kellert SR. 2002. *Children and nature. Psychological, Sociocultural, and Evolutionary Investigations* Cambridge/London. 2002.
- Kaikkonen, R., Mäki, P., Murto, J., Pentala, O., Hakulinen-Viitanen, T. & Laatikainen, T. 2014. Suomalaisten lasten ja lapsiperheiden terveys ja toimintakyky. Teoksessa J. Lammi-Taskula & S. Karvonen (toim.) *Lapsiperheiden hyvinvointi 2014*. Tampere: Juvenes Print – Suomen yliopistopaino, 150–168.

- Kaikkonen, R., Wikström, K. & Hakulinen-Viitanen, T. 2012. Lasten ja lapsiperheiden terveys- ja hyvinvointierot. THL:n raportti 16/2012, 148–151.
- Kang, M., Marshall, S., Barreira, T. & Lee, J. 2009. Effect of pedometer-based physical activity interventions: a meta-analysis. *Res Q Exerc Sport*, 80 (2009), pp. 648-655
- Kaplan & Kaplan, S. 1989. *The Experience of Nature. A Psychological Perspective*. Cambridge, Cambridge University Press. 340 s.
- Kaplan, S. 1995. The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, v.15, Page 169- 182.
- Karusisi, N., Bean, K., Oppert, J., Pannier, B & Chaix, B. 2012. Multiple dimensions of residential environments, neighborhood experiences, and jogging behavior in the RECORD Study. *Prev. Med.*, 55 (1) (2012), pp. 50-55
- Karvonen, Sakari & Salmi, Minna (toim.). 2016. *Lapsikäyhyys Suomessa 2010-luvulla. Terveiden ja hyvinvoinnin laitos (THL). Työpaperi 30/2016. Helsinki 2016. ISBN 978-952-302-741-1 (painettu), ISBN 978-952-302-742-8 (verkkojulkaisu).*
- Kauravaara, K. & Kantomaa M. 2018. Eri ikäiset yhdessä liikkujan polulla – katsaus tutkimuksesta ja hankkeista. Suomen Olympiakomitea, 2018. [https://www.olympiakomitea.fi/uploads/2018/03/eri-ikaiset-liikkujan-polulla\\_ruutuun.pdf](https://www.olympiakomitea.fi/uploads/2018/03/eri-ikaiset-liikkujan-polulla_ruutuun.pdf)
- Kaymaz, I., Oguz, D., & Cengiz-Hergul, O. C. 2019. Factors influencing children's use of urban green spaces. *Indoor and Built Environment*, 28(4), 520–532.
- Kendall S. and Bloomfield L. 2005. TOPSE: Developing and validating , a tool to measure Parenting Self-Efficacy, *Journal of Advanced Nursing*, 51(2), 174-181.
- Korkiakangas, E., Laitinen, J., Keinänen-Kiukaanniemi, S. & Taanila, A. 2010. Pienten lasten vanhempien liikuntamotivaatioon vaikuttavat tekijät. *Hoitotiede* 22(1), 3–13.
- Korpela K., Kyttä M., Hartig T. 2002. Restorative Experience, Self-regulation, and Children's Place Preferences. *Journal of Environmental Psychology* 22:387–98.
- Korpela, K. & Paronen, O. 2011. Ulkoilun hyvinvointivaikutukset. Teoksessa: T. Sievänen, & M. Neuvonen (toim.) *Luonnon virkistyskäyttö 2010*. Vantaa: Metsäntutkimuslaitos, 80-88. Thompson Coon.
- Kyttä , M , Hirvonen , J , Rudner , J , Pirjola , I & Laatikainen , T 2015 , ' The last free-range children?Children's independent mobility in Finland in the 1990s and 2010s ' *JOURNAL OF TRANSPORT GEOGRAPHY* , vol 47 , no. July , pp. 1-12 .
- Laaksoharju, T., Rappe, E. 2010. Children's relationship to plants among primary school children in Finland. *HortTechnology*, 20(4), 689-695.
- Lammi-Taskula, J. & Salmi, M. 2014. Työnjako ja tyytyväisyys parisuhteeseen lapsiperheissä. Teoksessa J. Lammi-Taskula & S. Karvonen (toim.) *Lapsiperheiden hyvinvointi 2014*. Tampere: Juvenes Print – Suomen yliopistopaino, 72–81.

