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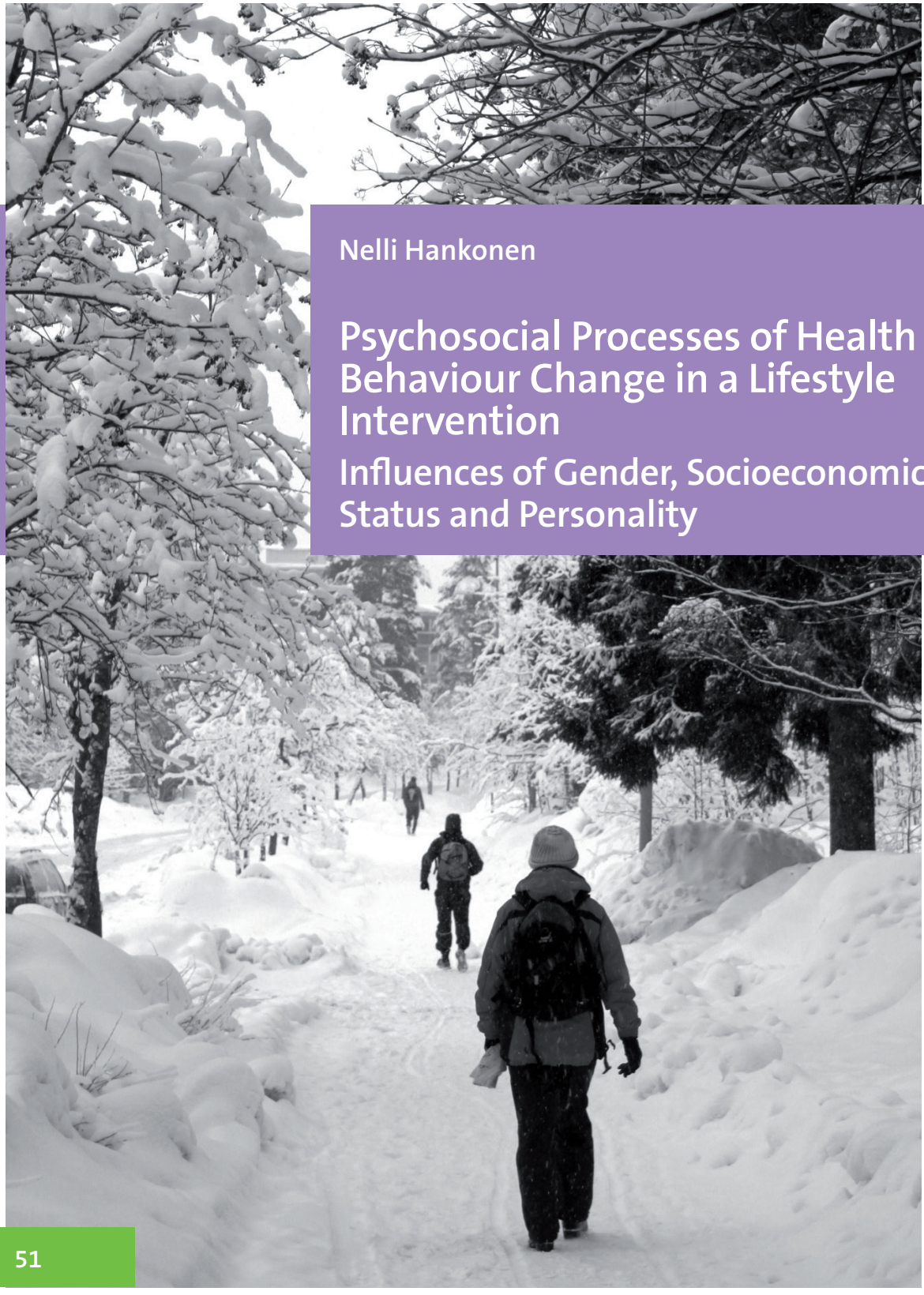

RESEARCH

Nelli Hankonen

Psychosocial Processes of Health Behaviour Change in a Lifestyle Intervention

Influences of Gender, Socioeconomic Status and Personality

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Psychosocial processes of health behaviour change in a lifestyle intervention

Influences of gender, socioeconomic status and personality

ACADEMIC DISSERTATION

To be presented, with the permission of the Faculty of Social Sciences of the University of Helsinki, for public examination in Small Hall, University Main Building on 4 March, 2011, at 12 noon

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Abstract

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Background: The onset of many chronic diseases such as type 2 diabetes can be delayed or prevented by changes in diet, physical activity and obesity. Known predictors of successful behaviour change include psychosocial factors such as self-efficacy, action and coping planning, and social support. However, gender and socioeconomic differences in these psychosocial mechanisms underlying health behaviour change have not been examined, despite well-documented sociodemographic differences in lifestyle-related mortality and morbidity. Additionally, although stable personality traits (such as dispositional optimism or pessimism and gender-role orientation: agency and communion) are related to health and health behaviour, to date they have rarely been studied in the context of health behaviour interventions. These personality traits might contribute to health behaviour change independently of the more modifiable domain-specific psychosocial factors, or indirectly through them, or moderated by them.

The aims were to examine in an intervention setting:

1) whether changes (during the three-month intervention) in psychological determinants (self-efficacy beliefs, action planning and coping planning) predict changes in exercise and diet behaviours over three months and 12 months,
2) the universality assumption of behaviour change theories, i.e. whether pre-intervention levels and changes in psychosocial determinants are similar among genders and socioeconomic groups, and whether they predict changes in behaviour in a similar way in these groups,
3) whether the personality traits optimism, pessimism, agency and communion predict changes in abdominal obesity, and the nature of their interplay with modifiable and domain-specific psychosocial factors (self-efficacy and social support).

Methods: Finnish men and women (N = 385) aged 50–65 years who were at an increased risk for type 2 diabetes were recruited from health care centres to participate in the GOod Ageing in Lahti Region (GOAL) Lifestyle Implementation Trial. The programme aimed to improve participants' lifestyle (physical activity, eating) and decrease their overweight.

The measurements of self-efficacy, planning, social support and dispositional optimism/pessimism were conducted pre-intervention at baseline (T1) and after the

intensive phase of the intervention at three months (T2), and the measurements of exercise at T1, T2 and 12 months (T3) and healthy eating at T1 and T3. Waist circumference, an indicator of abdominal obesity, was measured at T1 and at one-year (T3) and three-year (T4) follow-ups. Agency and communion were measured at T4 with the Personal Attributes Questionnaire (PAQ).

Results:

1) Increases in self-efficacy and planning were associated with three-month increases in exercise (Study I). Moreover, both the post-intervention level and three-month increases (during the intervention) in self-efficacy in dealing with barriers predicted the 12-month increase in exercise, and a high post-intervention level of coping plans predicted the 12-month decrease in dietary fat (Study II). One- and three-year waist circumference reductions were predicted by the initial three-month increase in self-efficacy (Studies III, IV).
2) Post-intervention at three months, women had formed more action plans for changing their exercise routines and received less social support for behaviour change than men had. The effects of adoption self-efficacy were similar but change in planning played a less significant role among men (Study I).

   Examining the effects of socioeconomic status (SES), psychosocial determinants at baseline and their changes during the intervention yielded largely similar results. Exercise barriers self-efficacy was enhanced slightly less among those with low SES. Psychosocial determinants predicted behaviour similarly across all SES groups (Study II).
3) Dispositional optimism and pessimism were unrelated to waist circumference change, directly or indirectly, and they did not influence changes in self-efficacy (Study III). Agency predicted 12-month waist circumference reduction among women. High communion coupled with high social support was associated with waist circumference reduction. However, the only significant predictor of three-year waist circumference reduction was an increase in health-related self-efficacy during the intervention (Study IV).

Conclusions: Interventions should focus on improving participants' self-efficacy early on in the intervention as well as prompting action and coping planning for health behaviour change. Such changes are likely to be similarly effective among intervention participants regardless of gender and educational level. Agentic orientation may operate via helping women to be less affected by the demands of the self-sacrificing female role and enabling them to assertively focus on their own goals. The earlier mixed results regarding the role of social support in behaviour change may be in part explained by personality traits such as communion.

Keywords: Health behaviour change, lifestyle intervention, psychosocial factors, personality, gender, socioeconomic status

Tiivistelmä

Nelli Hankonen. Psychosocial Processes of Health Behaviour Change in a Lifestyle Intervention [Terveyskäyttäytymisen muutoksen psykososiaaliset prosessit elämäntapainterventiossa: Sukupuolen, sosioekonomisen aseman ja persoonallisuuden merkitys onnistumisessa]. Terveyden ja hyvinvoinnin laitos (THL), Tutkimus 51/2011. 176 sivua. Helsinki 2011.
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Krooniset sairaudet kuten tyypin 2 diabetes yleistyvät ja heikentävät yhä useampien elämänlaatua ja elinajanodotetta. Ongelmia voitaisiin ehkäistä riittävällä liikunnalla ja terveellisellä ruokavaliolla, mutta elämäntapamuutos on monille vaikeaa. Pystyvyys-käsitysten, suunnittelun ja sosiaalisen tuen myönteinen vaikutus käyttäytymisen muutokseen ja sen ylläpitoon tunnetaan, mutta sukupuolen ja koulutuksen yhteyttä muutosmekanismeihin on tutkittu vain vähän väestöryhmien terveyseroista huolimatta. Persoonallisuuden vaikutuksia terveyskäyttäytymisen muuttamiseen ei juurikaan tunneta.

Tutkimuksen tavoitteina oli selvittää:
1) Ennustavatko kolme kuukautta kestäneen elämäntapaohjauksen aikana pystyvyysuskomuksissa sekä toiminta- ja varmistussuunnittelussa tapahtuneet muutokset liikunta- ja ruokailutottumusten paranemista heti ohjauksen päättyessä ja vuoden kuluttua, sekä laihtumista yhden ja kolmen vuoden kuluttua?
2) Ovatko elämäntapamuutosta tukevat mekanismit samanlaiset sukupuolesta ja koulutuksesta riippumatta ja ennustavatko ne muutoksia samoin eri ihmisryhmissä?
3) Mikä on erilaisten persoonallisuuspiirteiden rooli laihtumisessa?

Yhteensä 385 50–65-vuotiasta henkilöä, joilla oli kohonnut riski sairastua tyypin 2 diabetekseen, osallistui Ikihyvä Päijät-Häme Elämäntapaohjauksen kuuteen pienryhmätapaamiseen. Terveyspsykologiseen näyttöön perustuvan ohjelman tavoitteina oli auttaa osallistujia lisäämään liikuntaa ja muuttamaan ruokailutottumuksiaan terveellisemmiksi ja näin vähentää lihavuutta. Alkumittauksesta kolmen vuoden seurantaan sisältyi yhteensä neljä tutkimuskertaa, joina kartoitettiin psykososiaalisia tekijöitä, persoonallisuuspiirteitä ja liikunta- ja ruokailutottumuksia. Lisäksi mitattiin paino ja vyötärönympärys.

Tulokset:
1) Pystyvyyden lisääntyminen ohjauksen aikana ennusti liikunnan lisääntymistä kolmen kuukauden ja vuoden ajalla sekä laihtumista vielä kolmen vuoden kohdalla. Liikunnan suunnittelun lisääminen oli yhteydessä lisääntyneeseen liikuntaan heti ohjauksen päätyttyä. Suunnitelmat terveellisten ruokailutottu-

musten ylläpidon varmistamiseksi auttoivat rasvan vähentämisessä vuoden seurannassa.

2) Naiset muodostivat miehiä enemmän liikuntaa koskevia toimintasuunnitelmia, mutta saivat lähipiiristään vähemmän tukea elämäntapamuutokseen. Liikunnan esteiden voittamista koskeva pystyvyys koheni hieman vähemmän matalasti koulutettujen joukossa. Näiden tekijöiden vaikutukset käyttäytymisen muutokseen olivat pääosin samanlaiset naisilla ja miehillä sekä eri koulutusryhmissä.
3) Persoonallisuudeltaan optimistiset eivät laihtuneet pessimistejä enempää. Toimintasuuntautuneisuus oli naisilla yhteydessä laihtumiseen. Ihmissuhdesuuntautuneet naiset hyötyivät eniten lähipiirin tuesta. Kolmen vuoden laihtumiseen vaikutti vain pystyvyyden vahvistuminen, eivät persoonallisuustekijät.

Terveysammattilaisten tulisi keskittyä vahvistamaan elämäntapamuutokseen pyrkivän uskoa omaan pystyvyyteen sekä ohjaamaan konkreettisten toiminta- ja varmistussuunnitelmien tekoon. Näiden kohentaminen on yhtä hyödyllistä sukupuolesta ja koulutustaustasta riippumatta. Optimismi pysyvänä yleisenä piirteenä ei vaikuta laihtumiseen, pikemminkin nimenomaan terveysseikkoihin liittyvä optimistinen pystyvyysuskomus. Lähipiirin vähempi tuki naisten elämäntapamuutospyrkimyksiä kohtaan saattaa johtua naisrooliin liittyvistä vaatimuksista, mutta toimintasuunnitelmien teko ja toimintasuuntautuneisuus edesauttavat omiin terveystavoitteisiin keskittymistä. Erityisesti ihmissuhdesuuntautuneet naiset saattaisivat hyötyä sosiaalista tukea aktivoivista interventioista.

Avainsanat: Terveyskäyttäytyminen, terveyskäyttäytymisen muutos, terveyskäyttäytymisen ylläpito, elintavat, terveysinterventio, psykososiaaliset tekijät, persoonallisuus, sukupuoli, sosioekonominen asema

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II Hankonen, N., Absetz, P., Haukkala, A., & Uutela, A. (2009). Socioeconomic status and psychosocial mechanisms of lifestyle change in a type 2 diabetes prevention trial. *Annals of Behavioral Medicine*, 38(2), 160-165.

III Hankonen, N., Vollmann, M., Renner, B., & Absetz, P. (2010). What is setting the stage for abdominal obesity reduction? A comparison between personality and health-related social cognitions. *Journal of Behavioral Medicine*, 33(5), 415-422.

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Abbreviations

BCT	Behaviour change technique
BMI	Body mass index
CFI	Comparative fit index
DPS	Diabetes Prevention Study
GOAL LIT	GOod Aging in Lahti Region, Lifestyle Implementation Trial, Ikihyvä programme
HAPA	Health Action Process Approach
LCS	Latent change score
LDS	Latent difference score
LDSM	Latent difference score model
LOT-R	Life Orientation Test Revised
OR	Odds ratio
PA	Physical activity
PAQ	Personal Attributes Questionnaire
RMSEA	Root mean square error of approximation
SEM	Structural equation modelling
SES	Socioeconomic status (HSES, High; LSES, Low)
T1	Time 1, baseline assessment
T2	Time 2, post-intervention, at three months
T3	Time 3, one-year follow-up
T4	Time 4, three-year follow-up
T2D	Type 2 diabetes
TLI	Tucker-Lewis index

1 Introduction

Most of us wish to live long, healthy and happy lives. Engaging in four key health behaviours (being physically active, not smoking, only drinking alcohol moderately and consuming at least five portions of fruit and vegetables a day) may add up to 14 years to one's life (Khaw et al., 2008). However, at present, fewer and fewer people eat healthily and engage in regular physical activity. In fact, along with tobacco and alcohol use, poor diet and physical inactivity were among the leading causes of death in the US in 2000, causing two out of five premature deaths (Mokdad, Marks, Stroup, & Gerberding, 2004). Lifestyle-related, degenerative chronic diseases such as type 2 diabetes may be prevented by adopting healthy behaviours. For example, physical activity lowers the risk of diabetes, cancer and osteoporosis as well as all-cause and cardiovascular death (Warburton, Nicol, & Bredin, 2006). Changing one's habits is, however, easier said than done. To better help people adopt and maintain healthy behaviours, health promotion efforts should be based on a sound understanding of the psychosocial antecedents of successful behaviour change.

This doctoral dissertation consists of four independent studies, all conducted in the framework of a health behaviour intervention: the GOAL Lifestyle Implementation Trial to prevent type 2 diabetes (Absetz et al., 2007). The GOAL Lifestyle intervention was carried out in the "real world", that is, the primary health care setting. It was targeted at middle-aged adults with a heightened risk of type 2 diabetes and aimed to help them improve their diet and physical activity.

It is known that confidence in one's ability to adopt and maintain a healthier lifestyle, i.e. self-efficacy, as well as careful planning are prospectively related to success in health behaviour change attempts. Furthermore, we know that high socioeconomic status and personality traits such as dispositional optimism as well as agentic and communal orientation are related to better health. This dissertation sets out to investigate whether psychological changes during the intervention predict behaviour similarly across sociodemographic groups. In other words, did low- and high-educated men and women experience similar psychological changes and were the changes equally beneficial for behaviour change? Furthermore, it was examined whether different personality traits hinder or facilitate weight loss. Were optimists or pessimists, and "masculine" and "feminine" individuals more successful? Do optimists gain additional boosts in self-confidence from the intervention, and is support from friends and family helpful for everybody? Before answering these questions, the relevant literature will be reviewed, the aims specified and the methodology explained.

1.1 Physical activity, diet, obesity and Type 2 Diabetes

1.1.1 Prevalence of unhealthy behaviours and obesity

Poor diet and lack of physical activity are a growing cause of chronic diseases. The lack of engagement in four key health behaviours is related to fourfold risk of death compared to performing these behaviours (Khaw et al., 2008). Unhealthy diets with excess energy intake coupled with sedentary behaviour are primary causes of obesity and overweight. Abdominal obesit (visceral fat, marked by central adiposity) is a major predictor of many chronic y diseases (Björntorp, 1993; Janiszewski, Janssen, & Ross, 2007; Pi-Sunyer, 1991; WHO, 2000); for diabetes, it is an even stronger predictor than fitness and Body Mass Index (BMI) (Racette, Evans, Weiss, Hagberg, & Holloszy, 2006). Abdominal obesity is also the most prevalent manifestation of the metabolic syndrome, a major risk factor for both type 2 diabetes and cardiovascular disease (Despres & Lemieux, 2006). These and other chronic diseases reduce healthy life expectancy and, perhaps more importantly, quality of life (Wee, Cheung, Li, Fong, & Thumboo, 2005).

Obesity rates are rising fast: a recent study concluded that the current obesity trends will outweigh the recent improvements in population health (Stewart, Cutler, & Rosen, 2009). In Finland, among the 45–75-year-old population, over two thirds are overweight or obese (BMI > 25) (Peltonen et al., 2006). Many people want to lose weight: in the year 2008, 30% of Finnish men and 40% of Finnish women aged 55–64 reported having made serious attempts to lose weight during the previous year (Helakorpi, Prättälä, & Uutela, 2008). Health and health behaviours are related to gender and socioeconomic status.

Gender and health behaviour

In general, women's dietary habits are healthier than those of men (Hunter & Rosairo, 2010). For example, in Finland, 34% of men and 50% of women currently report eating vegetables daily (Helakorpi, Laitalainen, & Uutela, 2010). In 2009, a larger proportion of women than of men reported biking or walking to work. The differences in leisure-time physical activity are smaller: 66% of men and 72% of women reported physical activity of at least 30 minutes twice a week or more (Helakorpi et al., 2010). In the age group of 55–64, only 4% of men and 6% of women adhere to the Finnish physical activity recommendations[1]. All in all, diet and physical activity behaviours fall far short of health recommendations, and this is reflected in the risk factors of chronic disease: 69% of 45–75-year-old men and 76%

[1] The Finnish recommendations for health-enhancing physical activity for adults aged 18-64 include 2 hours 30 minutes of moderate aerobic (endurance) activity per week or 1 hour 15 minutes of vigorous activity per week, along with muscle-strengthening and balance training at least twice a week (UKK Institute, 2009). Other public health guidelines include very similar recommendations. (Haskell et al., 2007)

of women are abdominally obese (waist circumference ≥ 94 cm men, ≥ 80 cm women) (Peltonen et al., 2006).

There are numerous differences between men and women in physical health; it is commonly said that women more often live with a disease but live longer than men (Arber, 2001; Brahler & Maier, 2001). In Finland, women are reported to have poorer health than men, but the magnitude of this difference is relatively small (Lahelma, Martikainen, Rahkonen, & Silventoinen, 1999). Gender[2] differences have been explained by biological factors, psychosocial differences, risk behaviour, work-related factors, social roles and relationships, home-related factors, societal structural differences and health service-related factors (Arber, 2001). For instance, women use health services more than men do (Hibbard & Pope, 1983), a pattern that is also found in health behaviour and weight loss interventions.

Less research has investigated the mechanisms underlying gender differences in ill-health. Specifically, potential gender differences in the dynamic process of health behaviour *change* have received little attention. There are many potentially important factors contributing to gender differences. Related to social role and both structural and interpersonal factors, social support is an important determinant of health behaviour change. Although women generally have more close friends and receive greater social support (Schwarzer & Knoll, 2010), women receive less support from their spouses than men do (Boehmer, Luszczynska, & Schwarzer, 2007; Cutrona, 1996; Schwarzer & Gutiérrez-Doña, 2005). Moreover, women have the main caretaking responsibility for their close ones, and the load of paid work in combination with domestic work has stronger effects on their health (Hunt & Annandale, 1993). Turning to psychological level factors, gender differences in personality traits, such as agency, can play a role in a behaviour change process. Furthermore, there might be gender differences in the levels and predictive associations of social cognitions. For instance, planning has been reported to predict eating behaviour in women but not in men (Renner et al., 2008). So far, however, gender differences in psychosocial processes leading to health behaviour change have rarely been examined (e.g. French, Jeffery, & Wing, 1994).

[2] Gender has been a largely disputed concept in social and behavioural sciences. Being a woman or a man has not been seen as merely a biological phenomenon resulting from chromosomes and hormones; instead, this duality is seen as loaded with social and cultural meanings, coupled with heavy sex role-specific socialisation. Many social scientists have thus adopted the convention of talking about gender instead of sex when referring to men and women. However, gender is also used in the sense of gender role, i.e. psychological masculinity and femininity across men and women. In the following work, I will use the word gender in referring to the categories of men and women, and occasionally the concept of psychological gender in referring to psychological masculinity and femininity (i.e. agency and communion).

Socioeconomic status and health behaviour

Despite social and health policies that seek to reduce the gap between socioeconomic groups, socioeconomic inequalities in cardiovascular mortality in Finland are among the highest in Europe (Avendano et al., 2006), and disparities in life expectancy in Finland have even grown during the last decades (Martikainen, Blomgren, & Valkonen, 2007). Low socioeconomic status (SES), defined by lower education, lower income or less prestigious occupations, has long been known to relate to poorer health (Adler et al., 1994). Those with lower SES are more likely to suffer and die from non-communicable chronic diseases such as diabetes, cardiovascular diseases and many types of cancer (Huisman et al., 2005; Mackenbach, Kunst, Cavelaars, Groenhof, & Geurts, 1997). Compared to the highly educated, the prevalence of T2D is 50% higher among lower educated Finnish women over 30 years of age. Furthermore, among both genders, a higher proportion of the lower educated suffer from at least one chronic disease (Koskinen et al., 2007). Many theoretical frameworks have been proposed to explain the link between SES and health (for reviews, see Macintyre, 1997; Raphael, 2006); the investigated mechanisms have ranged from cultural factors to material conditions.

People with lower SES are less likely to adhere to healthy behaviours (Laaksonen, Prattala, Helasoja, Uutela, & Lahelma, 2003; Lantz et al., 1998). Some studies have shown educational level differences in health (Laaksonen et al., 2007) and mortality (Huisman et al., 2005) to be in large part attributable to unhealthy lifestyle. For example, although every year more people in all SES groups adopt healthy dietary habits such as daily fruit and vegetable consumption and low fat consumption, these habits are more common among the higher educated (Helakorpi et al., 2010). Moreover, while the proportion of individuals reporting leisure-time physical activity of at least 30 minutes twice a week or more has increased over the last decades in Finland, the difference between educational groups among men has increased (Helakorpi et al., 2010). Consequently, those with lower SES are more likely to develop risk factors such as gaining weight (Ball & Crawford, 2005) and being obese (Law, Power, Graham, & Merrick, 2007).

Cross-sectionally the SES gradient in health has long been established (Winkleby, Fortmann, & Barrett, 1990), but how do individuals change their health behaviour over time? An observational study over four years reported that although physical activity and dietary habits varied over time, there were no socioeconomic differences with regard to changes (Mulder, Ranchor, Sanderman, Bouma, & van den Heuvel, 1998); however, another study reported that, over seven years, adoption and maintenance of healthy eating and exercise was related to higher SES (Boniface, Cottee, Neal, & Skinner, 2001) and another that over two years, adoption and maintenance of physical activity was related to educational level among women but not among men (Sallis, Hovell, & Hofstetter, 1992). Despite such differences in naturally occurring changes, intervention studies in which analyses regarding SES

have been conducted show that the intervention effects on risk factor changes are not modified by SES (Absetz et al., unpublished manuscript; Govil, Weidner, Merritt-Worden, & Ornish, 2009; Mildestvedt & Meland, 2007; Wikström et al., 2009); however, a review of nutrition interventions found a mixed pattern (Oldroyd, Burns, Lucas, Haikerwal, & Waters, 2008).

The mixed efficacy according to SES in preventive and health promotion interventions may be linked to another proposed mechanism explaining the SES-health relationship: the differential access to health care. Those with low SES have the least access to preventive services ("inverse prevention law") (Acheson, 1998). Also, it has been claimed that public health interventions and programmes at the population level reach high-SES groups first and only later affect those with low SES ("inverse equity hypothesis") (Victora, Vaughan, Barros, Silva, & Tomasi, 2000). Hence, there is a fear that the health gap will keep widening, with larger increases in health for those who are better off (Joseph, 1989).

Whether the intervention produces similar or differing health outcomes according to SES, the psychological mediating mechanisms in health behaviour interventions might still be different for SES groups. There is a lack of research on whether SES modifies the psychological mechanisms of change. If behaviour change theories are to be used to design interventions to decrease health inequalities, there should be tested evidence that the conceptual theory (see Chapter 1.5) applies for all demographic groups.

1.1.2 Type 2 diabetes

Diabetes is a group of metabolic diseases characterised by hyperglycaemia and glucose intolerance due to insulin deficiency and/or impaired effectiveness of insulin action (American Diabetes Association, 2010; International Diabetes Federation, 2009). Approximately 90–95% of those with diabetes have type 2 diabetes (T2D), previously also referred to as adult-onset diabetes. Those with T2D have insulin resistance and usually have relative insulin deficiency, and often do not need insulin treatment to survive (American Diabetes Association, 2010).

Diabetes has been diagnosed with glucose-based criteria, such as the fasting plasma glucose or the oral glucose tolerance test (American Diabetes Association, 2010). Pre-diabetes is characterised by impaired fasting glucose or impaired glucose tolerance that does not meet the criteria for diabetes but is higher than the upper limit of normal. Such individuals have a higher risk for the future development of T2D (The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, 2003).

Having T2D leads to a risk of severe co-morbidities. Long-term complications of diabetes include cardiovascular disease, potential loss of vision, risk of foot ulcers and amputations, and sexual dysfunction. Furthermore, people with diabetes have an increased incidence of hypertension, stroke, coronary heart disease, heart attack and

dementia. In fact, largely due to the markedly increased risk of cardiovascular disease, diabetes is now one of the leading causes of death in high-income countries (American Diabetes Association, 2010). Hence, preventing diabetes encompasses preventing not only diabetes itself but also a host of other degenerative diseases, and thus, mortality, economic burden and human suffering.

The prevalence of T2D is rising. In 2008, half a million Finns were estimated to have T2D, and half of them were unaware of their disease (Peltonen et al., 2008). It is estimated that 438 million people in the world (7.8% of the adult population) will have diabetes by 2030 unless effective prevention programmes are implemented (International Diabetes Federation, 2009). The risk of developing T2D increases with age, obesity and lack of physical activity; having prior gestational DM and hypertension or dyslipidemia as well as a family history of diabetes is associated with a heightened risk (American Diabetes Association, 2010). The new European guideline for the prevention of T2D points to obesity and sedentary lifestyle as the main modifiable risk factors (Paulweber et al., 2010).

1.1.3 Chronic disease risk reduction by changes in health behaviour

In recent years, several randomised controlled trials have shown that T2D can be prevented or delayed in adults with impaired glucose tolerance (Lindström & Tuomilehto, 2010; Roumen, Blaak, & Corpeleijn, 2009). Such major diabetes prevention studies include the Finnish Diabetes Prevention Study (DPS) (Tuomilehto et al., 2001) and the Diabetes Prevention Program (DPP) (Knowler et al., 2002). The new European guideline for the prevention of T2D concludes that health behaviour changes delay the onset of type 2 diabetes in high-risk adults (Paulweber et al., 2010). What, then, is specifically required to lower one's risk? In terms of weight loss, as low as 5% is sufficient (Hainer, Toplak, & Mitrakou, 2008; Paulweber et al., 2010), and this may be achieved by improvements in diet and physical activity. In the DPS, a healthy diet shown to be effective in preventing diabetes has a low fat and high fibre content (Lindström, Peltonen et al., 2006), the latter important for glycaemic control. Also, at least 150 minutes of moderate to vigorous intensity PA per week was associated with a lowered risk (Laaksonen et al., 2005). Adopting the health behaviour objectives has been shown to prevent or at least delay the onset of diabetes (Lindström, Ilanne-Parikka et al., 2006). In fact, none of the high-risk participants who achieved all intervention goals in the DPS got diabetes in the following seven years (see Figure 1) (Lindström, Ilanne-Parikka et al., 2006; Lindström et al., 2010).

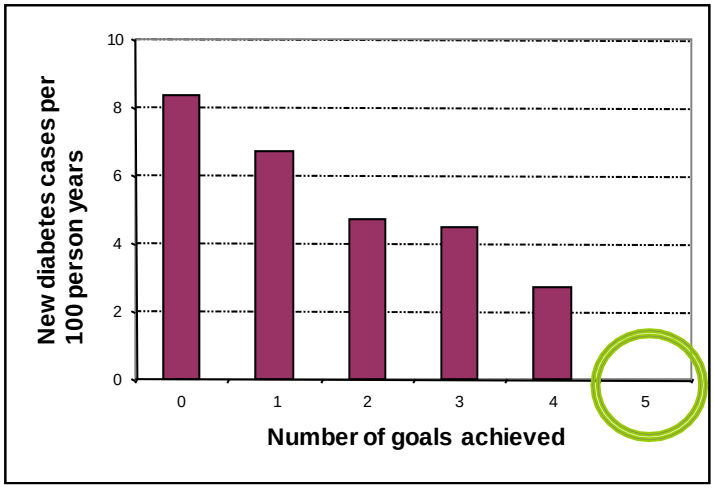

Figure 1. Achieving all lifestyle goals* prevented onset of T2D for at least seven years in the DPS.

(Lindström et al., 2010.)
* The goals in the DPS were:
1) At least 5% weight reduction,
2) No more than 30% of daily energy from fat,
3) No more than 10% of energy from saturated fat,
4) At least 15 grams per 1000 kcal of fibre, and
5) At least 30 minutes per day of moderate physical activity.

Healthy eating and physical activity should not be adopted only because they aid in weight loss, but also because they have important benefits irrespective of weight change: Lindström and Tuomilehto (2010) point out that in leaner populations (China, Japan, India) adopting a healthy diet and engaging in PA have been found to reduce the risk of T2D. Exercise has important health benefits in itself (Donnelly et al., 2004). In the case of diabetes prevention, exercise has been found to contribute to the improvement of glucose metabolism, regardless of weight loss (D.E. Laaksonen et al., 2005), and improve the capacity to oxidise fatty acids along with other mechanisms (see Roumen et al., 2009).

Although health behaviour change has been shown to be even more cost-effective than drug treatment in preventing T2D (Gillies et al., 2007), translating this evidence into the population level proves to be a challenge: major prevention programmes such as the DPS include intensive lifestyle counselling, with access to a gym and other resources not available in "real world" primary prevention (Uutela et al., 2004). Typically only a minority of participants achieve long-term weight loss (Wadden, Brownell, & Foster, 2002).

Lifestyle change is a process of *behaviour change*. Behaviour and behaviour change are affected by numerous different determinants, which must be understood in order to facilitate behaviour change. Behavioural science research has identified

important determinants for different behaviours and developed theories to account for the causal mechanisms of the process whereby they contribute to health, health behaviour and its change. Based on the theories, effective intervention strategies can be extracted. Next, important determinants of health behaviour will be reviewed, followed by a discussion of how interventions can target these determinants.

1.2 Psychosocial determinants of health behaviour change

Which traits, thoughts and actions and what types of environments facilitate adoption and maintenance of healthy behaviours? An understanding of such determinants enables the planning of health promotion interventions targeted at changing behaviour. In the following sections, literature will be reviewed focusing on social cognitive, interpersonal and personality determinants (and related mechanisms) of diet, physical activity, obesity and changes in them. The constructs of this dissertation will be presented in more detail and the mechanisms through which they are hypothesised to influence diet and exercise behaviours and obesity will be reviewed. Figure 2 summarises a simplified version of the concepts and anticipated relationships in the present study.

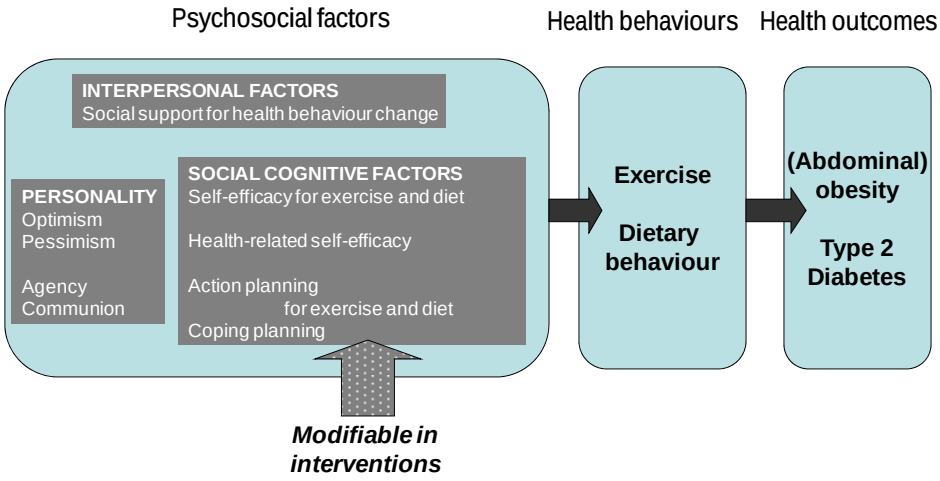

Figure 2. Overview of the concepts of the study.

The personality factors (optimism/pessimism, agency, communion) are shown on the far left, the modifiable psychosocial determinants (self-efficacy, planning, social support) in the middle, and the influencing health behaviour (PA, diet) and risk factor change (obesity) in the boxes on the right. Note that both levels and changes in self-efficacy and planning will be investigated as predictors.

Some issues need to be noted. Firstly, although the title implies "health behaviour change" in general, I will discuss only those aspects that are relevant to this study: changes in diet, physical activity and obesity. Adapting the definition by Steptoe et al. (2010), health behaviour can be defined as activities that may help to prevent disease and to promote and enhance health. Health behaviours may be done for non-health motives, e.g. concern for appearance. Obesity can not be considered to be a health behaviour but is strongly determined by excessive energy intake coupled with lack of physical activity (Steptoe et al., 2010), and in the context of a lifestyle intervention, change in obesity indicators may be held as a proxy measure for successful change in diet and physical activity behaviours.

Secondly, health behaviours are impacted by the broader cultural and social context, such as sociocultural, legislative and economic factors as well as systems of provision or services (e.g. walkable neighbourhoods, sports facilities, availability of palatable low-fat foods), health-service provision and biological factors (Steptoe, Gardner, & Wardle, 2010). It is acknowledged that formulation of national and international policy and legislation plays a primary role in public health promotion, having a strong and direct impact on people's behaviour and enabling the context for other health promotion activities (Abraham, Kok, Schaalma, & Luszczynska, in press). This study focuses on more individual-level health promotion activity.

Thirdly, many health behaviour determinants could be characterised as correlates rather than determinants, as the associations have been established in cross-sectional studies and no clear theoretical hypotheses for causal mechanisms have been specified. Most of the data on physical activity is cross-sectional, although it is essential to understand the "patterns of activity over time" (Buckworth & Dishman, 2007). Prospective randomised intervention studies would provide evidence of causal effects. Importantly, the associations of determinants (or "correlates") with behaviour might vary in cross-sectional, longitudinal and intervention studies: for example, in one study, self-efficacy was correlated with physical activity cross-sectionally, but did not predict naturally occurring change across one year (Motl et al., 2005), but in another, intervention-induced change in self-efficacy explained part of the intervention success (Dishman et al., 2004). Hence, attention should be paid to the nature of research designs when interpreting the reported associations: whether the evidence comes from a correlational, longitudinal prospective, experimental or an intervention design. Further, a determinant of behaviour might not be a determinant of behaviour *change* (Brug, Oenema, & Ferreira, 2005).

1.2.1 Health-specific psychological determinants

Overview

Social cognition models of health behaviour can be classified into motivational, behavioural enactment and stage models (Armitage & Conner, 2000). The core cognitive antecedents of health behaviours are attitudes (incl. outcome expectancies, benefits/barriers, affect), self-representations (incl. social identity), norms (incl., injunctive and descriptive norms), and self-efficacy or perceived control (Abraham, Sheeran, & Johnston, 1998). In the context of ***motivational*** models, these are mainly thought to affect *intention*, which is then assumed to translate into behaviour. Across theoretical frameworks, there has been a growing consensus regarding the central determinants of motivation (Abraham et al., in press; Fishbein et al., 2001). ***Behavioural enactment*** models are based on the notion that as intention is weakly related to behaviour (Conner & Armitage, 1998), post-intentional processes should also be taken into account. Such post-intentional processes bridging the "intention-behaviour gap" include, for example, self-regulation processes such as those specified in the Control Theory (Carver & Scheier, 1982). The third set of models, ***stage*** theories, propose that the health behaviour process consists of qualitatively different stages or phases, such as preintention, intention, action, maintenance and relapse. Stage theories assume that different determinants are important at different stages of behaviour change (Sutton, 2005). The transtheoretical model of behaviour change is the most widely known stage model (Prochaska & Velicer, 1997), but there is little empirical support for stage distinctions (Sutton, 2000). To date, there is evidence for the basic distinction between a pre- and post-intentional phase (i.e. unmotivated and motivated individuals) (Brug et al., 2005) but further stage distinctions still need to be tested in rigorous designs (Sniehotta & Aunger, 2010).

A theoretical model that combines elements from the social cognitive theory (Bandura, 1986) and self-regulation approaches (Baumeister & Vohs, 2004) is the Health Action Process Approach (HAPA) (Schwarzer & Fuchs, 1996). HAPA encompasses the behaviour change process from pre-intention to action initiation and maintenance. It entails both motivational, intention formation elements ("motivational phase") as well as "behavioural enactment" elements ("volitional phase"). HAPA can be treated both as a stage model differentiating between qualitatively different stages for preintenders, intenders and actors, and as a continuum model (Schwarzer, 2008). (See Figure 3 for the generic diagram of the HAPA.) Despite the model's emphasis on mainly individual psychological determinants (e.g. self-efficacy, planning), it also includes environmental barriers and resources (e.g. social support) as determinants of action. Outcome expectancies refer to beliefs, the weighed pros and cons of a behaviour. They can be emotional variables (e.g. anticipated regret over eating too much high-fat foods) or social variables (e.g. subjective norm of taking exercise) (Schwarzer, 2008b). Risk

perception is a special case of outcome expectancy, referring to perceived susceptibility to a severe disease such as type 2 diabetes. In addition to the conscious cognitive determinants, automatic and habitual processes are influential in health behaviour and behaviour change. However, as participation in a lifestyle intervention implies a volitional, intentional attempt to change behaviour, the post-intentional and conscious factors are of interest in the present study.

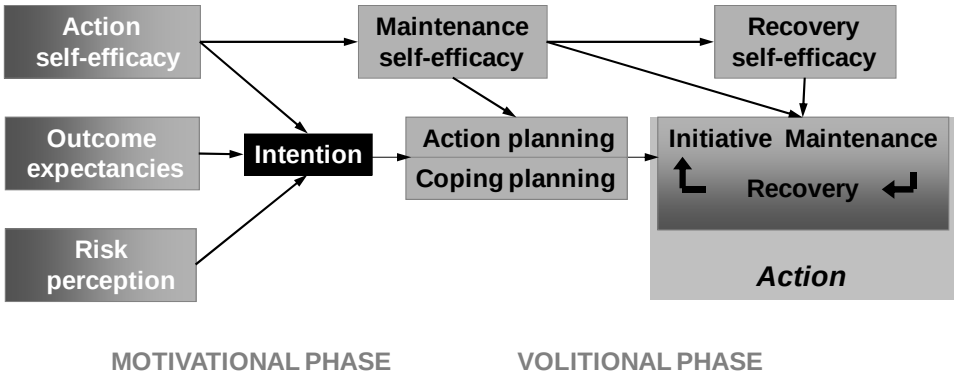

Figure 3. The Health Action Process Approach (HAPA)

(After Schwarzer, 2008.)

Out of the vast set of established social cognition determinants, the present research focuses on two important factors facilitating the adoption of new behaviours: a person's confidence in being capable of making the necessary changes and self-regulation of behaviour (Bandura, 1997; Gollwitzer & Sheeran, 2006; Sniehotta, Schwarzer, Scholz, & Schüz, 2005). Two central constructs representing these are self-efficacy and planning, which seem to be among the best predictors of many health behaviours amongst a broad range of psychosocial variables identified by past research (Schwarzer et al., 2007). Interventions designed to improve health behaviours via these factors have also been shown to be effective (Luszczynska, Tryburcy, & Schwarzer, 2006).

How are these constructs defined and through which mechanisms do they exert their impact on behaviours? These questions will be addressed in the following.

Self-efficacy

Self-efficacy reflects an individual's belief that she or he can successfully execute a sequence of actions in a specified context (Bandura, 1977, 1986, 1997). Originally introduced by Bandura in his self-efficacy theory (1977) and social cognitive theory (Bandura, 1986), self-efficacy is at present a central determinant in several other theories and models, e.g. the HAPA and theory of planned behaviour (perceived behavioural control) (Ajzen, 1991). Self-efficacy is the focal belief on which human

motivation and action is founded: unless a person believes he/she can produce desired effects by his/her own actions, he/she has little incentive to act or to persevere in the face of difficulties.