- Laroche, H. & Snetselaar, L. 2011. Rural parents and exercise: Children as barriers and motivators. *Topics in Clinical Nutrition* 26, (3) 234–245.
- Laukkanen, A. 2016. Physical activity and motor competence in 4–8-year-old children: results of a family-based cluster-randomized controlled physical activity trial. *Studies in Sport, Physical Education and Health* 238. Jyväskylä- län yliopisto.
- Liikunnan käypä hoito –suositus. 2016. Suomalaisen Lääkäriseuran Duodecimin ja Käypä hoito -johtoryhmän asettama työryhmä. Helsinki: Suomalainen Lääkäriseura Duodecim. Viitattu 14.1.2017. [www.kaypahoito.fi](http://www.kaypahoito.fi).
- Lindenberg, C. S., Solorzano, R. M., Vilaro, F. M., & Westbrook, L. O. 2001. Challenges and Strategies for Conducting Intervention Research with Culturally Diverse Populations. *Journal of Transcultural Nursing*, 12(2), 132–139.
- Lindström, B. & Eriksson, M. 2005. Salutogenesis. *J Epidemiol Community Health* 59,440–442.
- Lindström, B. & Eriksson, M. 2006. Contextualizing salutogenesis and Antonovsky in public health development. *Health Promot Int* 21(3), 238–44.
- Ling, J., Robbins, L. B., Wen, F., & Zhang, N. 2017. Lifestyle interventions in preschool children: A meta-analysis of effectiveness. *American Journal of Preventive Medicine*, 53(1), 102-112
- Longbottom, S.E., Slaughter, V. 2016. Direct experience with nature and the development of biological knowledge. *Early Education and Development*
- Lovasi, G. S., Quinn, J. W, Neckerman, K. M., Perzanowski, M., Rundle, A. 2008. Children living in areas with more street trees have lower prevalence of asthma. *Journal of Epidemiology and Community Health*, 62(7), 647-649.
- Lovelock, B., Walters, T., Jellum, C., Thompson-Carr, A. 2016. The participation of children, adolescents, and young adults in nature-based recreation. *Leisure Sciences*
- Maas, J., Dillen, S., Verheij, R. & Groenewegen, P. 2009. Social contacts as a possible mechanism behind the relation between green space and health. *Health and Place*. 15, p. 586-595  
10 p.
- Mailey, E., Huberty, J., Dinkel, D. & McAuley, E. 2014. Physical activity barriers and facilitators among working mothers and fathers. *BMC Public Health* 14(1), 657.
- Marselle, M., Irvine, K. & Warber, S. 2014. Examining Group Walks in Nature and Multiple Aspects of Well-Being: A Large-Scale Study. *Ecopsychology*, 6(3),134.
- Martin, C. & Czellar, S. 2016. The extended Inclusion of Nature in Self scale. *Journal of Environmental Psychology*. 47. 10.1016/j.jenvp.2016.05.006.
- Mayer, F.S. & McPherson Frantz, C. 2004. The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, 24, 503-515.



- McConnell, J. & Naylor, P. J. 2016. Feasibility of an intergenerational-physical-activity leadership intervention. *J Intergener Relatsh* 14 (3), 220–241.
- McFarland, A. L., Zajicek, J. M., Wallczek, T. M. 2014. The relationship between parental attitudes toward nature and the amount of time children spend in outdoor recreation. *Journal of Leisure Research*, 46(5), 525-539.
- McIntyre, C. & Rhodes, R. 2009. Correlates of leisure-time physical activity during transitions to motherhood. *Women Health* 49 (1), 66–83.
- McManus, J. 2012. The Thurston Family Project: Working with families through outdoor activities and resiliency training. *The Psychology of Education Review*, 36(2), 40 - 45.
- Michie S, Atkins L, West R. 2014 *The Behaviour Change Wheel: A Guide to Designing Interventions*. London: Silverback Publishing. [www.behaviourchangewheel.com](http://www.behaviourchangewheel.com).