How does self-efficacy increase the odds of success? Highly efficacious individuals tend to tackle more challenging tasks, employ better strategies, put forth more sustained effort and be more persistent in the face of obstacles, setbacks and difficulties (Bandura, 1977, 1986, 1997; Schwarzer, 2008a). Self-efficacy increases the probability of success through its effects on sustained effort and stamina. A self-efficacious individual persists because she believes she will eventually succeed. High self-efficacy minimises stress and hence improves performance (Bandura, 1999). As in the original formulations of the social cognitive theory by Albert Bandura, self-efficacy might not only influence one's intention to act but also have a direct effect on behaviour (Schwarzer, 2008a). The principle of reciprocal determinism encompasses the idea that cognitions influence behaviour but behaviour also influences cognitions (Bandura, 1986). Self-efficacy beliefs are measured against gradations of challenges to successful performance (Bandura, 2004). For example, in assessing personal efficacy in sticking to a healthy diet, people judge their efficacy in selecting healthy foods in the face of temptations, tiredness, social pressure and so on.

A distinction between differing forms of self-efficacy, each relevant in different phases of the behaviour change process, has been proposed by a number of researchers (Marlatt, Baer, & Quigley, 1995; Prochaska & Velicer, 1997). For example, action self-efficacy consists of optimistic beliefs about one's capability to *initiate* a new behaviour, whereas maintenance self-efficacy (or barriers self-efficacy, or coping self-efficacy) refers to optimistic beliefs about one's capability to deal with barriers to *maintaining* the behaviour change (Schwarzer & Renner, 2000).

If a sense of self-efficacy is essential in health behaviour change attempts, how can interventionists plan to increase it? Social cognitive theory postulates various sources of self-efficacy (few theories explicitly focus on how the proximal cognitive determinants of behaviour change should be manipulated in order to elicit behaviour change) (Sutton, 2004). According to the theory, self-efficacy can be enhanced via strategies such as enabling mastery experience, verbal persuasion, physiological and emotional cues, and vicarious experience (Bandura, 1977, 1997). A systematic review (Ashford, Edmunds, & French, 2010) showed that the best results in physical activity interventions have been gained when providing specific feedback on the past performance of the individual and others as well as vicarious experience (e.g. seeing similar people carrying out the behaviour). In contrast to the theoretical assumptions (and some empirical evidence), persuasion, graded mastery (i.e. gradually increasing the difficulty of target behaviour) and barrier identification were associated with lower levels of self-efficacy for physical activity (Ashford et al., 2010). Similar results were found in another study (Knittle, Warner, Ziegelmann, Schüz, & Wurm, 2010).

Planning

In making a volitional attempt to change one's behaviour, planning is a means of bridging the gap between intention and action (Maes & Karoly, 2005). *Action planning* refers to the process of specifying when, where and how to act according to one's general intentions and goals, which increases the likelihood of carrying out the intended behaviour (Leventhal, Singer, & Jones, 1965; Sniehotta, Schwarzer et al., 2005). For example, for the general goal intention of "exercising more frequently", action planning would consist of specifying "I will go jogging every Sunday evening in the nearby forest with my husband before my favourite TV show begins" and "Every time I go to work in the morning, I will take the stairs instead of the elevator". There are similarities between the concepts of action planning and implementation intentions (Gollwitzer, 1999; Gollwitzer & Brandstätter, 1997; Sniehotta, 2009). Having formed a specific plan triggers the initiation of action without additional investment in self-regulatory effort (Sheeran, Webb & Gollwitzer, 2006). The effectiveness of action planning has been demonstrated in several areas, including the domain of exercise behaviour (Lippke, Ziegelmann, & Schwarzer, 2004; Renner, Spivak, Kwon, & Schwarzer, 2007; Sniehotta, Scholz, & Schwarzer, 2005; Sniehotta, Schwarzer et al., 2005) as well as in interventions to promote healthier diets (Armitage, 2006; Schnoll & Zimmerman, 2001; Verplanken & Faes, 1999).

Goal-directed behaviour may be disturbed by several challenging and goal-discrepant situations. Negative emotional states, interpersonal conflict and social pressure represent the high-risk situations that most often lead to relapse, and apply to a number of health risk behaviours including overeating (Marlatt & George, 1998). *Coping planning* refers to the process of linking anticipated risk or relapse situations and suitable coping responses to prevent relapse (Sniehotta, Schwarzer et al., 2005.). In making a coping plan, the person links situational cues contingently associated with undesired behaviours (e.g. "going to a party where fatty and sugary foods are available") with cognitive or behavioural coping responses aimed at inhibiting the undesired response (e.g. "I will satisfy my hunger before going to the party so that I will not eat too much") or prioritising the desired behaviour (e.g. "I will only take a small slice of the chocolate cake and mostly eat fruit salad") (Sniehotta, 2009; Sniehotta et al., 2005).

Coping plans can only be made if one has also formed action plans (Schwarzer, 2008): coping plans protect action plans against obstacles. For example, if one has made a plan to go out jogging after work, one could anticipate barriers such as rain. For this obstacle, one would prepare coping strategies, such as going to the gym instead. The concept of coping planning shares some aspects with cognitive behavioural therapy techniques, such as relapse prevention (Marlatt & George, 1998). Evidence for the benefits of coping planning has begun to accumulate across many applied areas including healthy eating and exercise (Sniehotta, 2009).

What are the interrelationships between planning and self-efficacy? High self-efficacy might heighten the eagerness to translate general goals into specific plans. Generating plans might also enhance self-efficacy prior and during initial behavioural efforts. The mere knowledge that one has specific plans for how to cope with temptations might increase one's confidence, and after successfully responding as planned in a challenging situation, self-efficacy is likely to increase even more as a result of such a mastery experience. Hence, the relationship between planning and self-efficacy can be assumed to be bidirectional.

1.2.2 Interpersonal factors

Overview

In addition to the individual-level social cognitive factors, the social environment is associated with an individual's health-enhancing or health-endangering behaviours (Lewis & Rook, 1999; Schwarzer & Fuchs, 1996). Interpersonal-level theories focus on social networks providing social support as well as social capital and community competence (Bartholomew, Parcel, Kok, & Gottlieb, 2006).

Social support

Social support may either facilitate or hinder health behaviour change (Schwarzer & Fuchs, 1996). Social support can take many forms, with different implications for behaviour: social support has been divided into directive and non-directive or autonomy-supportive on the one hand (Fisher, La Greca, Greco, Arfken, & Schneiderman, 1997; Ryan & Deci, 2000), and informational, emotional and instrumental or tangible on the other (Antonucci, 2001). For example, in the case of attempting to change one's physical activity, social support could be emotional (e.g. encouraging to exercise), tangible (e.g. providing exercise equipment), informational (e.g. giving advice on exercise) or instrumental (e.g. changing one's schedule so that one can exercise together).

Support provided by friends or family members has been found to enhance both initial weight loss and maintenance of the lowered weight (Wing & Jeffery, 1999). According to the social cognitive theory, social support works primarily indirectly through its influence on self-efficacy (Bandura, 1997). This "enabling hypothesis" is supported by several empirical studies, although a reversed pathway has also been recognised (Schwarzer & Knoll, 2010).

Studies have shown that compared to men, women generally tend to have more close friends and receive and provide more emotional support (Schwarzer & Knoll, 2010). Such gender differences might be explained by personality traits such as emotional expressiveness or communion (Reevy & Maslach, 2001). The "support gap hypothesis" (Cutrona, 1996) refers to situations where women receive less support from their spouses than men from theirs. Ironically, some studies report that

social support is more important for women's physical activity behaviour than for men's (Molloy, Dixon, Hamer, & Sniehotta, in press; Sallis, Calfas, Alcaraz, Gehrman, & Johnson, 1999; Sallis et al., 1992), although some report support to be equally predictive among both genders (Allgöwer, Wardle, & Steptoe, 2001).

Social support is often not explicitly targeted by health behaviour interventions, but social support provided by the participants' close others (or the lack thereof) may play a role in the health behaviour change process via its influences on self-efficacy. Social support might also moderate the effects of personality on behaviour (Cheng, 1999). Reviews of health promotion interventions come to different conclusions regarding the benefits of including social support (Dombrowski et al., in press; Greaves, Reddy, & Sheppard, 2010), which might be explained by moderators.

1.3 Personality in health behaviour

1.3.1 Overview

In addition to social cognitive models and factors, psychological determinants of health behaviour and its consequences have been investigated within the personality framework (Timothy & Paula, 1992). The concept of personality refers to *stable individual differences in affect, behaviour and/or cognition* (Williams, Smith, & Cribbet, 2008). Generalised personality traits are relatively stable over time and relevant to many areas of everyday life (Boyle, Matthews, & Saklofske, 2008). Although traits are expressed in multiple situations and contexts, showing cross-situational consistency, the role of person-situation interaction (Mischel, 1973) is also well established. Situational factors may "switch traits on or off" (Boyle et al., 2008); some traits might only be expressed in certain types of situations. This principle of "situational moderation" can explain why research results concerning an association between a trait and an outcome might be mixed.

Personality traits have been shown to link to health behaviour and health outcomes. Several personality traits have been consistently found to prospectively associate with health outcomes (Williams et al., 2008); such traits include hostility, anger and social dominance, conscientiousness as well as negative affectivity and neuroticism. Many mechanisms to explain the personality-health link have been suggested: health behaviour (e.g. smoking), illness behaviour (e.g. adopting the sick role) and physiological mechanisms, especially in response to life stress (Williams et al., 2008). Importantly, prospective associations between personality traits and subsequent disease might possibly not reflect a causal effect, but instead co-effects of an underlying third variable (e.g. genetic or constitutional individual difference), which in turn may produce a certain personality trait and "also confer risk or resilience for a specific disease or for general health" (Williams et al., 2008). One

specific pathway for how personality may affect health behaviour change could be propensity for intervention effects.

Associations between personality and physical activity or exercise and diet behaviours have also been studied (Booth-Kewley & Vickers Jr, 1994). The trait most consistently linked to both behaviours is conscientiousness (Bogg & Roberts, 2004). For personality correlates of physical activity, a meta-analysis (Rhodes & Smith, 2006) concluded that higher extraversion, lower neuroticism and higher conscientiousness were related to higher levels of activity. What are the personality correlates of obesity and weight control behaviours? For example, a meta-analysis shows that hostility related to obesity (Bunde & Suls, 2006) and BMI increase among men over two decades (Nabi et al., 2009). Among other traits, sociability and low impulsivity were associated with greater monitoring and control of eating and body weight (van den Bree, Przybeck, & Robert Cloninger, 2006).

The direct link between personality and *changes* in PA/diet behaviours, especially in intervention settings, has been studied less. Teixeira and colleagues (2005) reviewed pre-treatment predictors of weight control and concluded that more studies on the effects of stable traits should be encouraged. There is a need for more research into how personality affects *health behaviour intervention* outcomes. Personality might moderate effects of interventions on psychological mediating factors but also on end outcomes. In one self-management intervention (Franks, Chapman, Duberstein, & Jerant, 2009), Big Five traits were found to moderate the psychological effects of the intervention, but at present, there seems to be very little research on the effects of personality in interventions.

1.3.2 Dispositional optimism and pessimism

Dispositional optimism and pessimism (Carver, 2007; Scheier & Carver, 1985) can be defined as generalised expectancies that good and bad outcomes will occur across important life domains (Scheier & Carver, 1985). Both optimism and pessimism are associated with a wide range of health-related outcomes (e.g. Rasmussen, Wrosch, Scheier, & Carver, 2006); for example, optimism predicts slower disease progression after HIV diagnosis (Ironson et al., 2005). On the other hand, pessimism is a risk factor for health complaints and mortality (Scheier, Carver, & Bridges, 1994), even at moderate levels (Räikkönen & Matthews, 2008).

Optimism is related to a number of health behaviours and related outcomes, such as therapy adherence and completion of interventions (Milam, Richardson, Marks, Kemper, & McCutchan, 2004; Strack, Carver, & Blaney, 1987), less often currently smoking (Giltay, Geleijnse, Zitman, Hoekstra, & Schouten, 2004), faster recovery and less health problems after a major life event (Kivimäki et al., 2005), whereas pessimism has been linked with higher alcohol consumption (Kelloniemi, Ek, & Laitinen, 2005) and more frequent cigarette smoking and drug use (Milam et al., 2004).

Dispositionally optimistic individuals are more likely to endorse healthy dietary habits and be physically active (Giltay, Geleijnse, Zitman, Buijsse, & Kromhout, 2007; Kelloniemi et al., 2005; Schroder & Schwarzer, 2005; Shepperd, Maroto, & Pbert, 1996; Steptoe, Wright, Kunz-Ebrecht, & Iliffe, 2006). The evidence regarding the impact on weight loss has been mixed (Benyamini & Raz, 2007; Fontaine & Cheskin, 1999; Shepperd et al., 1996).

There are several possible mechanisms for how dispositional optimism might facilitate health behaviour change attempts. When people confront adversity, they respond with feelings that may reflect either challenge or distress. Optimists are likely to experience a more positive mix of feelings because they expect good outcomes. In contrast, pessimists expect bad outcomes and thus experience more negative feelings such as anxiety, sadness and despair (Carver, 2007), which are dysfunctional in goal striving. When confronting challenges and slow progress, optimists are expected to be confident and persistent, pessimists doubtful and hesitant (Carver, 2007); in this way, effort is a crucial self-regulatory component producing the beneficial outcomes (Carver & Scheier, 1998). Empirical evidence supports the theory-driven predictions: higher optimism leads to more adaptive coping, more effort in the goal-striving process and higher engagement in important goals (Geers, Wellman, & Lassiter, 2009; Segerstrom & Solberg Nes, 2006; Solberg Nes & Segerstrom, 2006), while pessimism is likely to have inverse effects.

Although similar in their function and content, dispositional optimism and self-efficacy differ in central aspects. Firstly, optimism is a generalised expectation, whereas self-efficacy beliefs may be domain-specific. Secondly, the concepts differ in terms of the locus of expected positive happenings. The person's sense of their own agency (Bandura, 1997) is pivotal in self-efficacy. Perceived self-efficacy is characterised by an explicit attribution of expected goal mastery to one's competence (Schwarzer & Luszczynska, 2007). Dispositional optimism includes ability attribution as only one possibility among many others, such as good luck or divine powers, and hence is the broader construct (Schwarzer & Luszsynska, 2007; Bandura, 1997).

1.3.3 Gender-role orientation: agency and communion

"Men are active and independent, women are nurturing and kind." Such stereotypical personality characteristics traditionally associated with men and women are referred to as "gender-role orientation" (Bem, 1974; Helgeson, 1994; Spence & Helmreich, 1978). Women and men are socialised to adopt different behaviour patterns and social roles and as a result are likely to develop distinct personality traits (Helgeson, 1994). Bakan (Bakan, 1966) first coined the constructs agency and communion. *Agency* is characterised by a focus on the self and autonomy, and demonstrated in instrumental traits such as decisiveness, ambition and assertiveness. *Communion* is characterised by a focus on other people and

relationships, and is demonstrated in expressive traits such as gentleness, compassion and helpfulness (Helgeson, 1994; Spence & Helmreich, 1978). Stereotypically men are seen to possess agentic, self-assertive qualities and women communal, other-oriented qualities. In fact, men on average score higher on agency and women on communion (Helgeson & Fritz, 1999; Spence & Helmreich, 1978), but due to changes in gender roles, it has been found that these differences have recently decreased (Spence & Buckner, 2000).

In addition to occupying a prominent position in gender role research, agency and communion have been characterised as the basic components of personality (Wiggins, 1991). As the two meta-concepts relevant in interpersonal behaviour, they have been found to be associated with the Big Five dimensions of personality (Hurley, 1998; Lippa, 1995; Ward, Thorn, Clements, Dixon, & Sanford, 2006).

Agency and communion are not conceptualised as bipolar ends of a continuum, but as two independent dimensions: a person might score high on both or none. For both women and men, both agency and communion are required for optimal well-being (Bakan, 1966), and empirically high levels of both have been linked with adaptive functioning in many areas and emotional well-being in both genders (Helgeson, 1994). These findings apply in normal populations (Annandale & Hunt, 1990; Lefkowitz & Zeldow, 2006), as well as in various medical populations (Helgeson, 1993; Helgeson & Lepore, 1997; Piro, Zeldow, Knight, Mytko, & Gradishar, 2001; Trudeau, Danoff-Burg, Revenson, & Paget, 2003).

Agentic individuals are reported to be psychologically better adjusted than individuals with low agency. For example, agentic individuals have higher self-esteem (Whitley, 1983). Among adolescent boys and girls, high agency is associated with less internalised distress, whereas high communion is associated with less externally directed deviant behaviour problems (Huselid & Cooper, 1994). Agentic individuals report less depression and anxiety (Bromberger & Matthews, 1996; Cheng, 1999; Nezu & Nezu, 1987), fewer stress reactions and more optimism (Robbins, Spence, & Clark, 1991). Men high in communion are more aware of health risks (Kaplan & Marks, 1995) and less likely to die of cardiovascular disease (Hunt, Lewars, Emslie, & Batty, 2007). Compared to communion, agency has more consistently been found to predict better psychological and even physical health (Annandale & Hunt, 1990; Bassoff & Glass, 1982; Sanfilipo, 1994; Taylor & Hall, 1982; Whitley, 1983). Communion on the other hand has been linked with better relationships (Helgeson, 1994). Individuals high in communion have been found to both provide and receive greater amounts of social support (Ghaed & Gallo, 2006; Reevy & Maslach, 2001). Communal orientation might enable requests for social support (e.g. Hirokawa & Dohi, 2007; Reevy & Maslach, 2001).

What is the relevance of agency and communion for health behaviours? Agentic individuals have a greater interest in health, perform more physical activity and eat more healthily as well as are more likely to maintain proper body weight (Danoff-Burg, Mosher, & Grant, 2006; Robbins et al., 1991). Agency is negatively related to

eating disorders (Hepp, Spindler, & Milos, 2005), but findings on communion are rather mixed (Mosher & Danoff-Burg, 2008). Prospectively, among cardiac patients, agency has been reported to longitudinally predict increases in well-being and mental functioning (but not physical functioning) (Fritz, 2000). Communal orientation was reported to predict better outcomes in alcohol treatment which utilized social support (John, Alwyn, Hodgson, & Phillips, 2008). Also, communion predicts a reduction in depression when social support was increased, but an increase when support was decreased (Cheng, 1999).

To date, little is known about how agency and communion might relate to changes in eating and exercise behaviours and their consequences such as weight loss. Nevertheless, they both are potentially important due to connections with potential mediating mechanisms. Agentic people have higher achievement motivation (Spence & Helmreich, 1978), achievement strivings (Robbins et al., 1991) and better problem-solving ability, and they employ problem-focused active coping (Brems & Johnson, 1989; Nezu & Nezu, 1987). They are also more dominant interpersonally and conscientious (Ghaed & Gallo, 2006; Ward et al., 2006). These characteristics may facilitate health goal achievement through the tendency of such people to approach goals assertively, actively and independently. Agency-related trait tenacity has been found to be related to successful goal attainment (Baum & Locke, 2004). Communion, linked with more received and provided social support (Ghaed & Gallo, 2006; Reevy & Maslach, 2001), might predict better mobilisation of one's social resources to facilitate goal achievement.

1.4 Overview of the determinants in the present study

The health behaviour determinants used in the present study are summarised in Table 1. The constructs differ in their modifiability, and whether they appear at the social or individual level. These factors are relevant in health behaviour change and weight loss. As prior literature shows, some of these are extensively studied in the context of health. However, dynamic mechanisms as well as moderating and mediating influences have been studied less.

Table 1: Determinants of health behaviour and its change in the present study.

	Modifiable in interventions	Background factors
Individual	*Social cognitive variables* ADOPTION SELF-EFFICACY* BARRIERS SELF-EFFICACY* HEALTH-RELATED SELF-EFFICACY ACTION PLANNING* COPING PLANNING*	*Personality* DISPOSITIONAL OPTIMISM AND PESSIMISM AGENCY COMMUNION
Social	*Environmental factors* SOCIAL SUPPORT* * Specific to diet and exercise behaviours	*Sociostructural factors* SOCIOECONOMIC STATUS (SES) GENDER

1.5 Theory-based interventions to elicit behaviour change

An individual's behaviour is influenced by multiple sources, ranging from intraindividual, psychological factors to several environmental aspects. For example, lack of physical activity facilities in the living area (community level) or discouragement from family members (interpersonal level) might decrease the probability of engaging in regular physical activity. A social ecological approach in health promotion views health as a function of individuals and environments – including families and social networks, organisations, communities and societies (Bartholomew et al., 2006, p. 10; Kok, Gottlieb, Commers, & Smerecnik, 2008). Intervention programmes can be planned to target any of them, for example, to change a country's legislation on advertisement of health-endangering products (societal level) or to change workplace norms (organisational level). The present study focuses on the individual and interpersonal levels.

There is agreement among behavioural scientists that in order to change health behaviours, it is not enough to provide advice and information. Health Education Model-based interventions focus mainly on providing information only, whereas interventions informed by psychological theories also include other factors necessary for behaviour change (Hardeman, Griffin, Johnston, Kinmonth, & Wareham, 2000). Psychological constructs have been found to predict behaviour better than knowledge (Eccles et al., 2007). Knowledge-targeting interventions are less effective than those based on psychological theories. Because theories provide an explanation for an outcome and hence provide change targets, they are needed for

intervention design (Michie, Rothman, & Sheeran, 2007). Mediating variables inform about the mechanism of treatment action (Davidson et al., 2003). In effect, theory-based interventions have been shown to be more successful in engendering behaviour change than those without theory: a recent review of online health behaviour interventions (Webb, Joseph, Yardley, & Michie, 2010) concluded that the more extensive the use of theory, the larger the effect. A systematic review of reviews on school health promotion interventions also concluded that use of theory differentiated between effective and ineffective interventions (Peters, Kok, Ten Dam, Buijs, & Paulussen, 2009). Moreover, a theoretical understanding of the process also enables replication and adaptation of interventions into other settings. For these reasons, application of theory in health promotion practice and research is strongly advocated (e.g. IOM, 2002; NICE, 2007).