- Miettinen, A. & Rotkirch, A. 2012. Yhteistä aikaa etsimässä. Lapsiperheiden ajankäyttö 2000-luvulla. *Perhebarometri 2011. Väestöliitto, Väestöntutkimuslaitos Katsauksia E 42*.
- Mitchell, R., Africa, J. & Logan, A. 2018. Vulnerable populations, health inequalities, and nature. (Nature and public health). Ed. Bosch, M, Bird, W. Bell & Bain LTD., Glasgow.
- Mitchell, R. 2013. Is physical activity in natural environments better for mental health than physical activity in other environments? *Social Science & Medicine* Vol. 91, 130–134.
- Natural England. 2009. *Childhood and nature: A survey on changing relationships with nature across generations*. Cambridgeshire: Natural England. 32 p.
- Nigg, C. 2017. Pokemon GO May Increase Physical Activity and Decrease Sedentary Behavior. *AJPH*. Vol 107: 1.
- Nisbet, E. K., Zelenski, J.M., 2013. The NR-6 : a new brief measure of nature relatedness. *Front. Psychol.* 4,813.
- Nixon, C. A., Moore, H. J., Douthwaite, W., Gibson, E. L., Vogele, C., Kreichauf, S., Summerbell, C. D. 2012. Identifying effective behavioural models and behaviour change strategies underpinning preschool- and school-based obesity prevention interventions aimed at 4-6-year-olds: a systematic review. *Obesity Reviews: An Official Journal of the International Association for the Study of Obesity*, 13 Suppl 1, 106–117.
- Nutbeam, D., Harris, E. & Wise, M. *Theory in a Nutshell*. 2010. North Ryde, NSW : McGraw-Hill Australia, 2010.
- Nygård, S.A., 2012. *Natur i generation*. Danmarks Naturfredningsforening. Projekt 58949. København. <https://www.naturesdag.dk/media/1055/rapport-natur-i-generationer160113.pdf>
- Paajanen, P. 2005. Eri teitä vanhemmuuteen. Kaksikymppisenä ja kolmekymppisenä lapsen saaneiden näkemyksiä perheellistymisestä ja vanhemmuudesta. *Perhebarometri 2005. Väestöliitto, Väestöntutkimuslaitos, Katsauksia E 21*.

- Paananen, R. & Gissler, M. 2014. Hyvinvointi ulottuu yli sukupolvien. Teoksessa J. Lammi-Taskula & S. Karvonen (toim.) *Lapsiperheiden hyvinvointi 2014*. Tampere: Juvenes Print – Suomen yliopistopaino, 38–51.
- Pakarinen, A. 2018. The development and feasibility of gamified digital intervention aiming to promote physical activity in early childhood. Turun yliopiston julkaisuja, sarja D osa 1384. Viitattu 21.2.2019.
- Palmer, J. 1993. Development of Concern for the Environment and Formative Experiences of Educators. *The Journal of Environmental Education*, 24,3.
- Palmer S. *Toxic childhood: How the modern world is damaging our children and what we can do about it*: Orion; 2015.
- Parisod, H., Pakarinen, A., Kauhanen, L., Aromaa, M., Leppänen, V., Liukkonen, T. N., ... & Salanterä, S. 2014. Promoting children's health with digital games: A review of reviews. *GAMES FOR HEALTH: Research, Development, and Clinical Applications*, 3(3), 145-156
- Peters, K., Elands, B. & Buijs, A. 2010. Social interactions in urban parks: Stimulating social cohesion?. *Urban Forestry & Urban Greening* 9 (2010) 2. 9. 10.1016/j.ufug.2009.11.003.
- Pietilä, M., Neuvonen, M., Borodulin, K., Korpela, K., Sievänen, T., Tyrväinen L. 2015. Relationships between exposure to urban green spaces, physical activity and self-rated health. *J. Outdoor Recreat. Tour.*, 10 (2015), pp. 44-54.
- Pilgrim, S. E., Cullen, L. C., Smith, D. J., Pretty, J., 2008. Ecological knowledge is lost in wealthier communities and countries. *Environmental Science & Technology*, 42(4), 1004-1009.
- Pretty, J., Peacock, J., Sellens, M. & Griffin, M. 2006. The mental and physical health outcomes of green exercise *International Journal of Environmental Health Research* Vol. 15 319-337.