In specifying the mechanism of action of interventions, one useful differentiation is that between "action theory" and "conceptual theory" (see Figure 4) (Chen, 1990). By theoretical mediating constructs, I refer to the determinants of health behaviour change reviewed above. *Conceptual theory* refers to the link between the construct and the behaviour. *Action theory* specifies how a theoretical construct, e.g. self-efficacy, can be changed. Tests of whether theoretical constructs mediated the intervention effect are often conducted by calculating simultaneous action theory and conceptual theory tests (Chen, 1990). Such tests have been recommended for use in randomised controlled trials aiming to change health behaviour in order to find out whether the hypothesised mechanism was responsible for the intervention effect (Baranowski, Anderson, & Carmack, 1998). The present study focuses on "conceptual theory" associations.

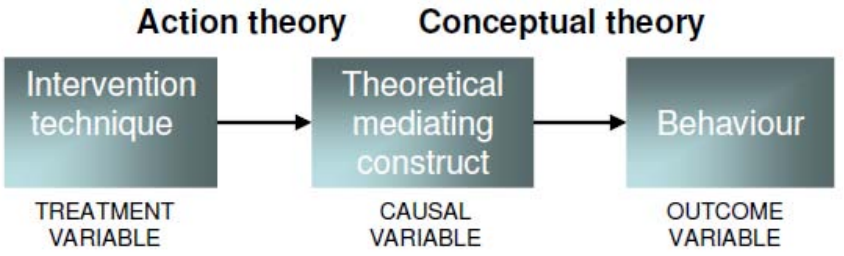

Figure 4. Action theory and conceptual theory
(adapted from Chen, 1991, p. 200).

In developing complex interventions, frameworks such as the PRECEED-PROCEED model (Green & Kreuter, 2005) or UK Medical Research Council guidance (Campbell et al., 2000; Craig et al., 2008) can be used. Intervention Mapping (Bartholomew et al., 2006) is one such framework with an explicit focus on how to select appropriate scientific theories for the specific behaviour and target group at hand and how to translate them into practical programmes. Based on prior

evidence and theory, relevant determinants are selected and associated with appropriate behaviour change techniques (BCT) (Abraham & Michie, 2008).

Recently, a universal taxonomy of behaviour change techniques (BCT) used in behaviour change interventions (Abraham & Michie, 2008) was published, with ongoing updating work (Abraham et al., in press; Michie et al., in press). The taxonomy has linked the BCTs with theoretical accounts of behaviour change: information-motivation-behavioural skills model, theory of reasoned action, theory of planned behaviour, social-cognitive theory, control theory and operant conditioning (Abraham & Michie, 2008). BCTs are not exclusive to one theory, but instead, several theories might specify similar processes of behaviour change (mediating mechanisms) and hence imply the same BCTs. Table 2 provides some examples of BCT definitions.[3]

Table 2. Sample behaviour change techniques defined.

Behaviour change technique	*Definition*
Prompt intention /goal formation	Encouraging the person to set a general goal or make a behavioural resolution, e.g. "I will take more exercise next week".
Prompt specific goal setting	Encouraging detailed planning of what the person will do including, at least, a very specific definition of the behaviour, e.g. frequency (such as how many times a day/week), intensity (e.g. speed) or duration (e.g. for how long). In addition, at least one of the contexts must be specified, i.e. where, when, how or with whom.
Prompt self-monitoring of behaviour	The person is asked to keep a record of specified behaviour/s. This could take the form of a diary or completing a questionnaire about their behaviour, for example.
Prompt barrier identification	Encourage participants to anticipate potential barriers, such as competing goals or lack of resources, and plan ways of overcoming them.

Source: Abraham & Michie (2008), Coding Manual; & Abraham et al., (in press).

[3] For some concepts, the theoretical mediating construct and the relevant behaviour change technique may be overlapping; for example, Gardner et al. (2010) describe action planning as a compatible strategy (Gardner, Whittington, McAteer, Eccles, & Michie, 2010) with the self-regulation theory (control theory) (Carver & Scheier, 1999). In the present study, planning is defined as a psychological (and behavioural) self-regulatory process that mediates the effect of the intervention (which targets this determinant via several BCTs; see Table 3).

This identification of common techniques has enabled researchers to evaluate the effectiveness of techniques across interventions despite differences in their theory base and terminology used. A meta-analysis (Michie, Abraham, Whittington, McAteer, & Gupta, 2009) revealed that in healthy eating and physical activity interventions, a combination of self-monitoring with at least one other self-regulation BCT was more effective. Another systematic review of obesity interventions (Dombrowski et al., in press) came to similar conclusions: self-regulation techniques were effective in changing dietary behaviour. Self-regulation processes/techniques are derived from Control Theory (Carver & Scheier, 1998), and include setting goals, specifying action plans, self-monitoring of behaviour, providing feedback on performance and reviewing goals. A review of health behaviour interventions for low-income groups (Michie, Jochelson, Markham, & Bridle, 2009) suggested that providing information, setting goals and prompting barrier identification are helpful for facilitating behaviour change in this population. Only recently, researchers have undertaken the task of specifying intervention components (theory-associated behaviour change techniques) and their links to behavioural determinants (e.g. Ashford et al., 2010; Michie, Johnston, Francis, Hardeman, & Eccles, 2008), reflecting the "action theory".

Does increasing the number of BCTs in an intervention enhance outcomes? The dose-response relationship of BCTs and intervention effectiveness is so far unclear: a larger number of BCTs increased effectiveness in internet interventions (Webb et al., 2010), for dietary changes in weight loss results but not for PA or other diet outcomes (Dombrowski et al., in press), and in interventions targeted at low-income groups it was associated with decreased effectiveness (Michie, Jochelson et al., 2009).

Other characteristics in intervention design might be important as well. For example, frequent contact and community as a recruitment setting are associated with better weight loss results in obesity interventions (Dombrowski et al., in press). A review that investigated successful components in interventions to promote PA and diet for diabetes prevention (Greaves et al., 2010) concluded that health behaviour interventions are more effective if they target both diet and physical activity, mobilise social support, involve the planned use of established behaviour change techniques and provide frequent contacts.

Theory can be tested in several types of designs, including correlational, predictive, experimental and intervention designs. Scientists have focused on the identification of relevant determinants of behaviour change in experimental research in controlled environments. However, less work has been directed at translating this evidence into real-world environments. Testing findings from controlled experimental settings in primary care contexts provides an excellent opportunity to study the phenomena in realistic settings. Applying the theories in practice settings allows testing the practical value of these theories and allows for theory development (Crosby & Noar, 2010; Rothman, 2004). Rothman (2004) has argued

that interventions provide an ideal setting to test theory (Rothman, 2004). We cannot *assume* that mechanisms demonstrated in laboratories operate elsewhere; hence, theories must be applied to interventions and subjected to tests in these applied settings (Michie & Prestwich, 2010). Crosby and Noar (2010) criticise health promotion research for not conducting tests of theory in practice settings. Clearly, testing theory in real-world interventions is necessary.

Another question is: how can we know whether components of interventions are similarly effective for all groups, such as demographic groups (age, gender, SES, ethnicity)? In fact, a meta-analysis of HIV prevention interventions by Albarracin and colleagues (2005) found that some techniques such as attitudinal arguments and skills training were differently effective for men and women. So far, the effects of health behaviour change interventions on psychosocial targets have rarely been studied for gender and SES, but such potential moderators of the effectiveness of intervention components (action theory) or target determinants (conceptual theory) need investigation. The present study will focus on the latter.

2 Aims

The general aim of this study was to examine the dynamic health behaviour change process and potential inter-individual and intergroup differences therein. The theoretical constructs, hypotheses and models tested in the substudies will be presented, organised within three overarching topics. All substudies involve using ***dynamic changes*** in psychological determinants as predictors of changes in behaviour (topic 1). Studies I, II and IV investigate the possibility of ***moderation*** by gender and SES (topic 2). Studies III and IV examine the interplay between health-specific, modifiable psychosocial factors and more stable ***personality traits*** (topic 3).

2.1 Dynamic changes in psychosocial factors as predictors of short- and long-term behaviour change (Studies I-IV)

Tests of conceptual theory refer to testing the association between a psychological construct and behaviour. Between-individuals cross-sectional studies and prospective non-interventional studies with two waves of measurement with relatively short follow-ups (days, weeks, months) have been the most commonly used designs for studying the cognitive determinants of health behaviours (Rhodes & Plotnikoff, 2005; Sutton, 2004). For example, psychological determinants are measured at baseline, and behaviour at a second measurement period, and then predicted. Although static in their form, the theories imply that changes in determinants would causally lead to changes in the health behaviour outcomes. Still, even empirical *tests* of theories tend to be static (Sutton, 2004). As cross-sectional study designs do not allow drawing conclusions on causal longitudinal relationships, prospective experimental or intervention studies provide an ideal setting to study both these relationships as well as to study change. Theoretically, focusing on *change* is important: interventions aim at changing individuals' cognitions, and it should be tested to what extent the amount of change in psychological predictors is related to change in the outcomes. Also, where no control group is available, intervention studies may analyse changes instead. Recently more and more researchers (e.g. Scholz, Nagy, Göhner, Luszczynska, & Kliegel, 2009; Skår, Sniehotta, Araújo-Soares, & Molloy, 2008) have taken an explicit dynamic approach to testing theories that have previously typically been examined in cross-sectional designs or designs that investigate levels only[4], i.e. where a predictor has been measured only once. Study I aims at estimating how the amount of change in the psychosocial predictors self-efficacy and planning is associated with increases in

[4] With level, I refer to variables measured at one single time point, i.e. static constructs only.

exercise (see Figure 5). Furthermore, Study II uses as exogenous (independent) variables both levels (e.g. post-intervention level) and the magnitude of change in psychological determinants.

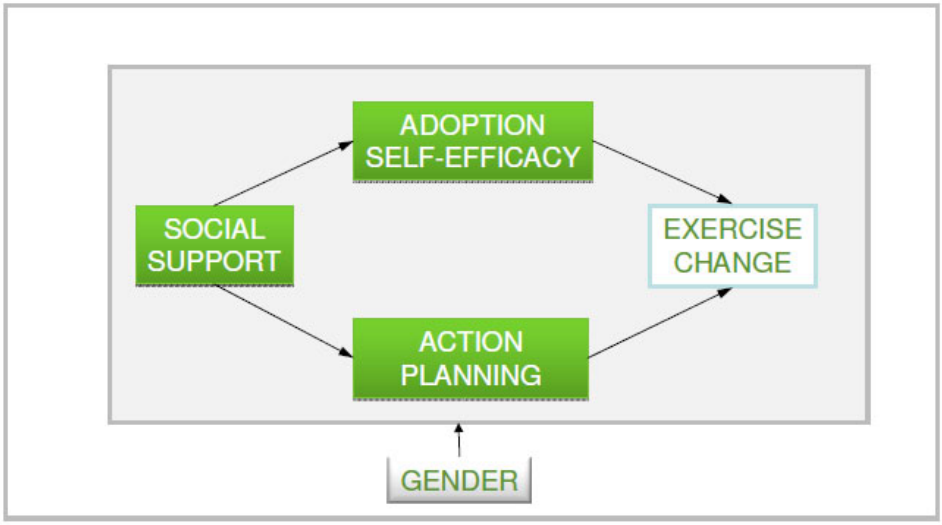

Figure 5. STUDY I: Theoretical model of the relationships between social support, self-efficacy, planning and behaviour.

The square denotes the investigation of potential moderation of regression effects by gender.

As for predicting behaviour, statistically it can be carried out with several strategies. Level of Time 2 (T2) behaviour can be predicted by Time 1 (T1) independent variables in a regression model, and past behaviour can be controlled for in this model. With respect to not controlling for past behaviour, this strategy has the benefit that the estimates for the effects of the psychological determinants are not overestimated, but may even be underestimated (Weinstein, 2007). However, controlling for past behaviour does not equal predicting changes in that behaviour, but in fact implies predicting T2 levels of behaviour *assuming that the baseline levels are the same* for all. Furthermore, including past behaviour as a determinant of later behaviour is problematic, since behaviour cannot cause itself (Sutton, 2004). As a more sophisticated approach, Sutton (2004) recommends using studying changes (T1–T2) in predictors and behaviour. Many prior studies have investigated dynamic change processes, but employed a "static statistical design" in the analyses. It has indeed been pointed out that although most psychological theories are dynamic in nature, the methods in most of the research fall short of evaluating such predictions (Ferrer & McArdle, 2010). In the present study, the outcome of interest is the *change* in behaviour or obesity.

In the existing literature, the follow-up measurements have been generally conducted shortly afterwards, and changes in cognitions have most often been linked with *simultaneous* changes in behaviours (e.g. Annesi, 2007; Sallis et al., 1999). Due to short follow-ups, the potential for dynamic initial changes in predicting long-term intervention outcomes has been rarely examined. Recent reviews of such mediating mechanisms in interventions conclude that most studies have not analysed temporally distant changes (Cerin, Barnett, & Baranowski, 2009; Rhodes & Pfaeffli, 2010). Study II compares the predictive value of both post-intervention levels and changes in psychosocial factors in predicting changes extending over 12 months (nine months after the last measurements of psychosocial factors). Study III tests whether the change in health-related self-efficacy during the three-month intervention predicts change in abdominal obesity over one year, and Study IV over three years.

The effects of stable personality traits might exert their influence on behaviour through their impact on the *changeability* of more proximal psychosocial factors. For example, the effects of dispositional optimism and pessimism have been studied in statistical mediation models that do not account for the dynamic nature of the cognitions. In Study III, three alternative models, variations of Figure 4, are examined. The models, differing in their dynamic focus, are presented below in more detail (see 2.3). For the reasons presented above, this dissertation thesis aims at examining dynamic changes as predictors of changes in behaviour.

2.2 Testing the universality assumption in an intervention setting

Many psychosocial theories of health behaviour assume, either implicitly or explicitly, that demographic variables exert their effects through more proximal psychological variables, i.e. are mediated by them (Sutton, 2001). They also assume psychological determinants to be associated with each other and with outcome behaviours similarly across different groups. Still, differential mechanisms of change might exist, with different determinants being more important for one group than the other. Nevertheless, empirical investigations of differences between men and women or socioeconomic groups with regard to the structural relationships ("conceptual theory") are rare.

2.2.1 Gender (Study I)

Only few studies have examined the structures of influence in psychosocial determinants of health behaviour change stratified by gender. Many determinants seem to predict changes in physical activity for both men and women; for example, change in self-efficacy to resist relapse (Sallis et al., 1999). Some gender differences have been reported: in one study, coping planning predicted dietary behaviour in women but not in men (Renner et al., 2008), and in another, coping planning

predicted physical activity in women but not in men (Molloy et al., in press). Yet, the processes of dynamic change in adoption self-efficacy and action planning and their relationships with social support on one hand and exercise change on the other have not been investigated by gender.

Figure 1 presents the theoretical model for the relationships between Study I variables. Social support is assumed to be positively associated with baseline levels of self-efficacy and action planning, and the three-month changes in the latter two are assumed to be positively related to three-month changes in exercise. Based on earlier research, planning can be expected to play a more salient role for women, but no differences for the role of self-efficacy are hypothesised.

The moderating role of gender will be also investigated in Study IV (elaborated more below in 2.3).

2.2.2 Socioeconomic status (Study II)

The relationships between SES, health behaviour and health are partly mediated by psychosocial resources, such as self-efficacy, self-regulation and social support (Taylor & Seeman, 1999). Higher sense of control, or self-efficacy, has often been found to be associated with high SES (Gurin, Gurin, & Morrison, 1978; Taylor & Seeman, 1999). The better educated experience greater sense of control over their lives and their health (Ross & Wu, 1995). Not only do the generalised control and self-efficacy measures reveal social class differences, but so do the domain-specific ones, such as self-efficacy to exercise (Clark, Patrick, Grembowski, & Durham, 1995), attributed to real or perceived obstacles, different values and beliefs regarding health behaviour, limited financial resources, physical environments and less support in general (Clark et al., 1995). In addition to self-efficacy, longer education might enhance people's ability to regulate their behaviour with rational planning and self-monitoring. Some have suggested that the SES-health relationship is explained by differences in self-management ability (Goldman & Smith, 2002).

Given the associations of self-efficacy and self-regulation with SES, attempts to promote health behaviour-related social cognitions might also be more successful among those with higher SES. Moreover, SES may moderate the effects of social cognitions on behaviour. A recent study found that the effects of cognitive dissonance vary according to SES, such that those with lower education do not fit the theoretical predictions (Snibbe & Markus, 2005). There is a lack of research evidence on behaviour change interventions for low-SES groups (Michie, Jochelson et al., 2009). Even in interventions aiming to reduce health inequalities, the psychosocial mediators have been rarely evaluated: the psychological models have been assumed to be universally applicable across SES groups.

Are the mediating mechanisms in fact similar in different socioeconomic groups and do changes in the assumed factors contribute to behaviour change universally? Whether the conceptual theory holds for all SES groups needs to be empirically

verified. In addition to health research, psychology in general has inadequately addressed social class in its theories and research (American Psychological Association: Task Force on Socioeconomic Status, 2007; Lott, 2002; Smith, 2005). For these reasons, the moderating influences of SES on psychosocial mechanisms of change will be investigated in Study II (Figure 6).

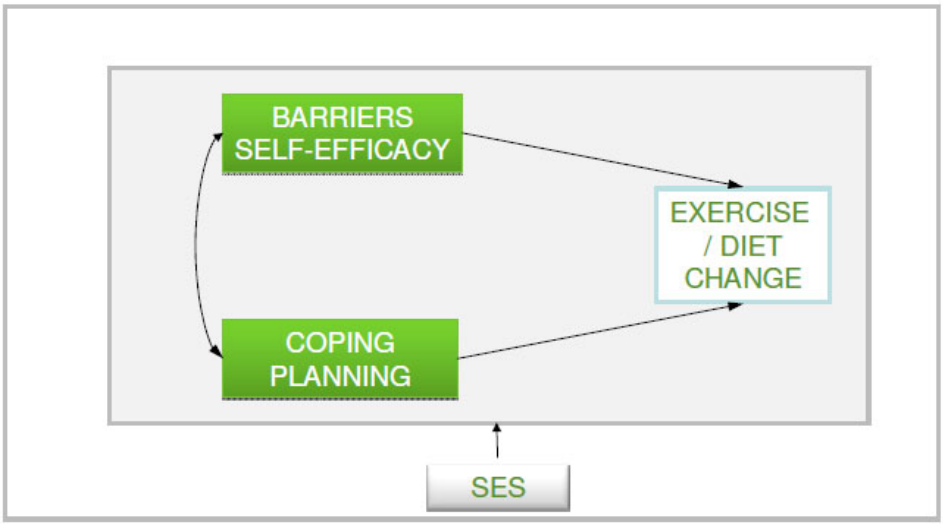

Figure 6. STUDY II: Socioeconomic status and health behaviour.

The square denotes the investigation of potential moderation effects by SES. Both post-intervention levels as well as changes in the predictors will be examined in this substudy.

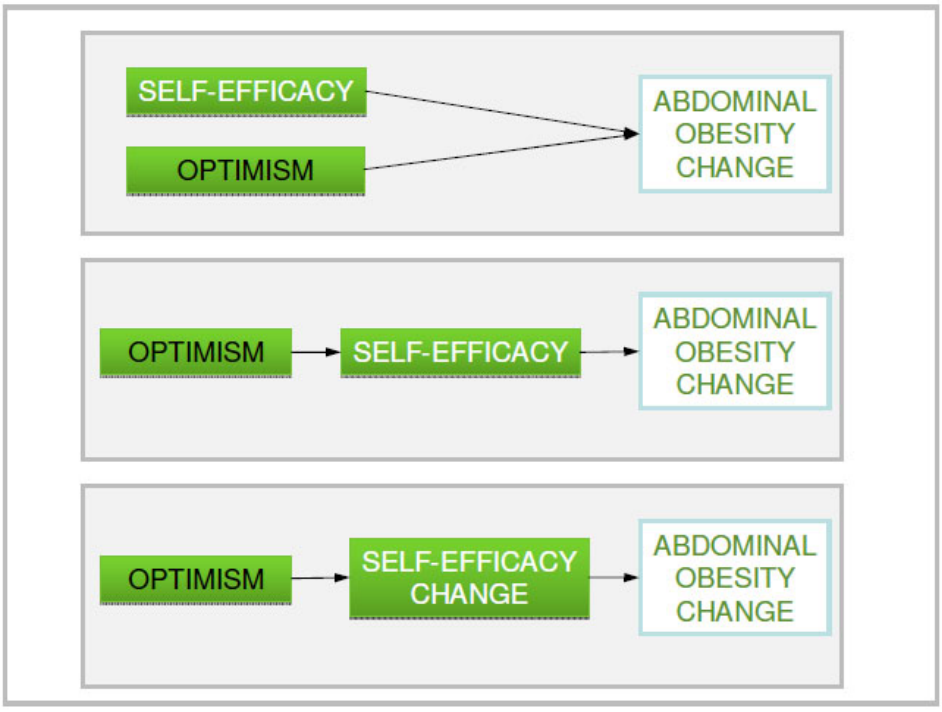

Figure 7. STUDY III: Alternative models of the interplay between personality and social cognitive variables.