- Pyky, R., Neuvonen, M., Kangas, K., Ojala, A., Lanki, T., Borodulin, K., Tyrväinen, L. 2019. Individual and environmental factors associated with green exercise in urban and suburban areas, *Health & Place*, Volume 55, Pages 20-28,
- Razani, N., Kohn, M.A., Wells, N.M., Thompson, D., Flores, H.H., Rutherford, G.W., 2016. Design and evaluation of a park prescription program for stress reduction and health promotion in low-income families: The Stay Healthy in Nature Everyday (SHINE) study protocol. *Contemporary Clinical Trials*, 51, 8-14.
- Razani, N., Morshed, S., Kohn, M.A., Wells, N.W., Thompson, D., Alqassari, M., Agodi, A., Rutherford, G.W., 2018. Effect of park prescriptions with and without group visits to parks on stress reduction in low-income parents: SHINE randomized trial. *PLOS ONE*
- Rhodes, R. E.; Naylor, P. J. & McKay, H. A. 2010. Pilot study of a family physical activity planning intervention among parents and their children. *J Behav Med* 33 (2), 91–100.

- Rideout, V., Foehr, U., Roberts, D. 2010. *Generation M2: Media in the lives of 8- to 18-year olds*. Menlo Park, CA: Henry J. Kaiser Family Foundation.
- Rosa, C, Profice, C. & Collado, S. 2018. Nature Experiences and Adults' Self-Reported Pro-environmental Behaviors: The Role of Connectedness to Nature and Childhood Nature Experiences. *Frontiers in Psychology*. 9. 10.3389/fpsyg.2018.01055.
- Ruiz, F. 2010. A Review of Acceptance and Commitment Therapy (ACT) Empirical Evidence: Correlational, Experimental Psychopathology, Component and Outcome Studies. *International Journal of Psychology and Psychological Therapy* 2010, 10, 1, pp. 125-162.
- Sallis, J., Owen, N. & Fisher, E. 2008. Ecological models of health behavior. Teoksessa Glanz, K., Rimer, B. & Viswanath, K. *Health behavior and health education: theory, research, and practice*. 4. painos. San Francisco, CA: Jossey-Bass 465–86.
- Schilhab, T. 2018a. Can your child's phone bring them closer to nature? ScienceNordic. Available online at: [http://sciencenordic.com/can-your-child %E2%80%99s-phone-bring-them-closer-nature](http://sciencenordic.com/can-your-child-%E2%80%99s-phone-bring-them-closer-nature) (Accessed January 10, 2018).
- Schilhab, T., . Stevenson M. and Bentsen, P. 2018b. Contrasting screen time and green time a case for using smart technology and nature to optimixe learning process. *Front. Psychol.*, 01 June 2018
- Schreuder, E. 2014. Study results indicate that the care farm approach did positively contribute to the youth's health and well-being, including their personal development and feelings that life can be meaningful and manageable.
- Sievänen, T. & Neuvonen, M. 2011a. Luonnon virkistyskäyttö 2010. Vantaa: Metsäntutkimuslaitos, 37–73.
- Sjöblom, P. 2012. Naturen och jag. En studie av gymnasiestuderandes förhållande till naturen ur ett miljöpedagogiskt perspektiv. Åbo Akademis förlag - Åbo Akademis University Press. (REF 27.2.2019) <http://www.doria.fi/bitstream/handle/10024/84811/sjoblom.pia.pdf?sequence=2&isAllowed=y>
- Skar, M., Gundersen, V., O'Brien, L., 2016a. How to engage children with nature: Why not just let them play?. *Children's Geographies*, 14(5), 527-540.
- Skar, M., Krogh, E. 2009. Changes in children's nature-based experiences near home: From spontaneous play to adult-controlled, planned and organised activities. *Children's Geographies*, 7(3), 339-354.
- Skar, M., Wold, L.C., Gundersen, V., O'Brien, L. 2016b. Why do children not play in nearby nature? Results from a Norwegian survey. *Journal of Adventure Education and Outdoor Learning*
- Sobko T, Jia Z, Brown G. 2018. Measuring connectedness to nature in preschool children in an urban setting and its relation to psychological functioning. *PLoS ONE* 13(11): e0207057. <https://doi.org/10.1371/journal.pone.0207057>

- Sobko, T., Jia, Z., Kaplan, M., Lee, A., Tseng, C. 2016. Promoting healthy eating and active playtime by connecting to nature families with preschool children. Evaluation of pilot study "Play&Grow". *Pediatric Research*, 81, 572-581.