2.3 The relevance of personality in health behaviour change (Studies III-IV)

Despite substantial interrelations between personality traits (e.g. dispositional optimism, agency) and domain-specific social cognitions (e.g. self-efficacy) (e.g. Adams & Sherer, 1985; Benyamini & Raz, 2007; Choi, 2004; Cozzarelli, 1993; Majer, Jason, & Olson, 2004; Waldrop, Lightsey, Ethington, Woemmel, & Coke, 2001), only few studies tackle the potential interplay of personality and social cognitive factors in facilitating favourable health outcomes. More proximal, domain- and behaviour-specific psychosocial factors (health-related self-efficacy and social support) might mediate or interact with more general personality traits in producing behaviour change outcomes.

Although earlier seen as antithetical, social cognitive and personality trait models have recently been integrated into unified frameworks for personality (McAdams & Pals, 2006). These suggest that personality traits underlie "characteristic adaptations", including motives, goals, plans, strivings, strategies, values, virtues and other aspects of human individuality. Social cognitive functions such as self-efficacy are examples of these adaptations (McAdams & Pals, 2006).

Theoretically, dispositional traits and domain-specific cognitions can be hypothesised to cooperate in various ways when influencing health behaviour outcomes (see Figure 7):

- *Additive model:* Both have a direct and unique effect on outcomes. Each of the determinants explains variance in the outcomes.
- *Static mediation model:* Personality traits are not directly related to health behaviour outcomes, but rather mediated by domain-specific social cognitions.
- *Dynamic mediation model:* Personality is related to the magnitude of the change in domain-specific social cognitions. Thus, personality facilitates *changes* in cognitions.

Within both mediation models, personality is conceptualised as a distal variable that *sets the stage* for positive behaviour outcomes through more proximal, domain-specific social cognitions. The "additive" and "static mediation model" are usual models of health behaviour theories (Sutton, 2004). For example, the additive model was supported in a study by Shnek et al., where self-efficacy and optimism had independent, additive effects on depression (Shnek, Irvine, Stewart, & Abbey, 2001). Cozzarelli (1993) applied the static mediation model in a study where self-efficacy mediated optimism's effect on coping with abortion (Cozzarelli, 1993). However, relationships as specified by the "dynamic mediation model" have been rarely tested. Study III aims to examine each of these models with respect to dispositional optimism/pessimism and health-related self-efficacy.

As stated above, agency and communion have to date not been studied in health behaviour interventions as predictors of weight loss. In addition to direct effects, the interplay of agency and communion with the behaviour-specific psychosocial factors will also be investigated. Firstly, high agency might be associated with reductions in waist circumference mediated through self-efficacy: prior studies demonstrated that they covary (Adams & Sherer, 1985; Choi, 2004; Matsui & Onglatco, 1991). Agentic traits might augment intervention effects by facilitating larger increases in health-related self-efficacy during the intervention, and hence, self-efficacy changes could dynamically mediate the beneficial effects of agency.

The interactionist approach to personality (e.g. Mischel, 1973) asserts that environmental factors influence the personality-behaviour relationship. Social support is a potential mediator of personality effects. The trait communion entails, by definition, high concern for the social environment, and communal individuals are better able to ask for (e.g. Hirokawa & Dohi, 2007; Reevy & Maslach, 2001) social support when pursuing important goals, but might also be more dependent on it. Communion has been reported to relate to depression, when social support is decreased (Cheng, 1999). Individuals high in communion, i.e. those who are concerned about social relationships in general, might especially suffer from low social support and benefit from high social support, compared to individuals low in communion. If communal traits facilitate receiving social resources that are helpful

in a health behaviour change process, the reciprocity of support will be of relevance. It is therefore hypothesised that communion is associated with better weight loss, but only among those with high social support.

As a final point: the effects of personality traits on behaviour are partly dependent on social factors and situations (Boyle et al., 2008), and the meaning of various behaviours is not uniform but varies according to a person's gender. For example, for men, agentic traits are strongly associated with the masculine social role, and the social norms related to traditional masculinity are in fact in favour of *not* adopting a healthy lifestyle (Courtenay, 2000; Van Gundy, Schieman, Kelley, & Rebellon, 2005), whereas for women, agency might not be tied to such associations. Also, communion might display similar gender-specific effects (e.g. Hunt et al., 2007). In other words, as gender is a potential moderator, the impact of gender-related traits on the behaviour change process needs to be investigated by gender.

In summary, Study IV aims to study the effects of agency and communion on behaviour change and how they interact with self-efficacy and social support. In line with the theory and evidence presented above, the theoretical model to be tested is outlined in Figure 8.

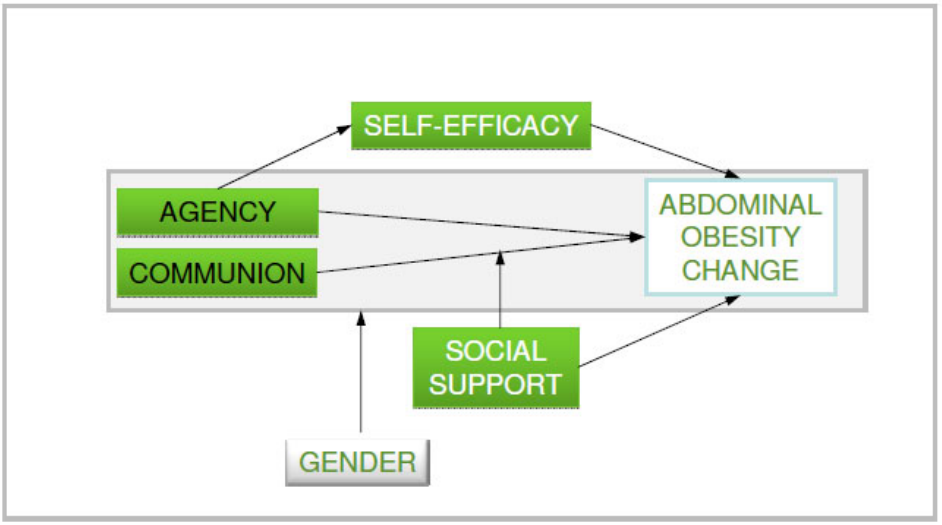

Figure 8: STUDY IV: Expected relationships between agency, communion, self-efficacy and social support predicting waist circumference change.

2.4 Aims summarised by substudy

I) (1) Do levels of self-efficacy, action planning and social support at pre-intervention baseline differ by gender, and do both men and women experience similar changes in self-efficacy and planning during a three-month health behaviour change intervention?
(2) Does gender moderate the associations of changes (T1–T2*) in self-efficacy and action planning with a three-month exercise change (T1–T2)? (Study I)

II) (1) Do levels of self-efficacy and coping planning at pre-intervention baseline differ by SES?
(2) Do both SES groups benefit from the intervention equally much in terms of changes in self-efficacy and coping planning?
(3) Does SES moderate the associations of: (a) Post-intervention levels of self-efficacy and coping planning with 12-month changes (T1–T3) in diet and exercise? (b) Pre–post-intervention changes (three months, T1–T2) in self-efficacy and coping planning with 12-month changes (T1–T3) in diet and exercise? (Study II)

III) Do dispositional optimism and pessimism influence abdominal obesity reduction (T1–T3) independently, through health-related self-efficacy or through health-related self-efficacy change? (Study III)

IV) (1) Are there differences in the associations of gender-related traits, i.e. agency and communion, on abdominal obesity reduction between women and men? (Study IV)
(2) Among women, how are agency, communion and more proximal psychosocial factors (health-related self-efficacy and social support) related to one-year (T1–T3) changes (T1–T3) in abdominal obesity and three-year changes (T1–T4) in abdominal obesity? (Study IV)
Hypotheses:
1. High agency is associated with abdominal obesity reduction
2. The effects of agency are mediated by (a) post-intervention self-efficacy level or (b) T1–T2 increase in self-efficacy
3. High communion is associated with abdominal obesity reduction only under the environmental condition of high social support (moderation).

* T1 = Pre-intervention baseline, T2 = immediate post-intervention, three months, T3 = Follow-up at one year, T4 = Follow-up at three years from baseline

The conceptual model of the study variables is summarised in the simplified graph below.

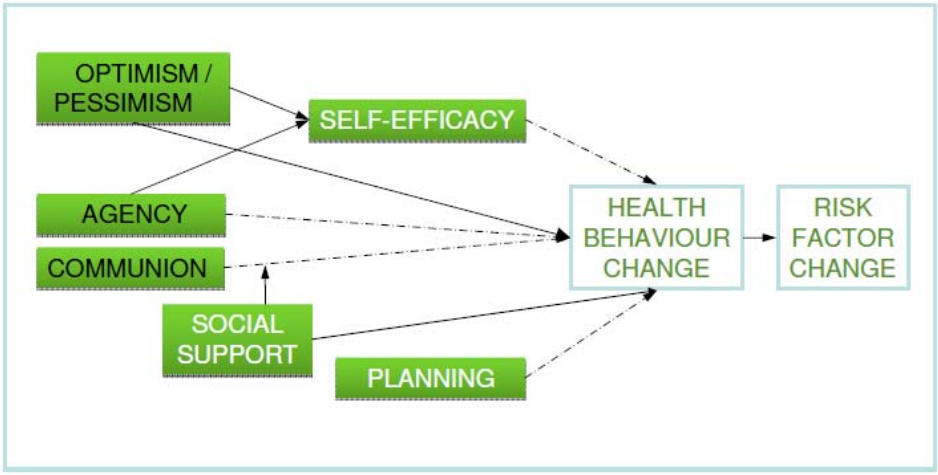

Figure 9: The conceptual model: the substudies combined.

Dashed lines indicate tests of moderation for gender and SES.

3 Method

3.1 Study setting and sample

The GOAL (GOod Ageing in Lahti Region) Lifestyle Implementation Trial, a group intervention to prevent type 2 diabetes, targeted middle-aged (50–65 years) men (*N* = 103, 26.8%) and women (*N* = 282, 73.2%) and was carried out in primary health care centres in Päijät-Häme province, Finland. Participants who were at elevated risk for type 2 diabetes indicated by the FINDRISC score (The Finnish Diabetes Risk Score) (Lindstrom & Tuomilehto, 2003) were recruited at nurses' appointments in the primary health care centres in Päijät-Häme province, Finland. Exclusion criteria were mental health problems or substance abuse likely to interfere with participation, acute cancer and myocardial infarction during the past six months. At the baseline, 95.5% of the participants were overweight or obese.

The objective of the group counselling was to facilitate the adoption of physical activity, healthy nutrition and weight loss objectives previously shown to delay and prevent the onset of type 2 diabetes and reduce the risk for diabetes in the Finnish DPS (Tuomilehto et al., 2001). The intervention programme consisted of six structured group sessions, with five sessions during the three-month intervention period and one booster session at eight months. The programme was planned based on social cognitive and self-regulation theories (see Uutela et al., 2004), especially the HAPA (Schwarzer & Fuchs, 1996), and translated into the practical programme with Intervention Mapping (Bartholomew et al., 2006). Accordingly, social cognitive theory determinants such as self-efficacy and self-regulation theory determinants such as planning were important target variables in the intervention with respect to both diet and physical activity behaviours. The intervention protocol on the whole was influenced by the Broaden-And-Build-Theory, which underscores the beneficial effects of positive emotions (Fredrickson, 2001), and Self-Determination Theory (Ryan & Deci, 2000), which posits that supporting the participant's autonomy is more beneficial for behaviour change than a directive counselling style.

The programme targeted central determinants of health behaviour change through theory-suggested strategies. Table 2 outlines which behaviour change techniques were designed to target self-efficacy, action planning and coping planning and through which intervention procedures ("action theory"). Other determinants targeted in the GOAL LIT programme are not presented here because they are not covered in these substudies. The presentation format follows that of another intervention study (Araujo-Soares, McIntyre, MacLennan, & Sniehotta, 2009), which also reported techniques and procedures according to Abraham and

Michie's (2008) taxonomy. Note that some of the techniques may indirectly target multiple variables, e.g. forming useful action plans might also lead to enhanced self-efficacy. Recent research has shown feedback provision and modelling to be effective techniques to change self-efficacy (Ashford et al., 2010).

The study sample was mostly representative of the general population but included comparably more retired and unemployed people. (For a more detailed description of the trial content, sample and design, see Absetz et al., 2007; Uutela et al., 2004. Note that the sample in the effectiveness trial only includes the participants without type 2 diabetes at the beginning of the program, $N = 352$, but the secondary analyses such as this one includes also those 33 participants). The reporting of the study here follows the TREND Statement guidelines for the reporting of nonrandomised interventions, where possible (Des Jarlais, Lyles, Crepaz, & the, 2004).

The Ethical Commission of the Päijät-Häme Central Hospital and the Ethical Committee of the National Public Health Institute gave their approval for the project. Participants provided a written informed consent, and were treated according to the APA ethical standards.

Altogether 389 participants were enrolled in the intervention, 385 of whom provided the necessary data at baseline. T2D was diagnosed in 32 participants at the baseline, and the effectiveness analyses (Absetz et al., 2009; Absetz et al., 2007) excluded these patients. In the substudies exploring the psychosocial processes of behaviour change, these participants are included in the analyses since there is little basis to expect different processes for these individuals and since more data add power to statistical analyses. See Figure 10 for the flow of the participants through the stages of the study and the original manuscripts for specific dropout analyses.

The design was a pretest-posttest design without a control group. The effectiveness analyses (Absetz et al., 2009; Absetz et al., 2007) were based on benchmark comparisons to the DPS findings, and the intervention was evaluated according to the RE-AIM framework (Glasgow, Vogt, & Boles, 1999). Compared to the DPS, the GOAL LIT resulted in equal or even better improvements in diet behaviour, whereas physical activity and weight loss goals were achieved less frequently (Absetz et al., 2007; Absetz, Valve et al., 2008). On average, men experienced more improvements in risk factor changes than women did, but socioeconomic groups performed equally well (Absetz et al., 2007).

Table 3. Target determinants, behaviour change techniques and intervention procedures targeting determinants in this study (self-efficacy, action planning and coping planning).

Target determinants	*Behaviour change technique (#)*	*Procedures, materials*	*Session no.*
Self-efficacy	Provide instruction (T8)	Instruction on eating/cooking healthily and on performing physical activity (PA). Visit to a neighbourhood gym.	3 & 4
	Provide feedback on performance (T13)	Based on the returned food diaries, a dietician gave individualised feedback. In group sessions, PA diaries were discussed and feedback given.	4
	Provide general encouragement (T6)	General encouragement was provided. Other group members were prompted to encourage each other. Rules of the group sheet.	1-6
	Provide contingent rewards (T14)	Facilitators gave praise and encouragement, linked to the achievement of specified behaviours (performance in PA or diet recorded in diaries or achieved weight loss).	3-6
	Relapse prevention (T23)	After some initial change, the facilitators helped participants identify situations likely to result in failure to maintain newly adopted behaviours (eat healthily or exercise), and helped them plan to avoid or manage these situations. Group discussion.	5 & 6
	Re-attribution of previous failures (*)	Analysis of previous experiences (successful experiences and failures), group discussion.	2, 6
	Model the behaviour (T9), Modelling (*)	Written stories of the successful lifestyle change experiences of similar peers were provided.	2
Action planning	Prompt specific goal setting (T10)	Formulating specific action plans for when, where and how to exercise and eat healthily. Participants are prompted to formulate positive, realistic, concrete and gradually developing goals. GOAL planning sheets.	3-6
	Teach to use prompts/cues (T15)	Teaching the participants to identify environmental cues (e.g. planning "where") that can be used to remind them to perform a behaviour. GOAL planning sheets.	3-5

Coping planning	Prompt barrier identification (T5)	Formulating specific coping plans for what to do if something interferes with one's plans to exercise and eat healthily. Participants are prompted to think about potential obstacles & barriers and ways of overcoming them. GOAL planning sheets.	3-6
	Relapse prevention (T23)	After some initial change, the facilitators helped participants identify situations likely to result in failure to maintain newly adopted behaviours (eat healthily or exercise), and helped them plan to avoid or manage these situations. Group discussion.	5 & 6
Action planning & self-efficacy	Prompt self-monitoring of behaviour (T12)	Seven-day physical activity diaries. Three-day food diaries. Self-assessment tests: Quality of fat sheet, fibre sheet The action plans were based on the self-monitored behaviour.	Baseline, Post 1, Post 2, Post 3 (PA only), Post 4 (diet only), 5, 6 (diet only)
	Set graded tasks (T7)	Participants were prompted to set easy tasks for dietary and PA behaviours, and increase difficulty progressively; GOAL planning sheets, "goal stairs" with differing level of difficulty at different time points.	3 & 4
	Provide opportunities for social comparison (observation of non-expert others' performance) (T19)	The intervention was conducted in a group setting involving group discussions. Written stories of the successful lifestyle change experiences of peers were provided.	1-6; 2

Notes. # The number of the corresponding Behaviour Change Technique (T1-T23) from the taxonomy by Abraham & Michie (2008), Coding Manual at: http://interventiondesign.co.uk/.

* Additional techniques that are not included in the taxonomy by Abraham & Michie (2008).

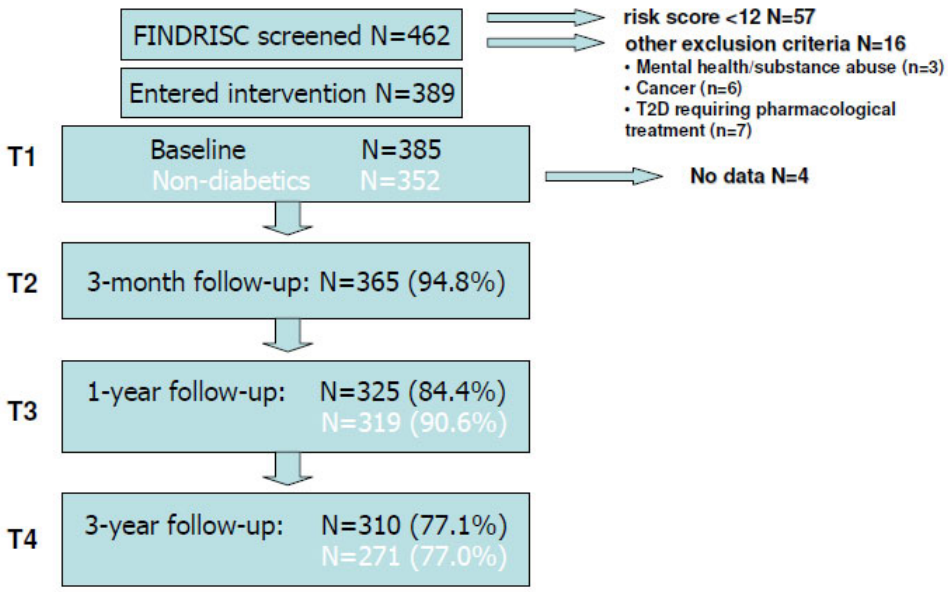

Figure 10: Participant flow diagram

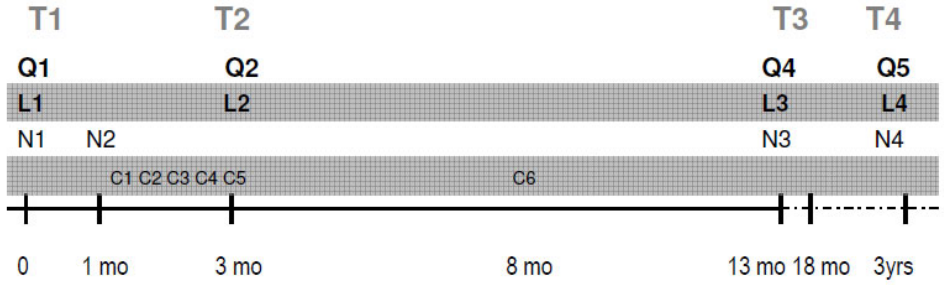

Figure 11: Study timeline.

T1 = Pre-intervention baseline, T2 = immediate post-intervention, three months, T3 = Follow-up at one year, T4 = Follow-up at three years from baseline
Q1-Q5 = Questionnaires
L1-L4 = Laboratory tests and anthropometric measurements
N1-N4 = Nurse's appointment
C1-C6 = GOAL Lifestyle counselling sessions

3.2 Measurements

Measurements were conducted at baseline (T1), after the intensive phase of the intervention at three months (T2), one-year follow-up (T3) and three-year follow-up (T4). See Figure 8 for study timeline.

Psychosocial factors were measured by mailed questionnaires, behaviours with self-report diaries and anthropometric measurements of height, weight and waist were performed by trained study nurses.

3.3 Measures

3.3.1 Psychosocial determinants

All self-reported questionnaire items are listed in the Appendix.

Adoption self-efficacy concerning physical activity (Study I) was measured with five items (Schwarzer & Renner, 2000) (e.g. “I can manage to maintain my exercise regimen, even if I need a long time to develop the necessary routines”) (T1 Cronbach’s $\alpha = .92$). Possible responses ranged from 1 (very certain I cannot) to 4 (very certain I can).

Barriers self-efficacy (Study II) was measured with five items for diet ($\alpha = .95$) and five items for PA ($\alpha = .94$) (e.g. “I can manage to maintain my exercise regimen, even when I have worries and problems”) (Schwarzer & Luszczynska, 2007; Schwarzer & Renner, 2000). Possible responses ranged from 1 (very certain I cannot) to 4 (very certain I can).

Health-related self-efficacy (Studies III and IV) was measured at T1 and T2 with six items referring to one’s confidence in dealing with difficulties, temptations and barriers to a health-related lifestyle (T1/T2 $\alpha = .78$). Thus, the health-related self-efficacy items were designed to assess self-belief in coping with a variety of difficult demands in the context of lifestyle change and were created on the basis of similar, but behaviour-specific self-efficacy measures that have been used in previous studies (Gutiérrez-Doña, Lippke, Renner, Kwon, & Schwarzer, 2009; Renner et al., 2008; Renner et al., 2007; Schwarzer & Renner, 2000). The items retained the common semantic structure: "I am certain that I can do X, even if Y (barrier)" (cf., Schwarzer & Luszczynska, 2007). Examples of these items include “I can resist temptations when I know they are bad for my health” and “I can take health considerations into account, even when it causes discomfort or a need to give up other important things”). Answers were given on a 4-point rating scale ranging from 1 (completely disagree) to 4 (completely agree).

Action planning for exercise (Study I) was measured with four items (Sniehotta, Schwarzer et al., 2005) (e.g. “I have made a detailed plan regarding when to exercise”) (T1 $\alpha = .94$). Possible responses ranged from 1 (definitely false) to 4 (definitely true).

Coping planning (Study II) was measured with four items for diet (α = .91) and four items for PA (α = .92) (e.g. "I have made a detailed plan regarding what to do if something interferes with my plans") (Sniehotta, Schwarzer et al., 2005). Possible responses ranged from 1 (definitely false) to 4 (definitely true).

Frequency of received *social support* provided by family, friends and relatives during the last three months was measured with an adapted and shortened version of a scale for participation in physical activity (Sallis, Grossman, Pinski, Patterson, & Nader, 1987) in Study I (T1 α = .85, T2 α = .86). The item stem was "How often have those close to you (friends, family or relatives)", followed by items such as "exercised with you", "discussed exercise with you" and "changed their schedule so that you could exercise together". Possible responses were "never" (1), "sometimes" (2) and "often" (3). In Study IV, the complete 11-item scale for participation in physical activity during the intervention at T2 (α = .92) (Sallis et al., 1987) was also used.

The distributions of psychosocial variables both at T1 and T2 were normal. The changes in self-efficacy and planning variables were also distributed normally among both men and women as well as both educational categories, and the values of the changes ranged from -2.25 to +3.00.

3.3.2 Socioeconomic status

Socioeconomic status was defined as the highest level of education obtained (primary education vs. secondary education or higher education), reported by the participants, and divided into two categories: primary education (LSES, n = 168) and secondary/higher education (HSES, n = 212).

Education, one of the most widely used indicators of socioeconomic status, has many advantages over SES indicators such as occupation and income: achieved early in life, it is stable across lifespan and it is also applicable among unemployed and retired persons (Krieger, Williams, & Moss, 1997), who are well-represented among the GOAL LIT study participants. Furthermore, while educational level has been criticised because of its differing meanings across age, race and gender groups (Krieger et al., 1997), this limitation is not of relevance in the present sample. Educational attainment level in our context can also be argued to be sensitive to detect potential SES differences: Finland has comparably small income inequalities, and health inequalities between income groups are smaller than health inequalities between educational groups (Cavelaars et al., 1998).

3.3.3 Personality

Dispositional optimism and pessimism (Study III) were measured at T1 with the Life Orientation Test – Revised (LOT-R; Scheier, Carver & Bridges, 1994). Cronbach's α was .67 for the total LOT-R scale (six items), .47 for the optimism subscale (three items) and .71 for the pessimism subscale (three items). Confirmatory factor analyses indicated a two-factor structure for the LOT-R, in line with many other previous studies (e.g. Robinson-Whelen, Kim, MacCallum, & Kiecolt-Glaser, 1997). Optimism and pessimism were significantly inversely correlated (r = -.60, p < .001).

Gender-role orientation (Study IV) was measured with the Personal Attributes Questionnaire PAQ (Spence, Helmreich, & Stapp, 1973) at T4, a semantic differential of attributes that are stereotypically viewed as being typical of the male role, female role or both. The present study uses two scales, agency and communion. The agency scale taps traits that refer to instrumental or self-assertive attributes (e.g. active, competitive, independent, stands up well under pressure), and the communion scale contains traits referring to expressive or interpersonal-oriented qualities (e.g. warm, friendly, aware of others' feelings, easy to devote self to others). Prior studies have investigated the validity and reliability of these scales (Fritz & Helgeson, 1998; Helgeson, 1994; Helgeson & Fritz, 2000). The 8-item scales yielded adequate internal consistencies (for men/women; agency α = .73/.74; communion α = .83/.80).

The distributions of optimism, pessimism, agency, and communion were normal.

In the SEM analyses, the original scales for agency, communion and social support were shortened: the short versions were more parsimonious while capturing 86%–92% of the variance of the long versions (r = .93–.96).

3.3.4 Health behaviours

Exercise (Studies I and II) was measured as average minutes per day, monitored over a one-week period, with every ten minutes of activity recorded in a diary at T1, T2 and T3. Participants reported their physical activity divided into two types of light-intensity physical activity, i.e. commuting physical activity (e.g. walking) and outdoor chores (e.g. gardening) and three categories of moderate-to-vigorous-intensity physical activity, such as gymnastics, ball games and jogging. In addition, the diary contained the category "other" for other physical activity.

For the analysis, the minutes of moderate-to-vigorous-intensity physical activity were summed from the three relevant categories (i.e. the weekly number of minutes of moderate-to-vigorous-intensity exercise was used). In the current study, exercise refers to intentional, moderate-to-vigorous-intensity activity that is done with the purpose of improving or maintaining one's physical fitness or health. Hence, mild intensity exercise (e.g. yoga) and non-purposive physical activity (e.g. gardening) have been excluded. Moderate-to-vigorous-intensity PA increases the magnitude of

weight loss and results in greater reduction of fasting serum glucose than lower intensity exercise (Shaw, Gennat, O'Rourke, & Del Mar, 2006).

In Study II, *dietary behaviour* was measured with a three-day food record at T1 and T3. A licensed dietician analysed the nutrient intake using Nutrica software. The three lifestyle change objectives concerning diet were: 1) less than 30% of total energy intake from fat, 2) less than 10% of total energy intake from saturated fat, and 3) at least 15 g of fibre/1,000 kcal. The intercorrelations of these variables ranged between .49 and .87. Data was analysed only for the total fat intake objective (Study II).

Measurements of *height*, *weight* and *waist circumference* were conducted at T1 and T3 by trained study nurses. Waist circumference was measured between the highest point of the iliac bone and the lowest rib at the end of expiration, with participants in light clothing and standing still with their legs slightly apart. Measurement was conducted on bare skin, and any tight clothing was removed. The participant was instructed to breathe tranquilly and the measurement was done when the participant was breathing out. Waist circumference is considered to be a proxy measure for health behaviours: as the GOAL intervention targeted diet and PA behaviours (i.e. lifestyle change was the primary goal, not weight loss or waist reduction), the results should be reflected in the waist circumference, because physical activity has been found to reduce central obesity in the absence of weight change (e.g. Lee et al., 2005; Mourier et al., 1997; Ross et al., 2000).

The distributions of BMI, waist circumference and fat intake were normal, but exercise at both T1 and T2 showed some kurtosis. Among men, exercise showed very slight positive skew. The changes were distributed normally except for the change in waist circumference that showed slight kurtosis, as well as exercise change that showed kurtosis among both SES groups.

3.4 Intervention exposure and study dropout

Overall, 58% of men and 57% of women attended all six sessions. Similarly, the attendance in the first five sessions (during the three months) was 75% of men and 74% of women. In other words, the intervention exposure was unrelated to gender. Also, exposure to intervention sessions was not related to SES, agency, communion, dispositional optimism or pessimism ($p > .05$). Baseline (T1) measures of waist circumference, BMI, exercise, diet and the psychological determinants were similar for those who attended all vs. only part of the sessions ($p > .05$).

Study dropout was not related to gender or SES. The response rate to the first questionnaire at T1 was 100% for men and 99.3% for women, and the T2 attendance rate was likewise high for both men (96.1%) and women (94.3%). Physical activity diaries were returned by 83.4% at T1, 82.9% at T2 and 84.4% at T3. At T1, 380 participants with education information responded, 168 with primary and 212 with secondary/higher (college or university degree) education. Dropout at T2 was

similar (5.4%, 4.7%) but at 12 months was SES-dependent (19.6% in low-SES, 11.3% in high-SES, $p = 0.03$). Women with larger T1 waist circumference were less likely ($p < .05$) to participate at T2 and T3.

Adherence to the planning intervention can be estimated from the mean response to the planning scales. The response alternatives were 1 (disagree), 2 (mostly disagree), 3 (mostly agree) and 4 (agree). Total non-adherence can be attributed from a response mean of 1.0. Partial non-adherence ("mostly disagree") would be implied from a mean score ranging between 1.01–1.99. Finally, if the mean of the scale is >2, the person has done at least some action or coping planning (responses below 2 can be regarded as not having a proper plan).

Post-intervention at T2, the total/partial non-adherence rates were as follows: diet action plans 1.7% / 9.9%, diet coping plans 4.7% / 24.6%, exercise action plans 4.7% / 13.9% and exercise coping plans 9.6% / 33.2%. Thus, participants were most likely to have formed action plans, but only two thirds had formed a coping plan for diet and only 57% a coping plan for exercise.

3.5 Statistical analyses

Structural equation modelling (SEM) was used to examine the change processes. In Studies I and II, a series of confirmatory longitudinal factor models were tested for the self-efficacy and planning constructs (McArdle & Nesselroade, 1994), and measurement invariance across time and groups was enforced (Horn & McArdle, 1992). Using SEM provides advantages compared to multiple regression, including more flexible assumptions, the reduction of the measurement error in latent variables, the possibility of testing models against each other, the ability to test coefficients across multiple between-subjects groups and the ability to handle difficult data, e.g. incomplete data.

In Study I, the Latent Difference Score Model (LDSM) (McArdle & Nesselroade, 1994), i.e. the Latent Change Score model (Ferrer & McArdle, 2010; McArdle, 2009), was applied. Measuring changes in the observed variables involves measurement error, which is one reason why recently the application of latent change scores has been recommended (Raykov, 1999). When measurement error is modelled, estimates of the latent factors are less biased since the error does not accumulate in the change score. The T2 variable is regressed with a weight of 1 on the T1 variable and the LCS was estimated in a similar way with a weight of 1 on the T2 variable (McArdle, 2009; McArdle & Nesselroade, 1994). This model also allows for the estimation of LCS means. One is also able to test for and force measurement invariance over time and across different groups. Compared with methods such as auto-regression, one can explicitly describe and test for change, for instance means and variances. This model was applied to both self-efficacy and planning as a multivariate latent difference score model (MLDSM) specification.

In Study II, for the research questions (1) & (2), the SES differences in T1 levels and changes were examined with a series of longitudinal multiple-group factor analyses using nested models, testing the equality of means of the variables across the SES groups. The changes were again estimated using Latent Change Score (LCS) models (McArdle, 2009; McArdle & Nesselroade, 1994). To investigate the SES differences in self-efficacy change and planning change, the LCS means were estimated for both groups separately. This model was then compared to a model specifying equal means.

For research question (3), the predictive associations of self-efficacy and planning with exercise and diet were tested with two sets of models: (a) a "level-model" with post-intervention T2 levels of self-efficacy and planning as predictors of T1-T3 change in exercise/diet, and (b) a "change model" with T1-T2 changes in self-efficacy and planning as predictors of T1-T3 change in exercise/diet. In the "level models" (a), T1 self-efficacy and planning predict T2 variables, which in turn predict T1-T3 changes in behaviour. In the change models (b), the latent change scores predict T1-T3 changes in behaviour. The models were as follows:

- I a: T2 levels of self-efficacy and planning → Change in exercise (T1-T3)
- I b: Changes (T1-T2) in self-efficacy and planning → Change in exercise (T1-T3)
- II a: T2 levels of self-efficacy and planning → Change in diet (T1-T3)
- II b: Changes (T1-T2) in self-efficacy and planning → Change in diet (T1-T3)

In each case, the model was first calculated for the total sample (M1). Next, a multiple-group SEM was estimated (M2), with the two path coefficients (self-efficacy → behaviour change, and planning → behaviour change) allowed to be freely estimated for both SES groups. Last, to test for the possible moderation of the associations by SES, a third model was specified, constraining the regression coefficients to be equal across the SES groups (M3). M2 and M3 were then compared using the χ^2-difference test to establish whether the constrained model, M3, had a statistically significantly ($p < .05$) worse fit compared to M2 (with varying estimates for SES groups). A loss in fit would indicate different associations for the SES groups.

In Study III, dispositional optimism and pessimism were modelled as latent factors and changes in health-related self-efficacy by applying latent change score (LCS) models (McArdle, 2009; McArdle & Nesselroade, 1994). For health-related self-efficacy three parcels were created in order create more reliable indicators (Bandalos & Finney, 2001) and factor loading invariance across time was enforced.

Three models with the following specifications were tested:

- Model 1 ("additive model"): T1 optimism, pessimism and health-related self-efficacy → waist circumference change T1-T3.

- Model 2 ("static mediation model"): T1 optimism and pessimism → T2 health-related self-efficacy → waist circumference change T1- T3.
- Model 3 ("dynamic mediation model"): T1 optimism and pessimism → health-related self-efficacy change T1-T2 → waist circumference change T1-T3. Also, health-related self-efficacy → waist circumference change T1-T3.

In Study IV, research question 2 was examined by three models, with Model 1 containing only the direct effects of agency and communion on waist circumference change. Model 2 added social support T2 and self-efficacy T2 as predictors and specified a "static mediation model" (as in Study III), and Model 3 replaced self-efficacy level with change T1-T2 ("dynamic mediation"). Hypothesis 1 was tested by examining all three models. Hypothesis 2 (mediation) was tested by examining the indirect effects within Models 2 and 3. Hypothesis 3 (moderation) was tested by specifying an interaction term between communion and social support in Models 2 and 3. This interaction effect was interpreted using simple slope analysis (Aiken & West, 1991). Additionally, hypotheses 2 and 3 were also subjected to test in separate models without any other study variables.

Whereas Studies I-III employed LCS models, changes in self-efficacy and waist circumference were modelled with latent change regression models (McArdle, 2009; McArdle & Nesselroade, 1994). Here the variable measured at follow-up (e.g. T2) is also regressed with a weight of one on the T1 variable, but then, instead of a covariance, a regression effect between the T1 score and the change score is specified. Hence, the model removes the part of the individual change that is related to the initial level, thus providing a base-free measure of change. Change-regression models are useful when the changes have not taken place by the time of the initial measurement, as opposed to observational research where the two occasions may be arbitrary selections (McArdle, 2009). Hence, change-regression models are suitable for analysing the processes in an intervention study where all cases are subject to the same "manipulation".

Fit indices used to assess model fit included the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), SRMR and Root-Mean Square Error of Approximation (RMSEA). Evidence of good fit depends on sample size and model complexity, but for most models in this study CFI and TLI > .92, SRMR < .08 and RMSEA < .07 can be considered demonstrating goodness of fit (Hair, Black, Babin, Anderson, & Tatham, 2006). Alternative nested models (e.g. a model with a regression path constrained to zero against one without that constraint) were compared with the help of chi-square difference tests.

Structural equation modelling (SEM) analyses were conducted using Mplus (Versions 5.1, 5.2 and 6.0) with maximum likelihood estimation. In Study IV, to study research question 1, linear and logistic regression analyses were conducted and interaction terms were investigated with the SPSS version 15.0 software and

PASW version 18.0 software. PASW was also used to obtain descriptive statistics and to conduct simple slope analysis for interpreting the interaction in Study IV.

Missing data were treated by full information maximum likelihood (FIML) estimation, an excellent statistical approach to missing data (Graham, 2009; Schafer & Graham, 2002). FIML does not assume data to be missing completely at random, but instead, if the variable related to the missingness mechanism is included in the model, the FIML estimation obtains unbiased parameter estimates for all parameters of the model (Graham, 2003). In the case of research question 1 in Study IV, listwise deletion of the data was used, as the central independent variables were measured in retrospect at T4. Hence, only complete cases were included (the three-year follow-up questionnaire measurement, $N = 254$, 66.0% of the original sample).

4 Results

The results of Studies I-IV are presented according to the three overarching topics. Detailed analyses are presented in the original manuscripts.

4.1 Do changes in cognitions predict behaviour change?

4.1.1 Self-efficacy and planning predict exercise and diet (Studies I-II)

Study I investigated changes in adoption self-efficacy and action planning as predictors of three-month exercise change. The model (Model A, Figure 12) defines a latent change score (LCS) for adoption self-efficacy, LCS for action planning for exercise, the social support latent variable and LCS for exercise. Figure 12 displays the parameter estimates for the total sample. The model fit indices were as follows: χ^2 (272) = 591.72 (p < .001), CFI = .95, TLI = .95, RMSEA = .055; 90% CI [0.049 – .061]. The results indicate that both change in adoption self-efficacy and change in action planning predict exercise change.

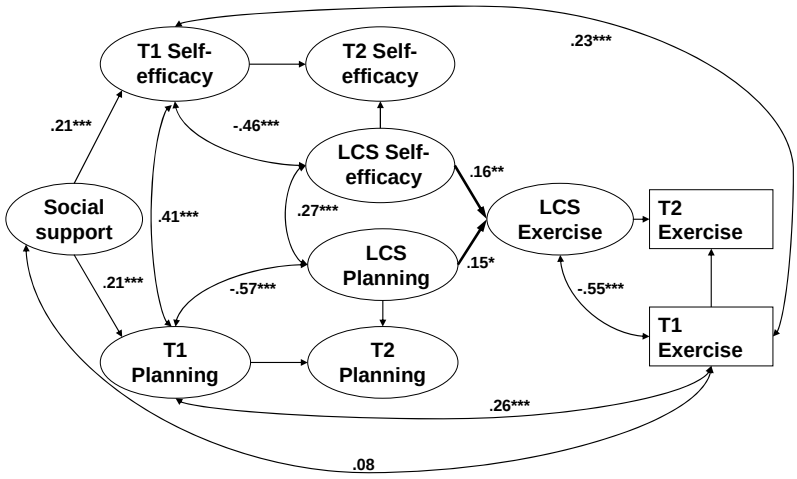

Figure 12: Changes in adoption self-efficacy and action planning as determinants of changes in exercise (Study I).

The overall estimate for the total sample for each parameter is shown. Standardised coefficients. Some of the parameters are excluded for presentation purposes.
T1 = Baseline, T2 = Post-intervention (three months)
*** p < .001, ** p <.01, * p < .05.

Study II investigated (a) post-intervention (at three months) levels in barriers self-efficacy and coping planning as predictors of exercise and diet change (from baseline to 12 months) and (b) changes in the determinants (baseline to three months) as predictors of exercise and diet change (baseline to 12 months). See Figure 13 for simplified models.

- Ia: The overall model (M1) showed that high T2 self-efficacy predicted increases in exercise. Coping planning had no significant effect on exercise change.
- Ib: M1 showed that exercise change (T1–T3) was predicted by changes (T1–T2) in exercise self-efficacy, but not changes in exercise planning.
- IIa: M1 showed that reduction in dietary fat (T1–T3) was predicted by high T2 level of diet coping planning, but not diet barriers self-efficacy.
- IIb: M1 showed that the change in diet was not predicted by changes in self-efficacy or planning.

4.1.2 Increase in self-efficacy and abdominal weight loss (Studies III-IV)

Study III showed (see the dynamic mediation model, Model 3 in Figure 10) that more than any other predictor in the model, the change in health-related self-efficacy (T1-T2) predicted change in waist circumference by one year (T1-T3). The more health-related self-efficacy increased during the first three months, the greater the reduction in waist circumference. Further, Study IV showed that the change in this variable, health-related self-efficacy, significantly predicted the three-year (T1-T4) waist circumference change (β = -.17, p = .024).