- Soga, M., Yamanoi, T., Tsuchiya, K., Koyanagi, T.F., Kanai, T. 2018. What are the drivers of and barriers to children's direct experiences of nature?. *Landscape and Urban Planning*, 180, 114-120.
- Suominen, S., Helenius, H., Blombers, H., Uutela, A. & Koskenvuo, M. 2001. Sense of coherence as a predictor of subjective state of health. Results of 4 years of follow-up of adults. *J Psychosomatic Res* 50, 77–86.
- Sääkslahti, A., Numminen, P., Salo, P., Tuominen, J., Helenius, H., & Välimäki, I. 2004. Effects of a three-year intervention on children's physical activity from age 4 to 7. *Pediatric Exercise Science*, 16(2), 167-180.
- Thompson Coon, J., Body, K., Stein, K., Whear, R., Barton, J., Depledge, M.H., 2011. Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review. *Environmental Science & Technology*, 45, 1761-1772.
- Tracey, D., Gray, T., Truong, S., Ward, K. 2018. Combining Acceptance and Commitment Therapy with Adventure Therapy to promote psychological wellbeing of children at-risk. *Frontiers in Psychology*
- Twohig-Bennett, C., Jones, A. 2018. The health benefits of the great outdoors: A systematic review and meta-analysis of greenspace exposure and healthy outcomes. *Environmental Research*, 166, 628-637.
- Tyrväinen, L., Silvennoinen, H., Korpela, K. & Ylen, M. 2007. Luonnon merkitys kaupunkilaisille ja vaikutus psyykkiseen hyvinvointiin. Teoksessa Tyrväinen, L. & Tuulentie, S. (toim.). 2007. Luontomatkailu, metsät ja hyvinvointi. 57-77.
- UyBico SJ, Pavel S, Gross CP. 2007. Recruiting vulnerable populations into research: a systematic review of recruitment interventions. *J Gen Intern Med.* (2007) 22:852–63.
- Vandewater, E. A., Rideout, V. J., Wartella, E. A, Huang, X., Lee, J., Shim, M. S. 2007. Digital childhood: Electronic media and technology use among infants, toddlers, and preschoolers. *Pediatrics*, 119(5), E1006-E1015.
- Wang, X., Geng, L., Zhou, K., Ye, L., Ma, Y., Zhang, S., 2016. Mindful learning can promote connectedness to nature: Implicit and explicit evidence. *Consciousness and Cognition*, 44, 1-7.
- Wang, X., Woolley, H., Tang, Y., Liu, H-y., Luo, Y., 2018. Young children's and adults' perceptions of natural play spaces: A case study of Chengdu, southwestern China. *Cities*, 72, 173-180.
- Ward Thompson, C., Aspinall, P., Montarzino, A. 2008. The childhood factor - Adult visits to green places and the significance of childhood experience. *Environment and Behavior*, 40(1), 111-143.

- Ward, K. 2018. What's in a dream? Natural elements, risk and loose parts in children's dream playspace drawings. *Australasian Journal of Early Childhood*, 43(1), 34-42.
- Ward, T., Goldingay, S., Parson, J. 2019. Evaluating a supported nature play programme, parents' perspectives. *Early Child Development and Care*, 189(2), 270-283.
- Well, N. 2000. At home with nature- Effects of "greenness" on children's cognitive functioning. *Environ Behav* 32: 775–795.;
- Wells, N. & Evans, G. 2003. Nearby Nature: A Buffer of Life Stress among Rural Children. *Environment and Behavior*, 35(3), 311–330.
- Wells, N., Jimenez, F., Mårtensson, F. 2018. Children and nature. (Nature and public health). Ed. Bosch, M, Bird, W. Bell & Bain LTD., Glasgow.
- Wells, Nancy & Lekies, Kristi. 2006. Nature and the Life Course: Pathways from Childhood Nature Experiences to Adult Environmentalism<sup>1</sup>. *Children, Youth and Environments*. 16.