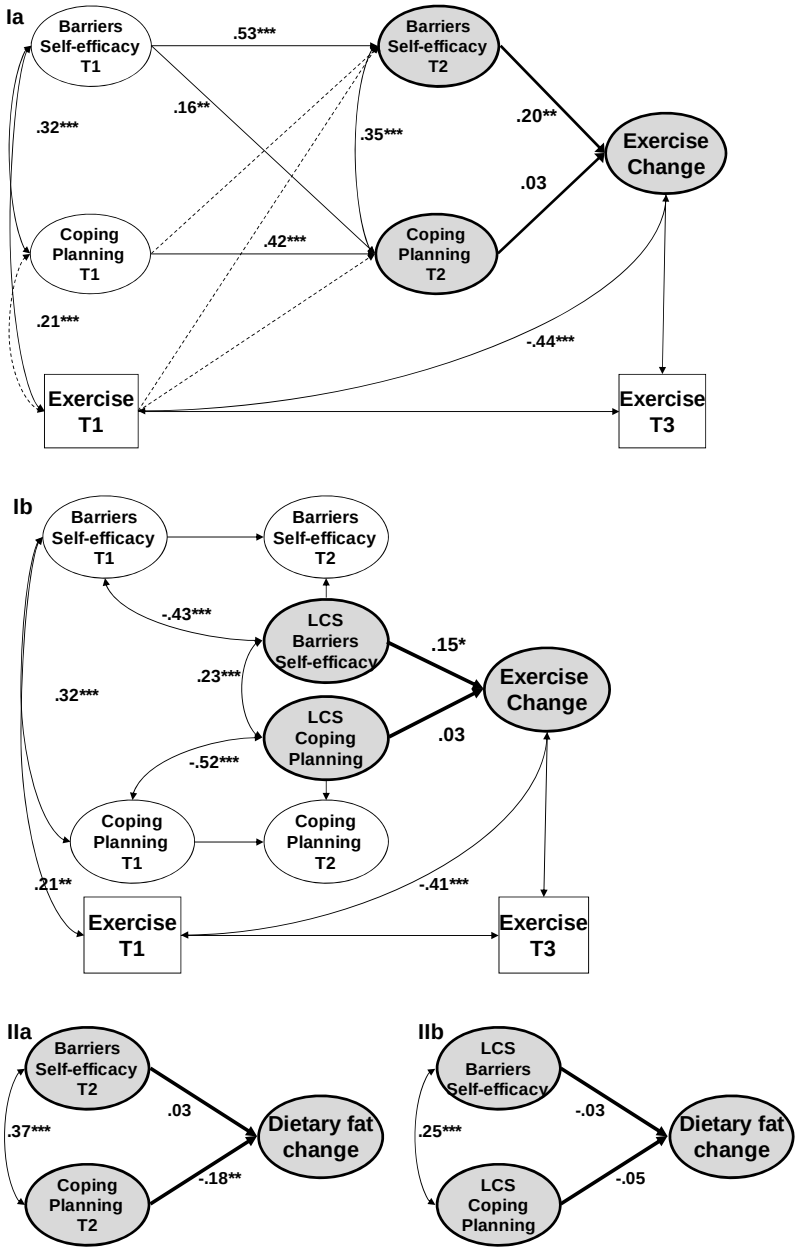

Figure 13. Levels and changes in self-efficacy and planning predicting health behaviours (Study II)

Standardised coefficients. Some of the parameters are excluded for presentation purposes.
T1 = Baseline; T2 = Post-intervention, three months; T3 = 12 months
*** $p < .001$, ** $p < .01$, * $p < .05$.

4.2 Are there gender and SES differences in psychosocial mechanisms?

For Studies I and II, the assumption of measurement invariance across gender and SES groups received support in analysing the confirmatory longitudinal factor analysis; for details, see manuscripts I and II. Factor loadings were identical among LSES and HSES ($p < .05$). However, residual variances were not and these restrictions were not imposed in the analyses.

4.2.1 Levels and changes of psychosocial determinants: gender and SES differences

In Study I, the means of three factors were similar for men and women, but two were different. Firstly, the mean of action planning at T2 was different for men and women ($p < .05$), indicating that women did more plans during the intervention. Secondly, women received less social support for exercise than men.

Study II showed that before the intervention, levels of barriers self-efficacy and coping planning were equally high in both SES groups. Secondly, at T2, exercise barriers self-efficacy increased among the HSES but not among the LSES. However, this difference was only borderline significant ($p = .08$). Overall, exercise barriers self-efficacy increased ($p < .05$) during the intervention but the average change was modest in size. Exercise coping planning increased during the intervention in both groups ($p < .001$). No SES differences were detected in the levels or changes of diet determinants, but overall, diet barriers self-efficacy increased slightly ($p < .05$) and diet coping planning slightly more ($p < .001$) during the intervention.

4.2.2 Associations with behaviour: universal or gender-specific? (Studies I, IV)

Study I examined whether the three-month change in exercise is predicted by the three-month changes in adoption self-efficacy and action planning *similarly* for women and men. Figure 1 displays a simplified figure and the gender-specific parameter estimates from a multiple-group model (Model B). The indices for Model B were: χ^2 (558) = 923.56 ($p < .001$), CFI = .94, TLI = .94, RMSEA = .058; 90% CI [0.052 – .065].[5] The model enforcing equality of the regression paths (Model C) was tested against the model allowing gender-specific estimation of the parameters (Model B). Model C yielded a good fit χ^2 (562) = 931.04 ($p < .001$), CFI = .94, TLI = .94, RMSEA = .058; 90% CI [0.052 – .065], and the Chi square difference test

[5] In Models B and C, to apply the most parsimonious model, the means of self-efficacy at T1, self-efficacy difference score and planning at T1 were constrained to be equal across the genders.

(difference in χ^2 of 7.48 for 4 df, $p = .11$) suggested that Model C was superior to Model B. Thus, even though there seem to be gender differences in the regression weights, the analyses did not confirm that the gender groups differ with a significance level of $p < .05$.

Study IV investigated whether agency and communion were related to waist circumference change in a similar way among men and women. Examining the pairwise correlations indicated a negative (although statistically non-significant) relationship between communion and waist circumference change at both timepoints for both sexes (women: $r = -.07$; $r = -.01$; men: $r = -.07$; $r = -.14$). However, the relationship between agency and waist circumference change was negative among women but positive among men (women: $r = -.13$, $r = -.04$; men: $r = .11$. $r = .08$), indicating an interaction effect between agency and gender. In a linear regression analysis the interaction term did not yield significance ($p = .12$). In contrast, in a logistic regression analysis the interaction term between agency and gender was statistically significant ($p = .007$), implying that agency plays a different role for men and women in predicting waist changer category membership[6]. For women, agency predicted the likelihood of achieving greater waist reduction (OR: 2.70; CI 95%: 1.19–6.15, $p = .017$). For men, the effect was the opposite, but only marginally significant (OR: 0.27; CI 95%: 0.07–1.04, $p = .057$): among men, higher agency predicted waist gain.

The interaction term between gender and communion was non-significant ($p = .847$), and communion had no significant main effects on waist circumference change.

These analyses are not included in the manuscript of Study IV.

[6] Two groups were compared to each other: Those with a successful waist circumference reduction, i.e. at least 5%, and those with negligible waist circumference reduction or gain (less than 5% reduction). No sex differences in waist reduction categories were discovered ($p = .22$).

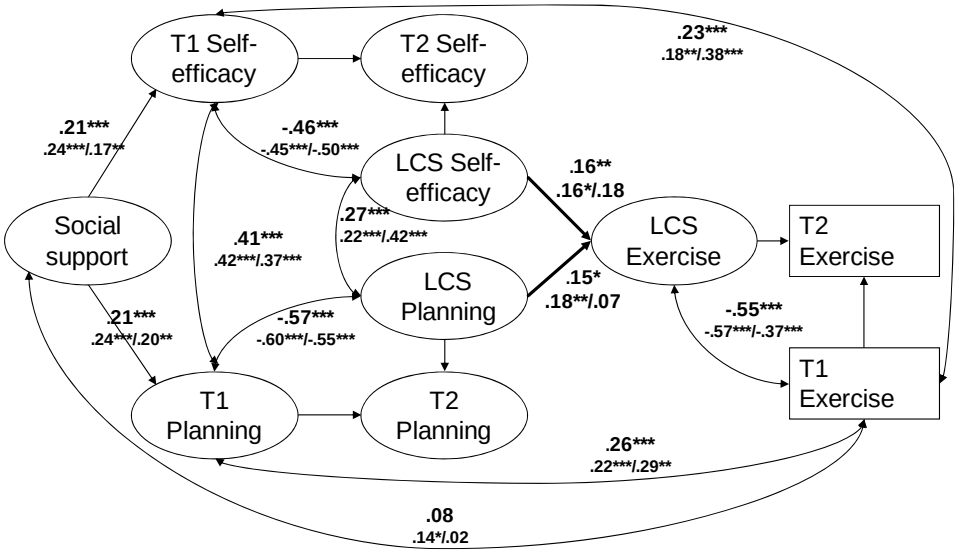

Figure 14: Psychological determinants of changes in exercise, men/women (Study I).

Two estimates for each parameter are shown: women/men (Model B). Standardised coefficients. Some of the parameters are excluded for presentation purposes.
T1 = Baseline, T2 = Post-intervention (three months)
*** $p < .001$, ** $p < .01$, * $p < .05$.
(Adapted from Hankonen, Absetz, Ghisletta, Renner, & Uutela, 2010)

4.2.3 Associations with behaviour: universal or SES-specific? (Study II)

The four models testing the equality of associations between SES groups are displayed in Figure 1.

- Ia: A multiple-group model with freely varying regression parameters (M2) was compared against the model, assuming the regression parameters to be the same in both SES groups (M3). The χ^2-difference test indicated no decrease of the model fit of M3 compared to M2, suggesting similar associations for both SES groups (χ^2 difference test: $\Delta\chi^2 = 1.8$, $\Delta df = 2$, $p = .41$).
- Ib: Comparison of M2 and M3 ($\Delta\chi^2 = .84$, $\Delta df = 2$, $p = .66$) indicated similar associations for both groups.
- IIa: Again, χ^2 difference test ($\Delta\chi^2 = 3.69$, $\Delta df = 2$, $p = .16$) showed no statistically significant differences between M2 and M3.
- IIb: Although the regression coefficients seemed to be larger for the high-SES group, they did not yield significance. Comparison of M2 and M3 suggested that the associations were similar for both SES groups ($\Delta\chi^2$=3.20, $\Delta df = 2$, $p = .20$).

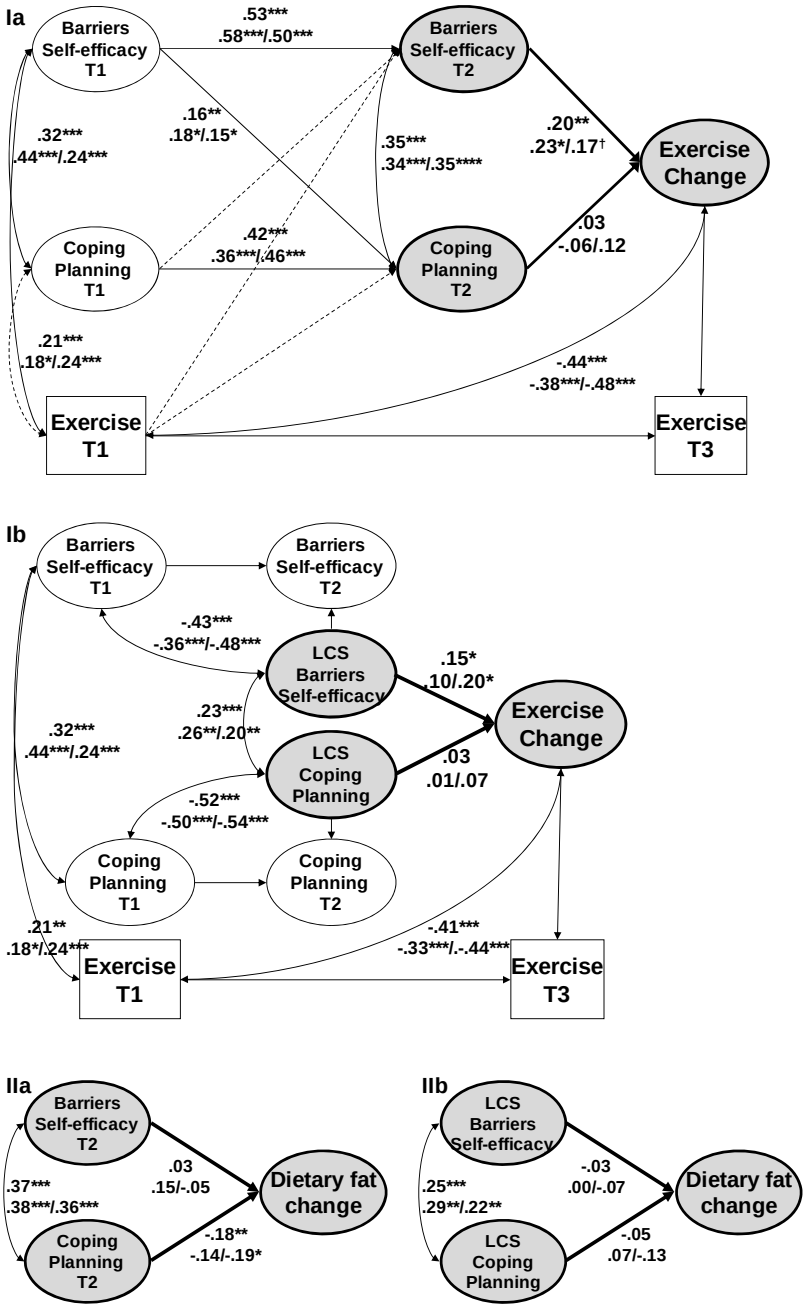

Figure 15: Changes in psychological determinants predicting changes in behaviour: low/high SES (Study II).

Standardised coefficients. Some of the parameters are excluded for presentation purposes.
T1 = Baseline; T2 = Post-intervention, three months; T3 = 12 months
*** $p < .001$, ** $p < .01$, * $p < .05$. (Hankonen, Absetz, Haukkala, & Uutela, 2009)
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4.3 Does personality set the stage for weight loss?

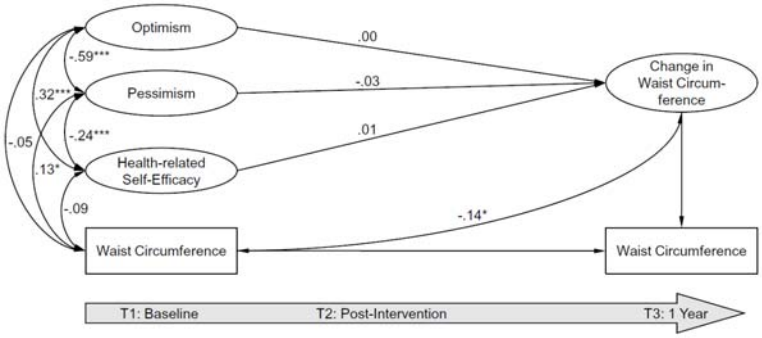
4.3.1 Alternative models of optimism, pessimism, self-efficacy and weight loss (Study III)

Additive model. Model 1 tested whether optimism and pessimism and health-related self-efficacy (T1) predicted changes in waist circumference between T1-T3 directly and independently (see Figure 10). The fit of the model was adequate with χ^2 (42) = 123.108, $p < .001$; CFI = .94, TLI = .92, RMSEA = .071. However, all three predictors had negligible effects, and hence, comparing the additive model with a null-effect model (setting the regression effects for these three predictors to zero), did not yield a statistically significant drop in the χ^2-value ($\Delta\chi^2(3) = .23$, ns.). Thus, the "additive model" was not supported.

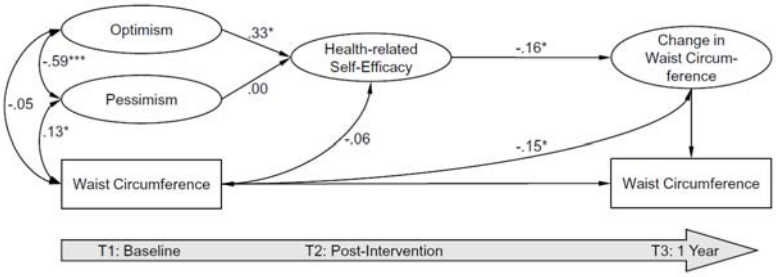
Static mediation model. Model 2 tested whether personality impacts health-related social cognitions, which then in turn facilitate health. T1 optimism (but not pessimism) affected health-related self-efficacy measured three months later (see Figure 10). Moreover, T2 health-related self-efficacy predicted changes in waist circumference between T1-T3. Optimism and pessimism did not directly predict waist change. Also, the estimate of the indirect effect of optimism on waist circumference change through health-related self-efficacy was only marginally significant (-.05; $p = .07$). The overall fit of the model was good with $\chi^2(42)$ = 110.30, $p < .001$; CFI = .95; TLI = .93; RMSEA = .065. In a modification of the model, the T1 health-related self-efficacy was added as a predictor of T2 health-related self-efficacy. This modification rendered the effect between optimism and T2 health-related self-efficacy non-significant and not supportive of the static mediation model.

Dynamic mediation model. Model 3 (see Figure 10) tested whether optimism and pessimism influenced the amount of change in health-related self-efficacy occurring during the intervention (T1-T2). The overall model fit was good with $\chi^2(71)$ = 165.43, $p < .001$; CFI = .95; TLI = .93; RMSEA = .059. Optimism and pessimism (T1) had no direct effect on either waist circumference change or health-related self-efficacy change (T1-T2). Changes in health-related self-efficacy (T1-T2) predicted changes in waist circumference (T1-T3).

Model 1: Additive model



Model 2: Static mediation model



Model 3: Dynamic mediation model

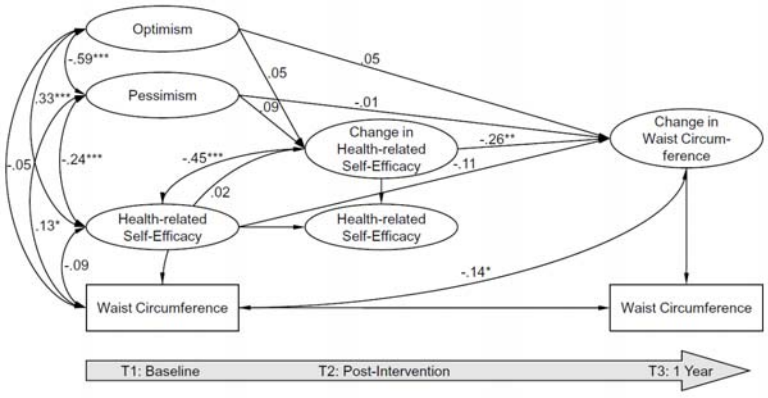


Figure 16: Alternative models (Study III).

(Hankonen, Vollmann, Renner, & Absetz, 2010)
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4.3.2 Agency and communion, and their interplay with modifiable psychosocial factors (Study IV)

The second goal of Study IV was to examine the associations of agency, communion, self-efficacy change and social support with the one-year and three-year changes in waist circumference among women.

Hypothesis 1. The results suggested that high agency was related to greater reductions in waist circumference, controlling for social support and the change in self-efficacy. Using the χ^2 difference test, a comparison between a model (shown in Figure 17) that allowed a regression effect between agency and waist circumference change to be freely estimated, against an alternative nested model that constrained the effect to be zero, indicated that the latter model had a significantly ($p < .05$) worse fit.

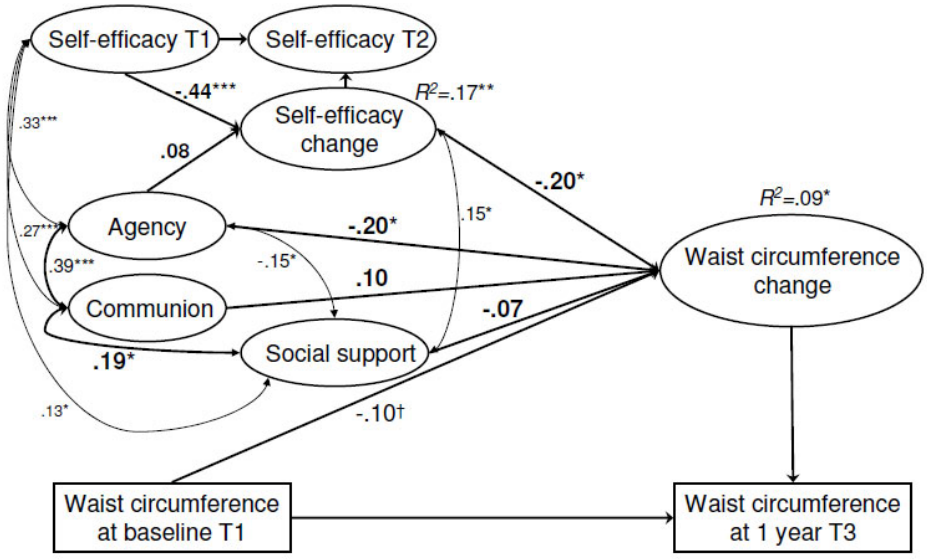

Figure 17. The structural model of associations between gender-role orientation (agency and communion), social support and self-efficacy in predicting waist reduction.

Hypothesis 2. The results suggested no mediation effect for health-related self-efficacy either as the post-intervention level or as change, contrary to what was hypothesised. Increases in health-related self-efficacy predicted waist reduction ($p <$ .05).[7]

Hypothesis 3. Testing the communion × social support interaction hypothesis, the moderation hypothesis received support. This interaction effect was interpreted using procedures by Aiken and West (1991) (see Figure 4): those with high social support and high communion lost the most weight, but those with low social support and high communion lost the least weight. Social support played no role for women low in communion.

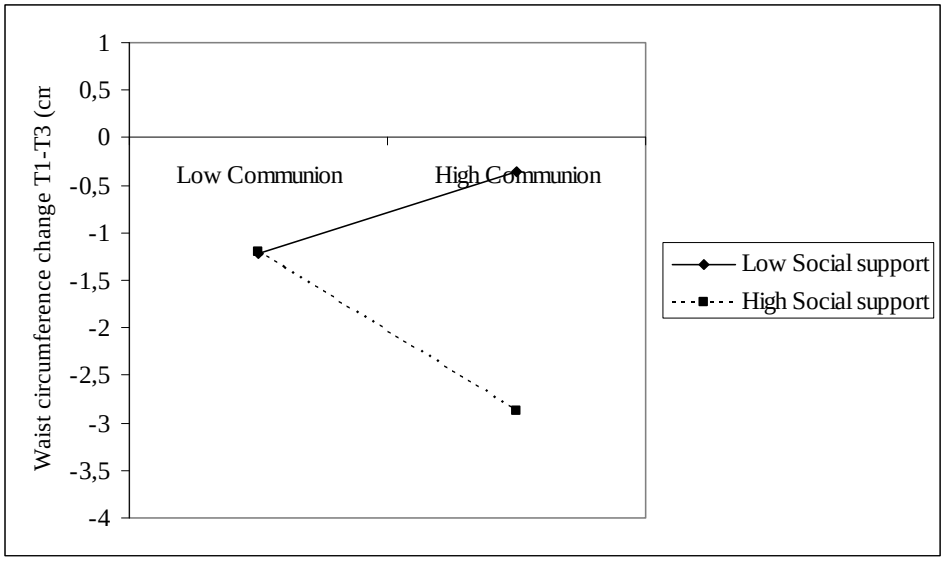

Figure 18. The interaction between communion and social support among women.

[7] The relationship between change in self-efficacy and change in waist circumference might be due to a common cause, i.e. change in behaviour. To test whether the effect of self-efficacy was merely a covariate of changes in behaviour rather than direct and independent, an additional control analysis was conducted. Here, the change in exercise behaviour T1-T2 was added as a predictor of waist circumference change. The results indicated that the change in self-efficacy remained a significant predictor ($p <$.05) also after controlling for the simultaneous change in behaviour.

5 Discussion

This dissertation aimed at 1) examining whether dynamic changes in psychological determinants predict changes in health behaviour, 2) testing the universality assumption with regard to self-efficacy and planning constructs and 3) exploring the relevance of personality in health behaviour change in an interplay with behaviour-specific psychosocial determinants.

Firstly, it was established that changes in psychological determinants during the intervention predict changes in health behaviour both over the short term (three months) and the long term (one and three years). Secondly, the findings suggested the universality of these associations for genders and socioeconomic groups, indicating that these processes are mostly similar for women, men and different educational groups. Thirdly, personality traits were found to set the stage for weight loss in terms of agency independently, with communion – coupled with high social support – predicting one-year change, but dispositional optimism and pessimism were unrelated to any changes.

The individual contributions of the substudies are summarised in Table 5. Briefly reviewed, Study I was the first study to examine the structures of influence in self-efficacy change, planning change and social support on exercise in a gender-specific manner. Study II innovatively contrasted static predictors of behaviour change with dynamic ones in alternative SEM models, and investigated SES differences in the effects. Study III was the first to test alternative models of interplay between dispositional optimism/pessimism and self-efficacy in influencing weight loss. Study IV made a novel, exploratory contribution in evaluating the relationships between stable gender-related traits and more proximal psychosocial factors with weight change.

Next, the methods, data and results will be evaluated and implications for theory, research and practice discussed.

Table 5. Summary of the contributions of the substudies.

Study	What was already known	What was asked	What the study found out
I	■ High self-efficacy and action planning predict successful behaviour change	■ Are pre-intervention levels and changes in self-efficacy, planning and social support **similar among men and women**? ■ Are their **associations** to exercise behaviour **similar** among men and women?	■ Men receive more social support for exercise than women. During the intervention, women did more exercise plans than men did. No other gender differences were found. ■ Self-efficacy change is similarly associated with exercise change among both genders, but planning may be more important among women.
II	■ Increases in self-efficacy to tackle barriers and coping planning predict successful behaviour change ■ Low socioeconomic status (SES) is related to poorer health	■ Do all SES groups experience the same levels and changes in self-efficacy and coping planning? ■ Are the associations to exercise and eating behaviour **similar between SES groups**? ■ Are initial increases in cognitions **predictive of long-term** maintenance of **behaviour change** (12 months)?	■ No baseline SES differences in psychological factors. ■ Those with low SES were slightly less likely to increase their exercise barriers self-efficacy during the intervention. ■ Associations were similar for both SES groups: exercise change was predicted by barriers self-efficacy (post-intervention level and change during intervention). Dietary change was predicted by post-intervention coping planning.
III	■ Self-efficacy predicts weight loss ■ Optimism is related to successful goal pursuit ■ Similar positive expectancies & often interrelated	**Do dispositional optimism and/or pessimism influence weight loss** (one year) directly, indirectly or by **facilitating changes** in self-efficacy?	Changes in health-related self-efficacy predict waist circumference change but dispositional optimism/pessimism does not affect waist circumference change, even indirectly through changes in self-efficacy during the intervention.
IV	■ Gender-related traits agency and communion are related to health and health behaviour ■ Self-efficacy and social support are associated with agency and communion	■ **Do agency and communion influence weight loss** similarly among women and men? ■ What is their **interplay** with self-efficacy and social support among women? ■ Which of these best **predicts three-year weight loss**?	■ High agency, independent of health-related self-efficacy change, facilitated one-year waist circumference reduction. ■ Women high in communion with high rather than low social support showed the greatest one-year waist circumference reduction. ■ Three-year waist reduction was predicted by initial self-efficacy change.

5.1 Discussion of the main results

5.1.1 Dynamic changes as predictors

Study I demonstrated the associations between cognitive changes and health behaviour change, similar to prior studies (e.g. Rhodes & Pfaeffli, 2010; Scholz et al., 2009). The magnitude of the relationship was not very high. Study II demonstrated that the three-month change in planning predicted 12-month changes in diet. Similar results have been reported earlier, but in these studies, the behaviour follow-up measurement took place at the same time as the measurement of planning (Luszczynska, 2006; Luszczynska et al., 2006; Scholz et al., 2009).

Moreover, Study II explicitly contrasted a dynamic change model with a level model. An interesting result was that T2 levels of diet coping planning predicted changes in dietary fat, but changes did not. The finding means firstly that the higher the T2 level – holding T1 factors constant – the greater the reduction in fat, and secondly, that the amount of change, i.e. how drastic the change was, did not play a role in reducing fat. Only absolutely high levels of coping planning post-intervention – whether already high or low at baseline – were related to better results at one-year follow-up. Perhaps everyone increased the number of coping plans to some extent. Post-intervention, it was crucial to have enough coping plans, indicating the existence of a critical threshold value. For example, any 1.5 unit-increase in plans might not be relevant, but instead the absolute level of planning. Indeed, a recent study suggests that the more plans one formulates, the better (Wiedemann, Richert, & Koring, 2010).

Why were the changes in physical activity not explained by coping planning? Data-driven explanations might include nonsignificant variance in the latent change score of exercise coping planning or multicollinearity; however, both were refuted by inspection of the data. Although the participants prepared fewer coping plans for exercise than for diet, more than half of the participants nevertheless reported having formed coping plans for exercise at T2. Also, coping planning predicted dietary change, whereas self-efficacy did not. This may be due to the essential nature of the behaviours: healthy eating (especially avoiding fatty foods) requires preparation of coping plans to tackle food temptations and avoid relapse; in contrast, exercise requires a more *proactive* approach in taking action. For exercise maintenance, strong confidence in one's ability to persist might be more important than preparing to shield one's goals against risk situations.

Also, prior intervention studies have reported that self-efficacy is predictive of weight loss (Linde, Rothman, Baldwin, & Jeffery, 2006). Some studies suggest that while self-efficacy is a major determinant for short-term action initiation, it would lose its predictive importance when maintaining the behaviour change over the long term (Baldwin et al., 2006; Linde et al., 2006). However, in the present study, barriers self-efficacy was found to predict long-term (12-month) exercise change.

Furthermore, prior studies have typically not looked at the *change* in self-efficacy but rather the pre- and post-intervention levels.

There are examples of past studies on health-related self-efficacy change as a predictor of behaviour change (Maibach, Flora, & Nass, 1991), but it is only recently that studies have started to link changes in self-efficacy to longer-term change in weight loss: for example, one-year self-efficacy change to two-year weight loss (Teixeira et al., 2010). Further, Study IV showed effects on abdominal obesity reduction in follow-ups as long as three years, which to the author's knowledge have not been reported previously. Study III demonstrated that the level of self-efficacy at baseline had no effect, indicating a negligible role of the "take-off" level of resources and pointing to the importance of the amount of change induced by the intervention.

The GOAL intervention participants were in the *post-intentional* phase of health behaviour change: as they entered the intervention, they had formed an intention. That said, there might still be some variation within the sample with regard to key variables in the pre-intentional (or motivational) phase (e.g. outcome expectancies, intention). A limitation is that due to a lack of measurements, we could not examine the potential moderating influence of, for example, intention strength (e.g. Sheeran & Abraham, 2003) on either the amount of changes in self-efficacy or planning or their relationship to behaviour.

In Study III, in order to rule out the alternative explanation that *changes* in positive expectancies *in general* might account for changes in waist circumference, additional control analyses were conducted, using changes in optimism and pessimism (T1–T2) as predictors of waist circumference change. No effects were found. Thus, the dynamic perspective applies for the domain-specific social cognition self-efficacy, but not for the personality traits optimism/pessimism.

Change in self-efficacy predicting the three-year weight change results can be interpreted as representing a causal effect of the self-efficacy belief itself, but also as an indicator of a drastic cognitive "mindset" change during the intervention. It has been argued that rather than predicting from a wide set of individual cognitive-rational determinants in a linear fashion, behaviour change may (also) consist of chaotic, nonpredictable – yet modellable – events, with the resulting "sum" being irreducible to its parts (Resnicow & Vaughan, 2006). According to this view, even small changes in knowledge or efficacy, for example, may dramatically alter motivation and behaviour. Resnicow and Vaughan (2006) argue that decisions to change are quantum rather than planned events, and changes resulting from such quantum processes seem to endure longer than those involving more rational, planned processes (Resnicow & Vaughan, 2006). In line with this reasoning, it might be argued that those changes in self-efficacy that carry their effects even over the three-year period might be a reflection of such a qualitative change in participant motivation, and as such difficult to predict with social cognitive models of motivation.

Based on this dissertation, the focus on change and distinguishing a level approach from a change approach appear to bring novel contributions to the field. When changes in cognitions are actually modelled, we can discern the relationship between the *amount of change* in cognitions and subsequent variables. In much of the research, post-intervention values are adjusted for the baseline values. This does not mean investigating change in the variables, but rather their post-intervention levels, assuming baseline levels to be equal. The results are often convergent, but there might also be slight differences.

Focusing on the magnitude of the psychological change poses new challenges to interpreting the discovered effects. Often, statistical artefacts related to regression to or from the mean might create spurious relationships between variables. Moreover, the causal effects between variables vary according to their content and function: for example, high perceived health risk predicts uptake of health protecting behaviours, whereas decreases in risk perception over the course of a lifestyle change attempt might be associated with improvements in health behaviour. This is due to the rational process whereby improved behaviour is perceived to instantly reduce the risk of disease (Weinstein, Rothman, & Sutton, 1998). Hence, for some variables, the level associations vary from those that would be expected between changes in variables.

Also, it may be proposed that a "true" temporally distinct effect can only be shown by regressing T2–T3 change on T1–T2 change, with no overlap between the changes. However, it has been noted that changes in behaviours also occur early on in interventions (Williams & Dunsiger, 2007); hence, such an analytical approach might not be fruitful.

The number of studies investigating moderated mediational models has increased in recent years. Behaviour change theories are studied for interaction effects of factors such as personality traits. For instance, the relationship between two variables (e.g. intention and behaviour) might be stronger to one group of people (e.g. those who have high self-efficacy). In fact, dynamic mediation (presented in Study III) is distantly similar to moderated mediation. In a controlled trial, it is possible to regress self-efficacy change on the intervention condition, and then investigate whether for example personality traits moderate the effect of intervention on self-efficacy. However, without a comparison group, a dynamic mediation model can be used to study this effect.

5.1.2 Testing the universality assumption: gender and SES as moderators

Gender and health behaviour change

Women and men both benefited from self-efficacy increases in exercise change, but planning may be more useful for women (Study I). Agentic traits and social support facilitated women's one-year abdominal weight loss (Study IV). The findings of Studies I and IV can be interpreted as consonant with the fact that women face social role demands (e.g. Hunt & Annandale, 1993) that restrict their opportunities to pursue their personal weight-loss goal. The "support gap hypothesis" (Cutrona, 1996; Schwarzer & Knoll, 2010) was supported by the findings from Study I: women received slightly less social support than men did. Women have the main caretaking responsibility for close others, the combined load of paid work and household chores has stronger effects for their health (Hunt & Annandale, 1993), caregiving demands hinder women's exercise participation (Verhoef, Love, & Rose, 1992) and family-related distress has stronger effects on women's weight change (Block, He, Zaslavsky, Ding, & Ayanian, 2009). In the context of competing goals – on the one hand, personal weight loss goals, and on the other, family demands and social obligations – it might be essential for women to be able to be sufficiently assertive and self-regulated so that they carry out their health behaviour intentions. Indeed, studies I and IV indicate that possessing personal and psychological resources (i.e. planning for exercise, agentic traits, social support) better enables women to achieve the lifestyle change.

Study I indicates that although women, compared to men, face a slightly less benevolent social environment for lifestyle change (with less social support available), they still seem to make an effort in trying to increase their exercise by making more action plans. However, one must bear in mind that statistical significance does not reveal the magnitude of the effect. The effect size for the mean differences in planning and social support can be calculated using Cohen's *d*. The Cohen's *d* for planning at T2 was .402, which can be considered an almost medium-size effect, and for social support .364, a small to medium-size effect. Hence, the practical significance of these findings should not be overestimated.

Furthermore, examining the practical significance of changes in self-efficacy and planning using the unstandardised regression coefficients from Model A, an increase of one unit in self-efficacy change would translate into 42 minutes and an increase of one unit in planning change into 24 minutes of exercise weekly. Even assuming one-way causation, these effects are rather small: the amount of change that would be required to increase moderate-to-vigorous exercise by 60 minutes per week is 1.4 units for self-efficacy and 2.5 for planning. In other words, during an intervention, starting with "completely disagree" (1) and changing to "completely agree" (4) on all items, would mark an increase in exercise minutes of 126 for self-efficacy and 72

for planning. Such extreme changes in psychological variables are however unlikely. As is the case with most psychological variables, the effects of the changes in self-efficacy and planning are not large, but they do make a small but important contribution. In addition, these predictors are not the only relevant psychological predictors of health behaviour change: accompanied with changes in other relevant determinants, such small changes potentially translate into relevant behavioural outcomes.

The universality assumption of psychological models has not often been explicitly tested. The structural path model of Study I shows that the paths from social support to self-efficacy and planning are largely similar for men and women, as are the paths from the change in self-efficacy to exercise behaviour change. Interestingly, the effects of planning were slightly different (again, the gender difference was small). Earlier studies (Renner et al., 2008; Tangney, Baumeister, & Boone, 2004) have indicated that women and girls on average have higher self-control and perhaps also benefit more from self-regulatory behaviours. One interpretation might be that due to women's role in society, girls are socialised to exercise stricter self-control but also, as women's role sets constraints on their everyday behaviour (Hunt & Annandale, 1993), forming plans enables women to cope with those multiple demands.

Yet, speaking about women as a homogenous entity undermines the fact that there are many differences within genders, too (Emslie, Hunt, & Macintyre, 1999). In this respect, Study IV extended the scope relative to Study I, which only looked at the biological sex aspect of gender. The *biological* sex does not necessarily determine whether the social role is restrictive or not. The results of Study II suggest that differences in gender role-related traits also contribute to behaviour outcomes *within* gender groups. For example, more agentic women were better able to lose weight, possibly through their increased ability to resist the external influences and double burden related to women's role (Hunt & Annandale, 1993).

The question of SES-specific mechanisms

The GOAL intervention brought about mostly similar changes in the psychosocial determinants (self-efficacy, planning) across the educational groups, implying that in this respect those with higher education did not gain significantly more psychological benefit from the interventions. While the only SES difference found was beneficial for the higher SES group, it was rather small and emerged in exercise only. No differences were found between the SES groups in any of the other psychosocial determinants. Thus, the worry that interventions mainly serve high-SES individuals (Victora et al., 2000) is not supported in the context of the GOAL LIT, and this might also apply to other interventions targeting self-efficacy and self-regulation. This does not preclude the possibility of a SES gradient in interventions targeting other behavioural determinants and employing different behaviour change

techniques. As the health literacy of the low-SES groups is more limited (Porr, Drummond, & Richter, 2006), provision of health information, for example, might have SES-specific effects.

However, the investigation of the health behaviour change process in this study focused on the *post-intentional* phase of behaviour change, where a health behaviour change attempt was already underway: the motivational phase, i.e. intention formation, might show a different pattern of socioeconomic response. Indeed, one mechanism producing socioeconomic differences in response to interventions may be that those with higher SES are in more advanced stages of change (Adams & White, 2007) and thus are more *willing* to *enter* interventions (Grandes et al., 2008; Lakerveld et al., 2008).

Moreover, cultural beliefs about health (Wardle & Steptoe, 2003) differ between SES groups in major ways, beneficially for those with high SES. Less social support for those with low SES (Ross & Wu, 1995; Taylor & Seeman, 1999) and even punishment for health behaviour change attempts for the low-SES women (Hankonen, Absetz, & Uutela, 2007) suggests that the cultural environments of low-SES individuals are less accepting of health values. This poses challenges to intervention planners as to how to help low-SES participants cope better with their less benign environment.

In the present study, SES did not modify the associations between psychosocial determinants and health behaviour outcomes, which were equally positive in both groups. A recent observational study (Godin et al., 2010) examined whether sociostructural factors such as level of education or income moderate cognition-behaviour associations, and came to similar conclusions. However, there is preliminary evidence that while autonomous motivation predicts physical activity for high-SES women, it has no effects among low-SES women, among whom social support and punishment were stronger predictors (Uutela, Hankonen, & Absetz, 2009). Thus, more studies are needed to test whether SES modifies the "conceptual theory" with a broader set of psychosocial determinants from different theories. Moreover, although the present study lends support to the universality assumption for the conceptual theory with regard to self-efficacy and planning concepts, it must be borne in mind that *techniques*, i.e. action theory, might be differentially effective in various groups. Perhaps some intervention components might be more effective in enhancing self-efficacy for low-SES individuals. This must be studied in the future.

All in all, Studies I and II show that changes in theoretical determinants of self-efficacy and action and coping planning are similarly related to behaviour changes across gender and SES groups. Study IV showed, however, that the agency trait plays a different role for men and women.

5.1.3 Does personality "set the stage" for change?

Studies III and IV examined whether personality sets the stage for weight loss success, and how personality interplays with health-specific psychosocial factors.

Prior studies have related optimism to health behaviour and its outcomes, such as healthy dietary habits (e.g. Kelloniemi et al., 2005; Schroder & Schwarzer, 2005) and weight loss (Shepperd et al., 1996). However, more behaviour-specific cognitions predict health behaviour change and health outcomes better than the trait or individual-difference variables (Armitage, 2003; Benyamini & Raz, 2007; Taylor et al., 1992). Indeed, social cognitive models assume that personality variables have an effect on behaviour through social cognitive variables, but this has rarely been put to empirical test. Our findings support the assumption that behaviour outcomes are best predicted by cognitions or expectancies that match the specific behaviour.

Why was abdominal weight loss not influenced by dispositional expectancies? Firstly, in prior studies, the health outcomes were more distal (emotional adjustment, satisfaction, therapy adherence) and not so dependent on actual health behaviour, such as weight loss is on diet or exercise. Most research in the health domain has investigated optimism's beneficial effects on emotional adjustment (Scheier & Carver, 2003), and joint effects with self-efficacy were found in depression (Shnek et al., 2001); hence the positive effects may not occur through health behaviours but rather through emotional and immune functions effects. The gap from optimism to waist change might be too wide.

Secondly, this study was an intervention study instead of a natural follow-up – perhaps group support and the targeting of specific cognitions reduces the differences in the goal-striving processes between optimists and pessimists. Two other obesity interventions with shorter follow-ups reported no effect of dispositional optimism, either (Benyamini & Raz, 2007; Fontaine & Cheskin, 1999).

Third, generalised expectancies may have an impact particularly when people are confronted with novel or ambiguous challenges and situations (Scheier & Carver, 1985). A lifestyle change attempt might not have been a novel behaviour for many of the GOAL participants, thus attenuating the effects of the generalised expectancies. In effect, moderators such as previous experience might explain earlier discrepant findings regarding the effect of dispositional optimism on weight loss (Benyamini & Raz, 2007; Fontaine & Cheskin, 1999; Shepperd et al., 1996).

Fourthly, in addition to persistence in goal pursuit, optimism is also associated with more easily being able to reengage in new activities when earlier goals seem unattainable (Rasmussen et al., 2006). In a similar vein, optimism is not always related to more active goal pursuit, but instead, goal priority moderates its effect on goal engagement and goal attainment (Geers et al., 2009). Hence, if during the process a dispositionally optimistic person finds that the weight loss goal is difficult to attain or less important, the beneficial effects of optimism disappear.

Social support was conceptualised as playing different roles in the models of Study I and IV. In Study I, social support was a distal predictor of behaviour, influencing self-efficacy and planning. For both men and women, receiving support from friends and family was associated with higher exercise adoption self-efficacy and more action plans for exercise. In Study IV, social support was examined as a moderator for the effects of communion. Consistent with the hypothesis, communion was facilitated women's weight loss when social support was available. As individuals high in communion have higher affiliative needs, they may be more sensitive to the social environment. Cheng (1999) argues that they may be more concerned about maintaining harmonious relationships with others and more readily seek social support. If this need is reciprocated, i.e. close others provide assistance and harmony in the relationship, the need for affiliation is satisfied and communal individuals are likely to succeed better in goal pursuit. The detected interaction lends support to this idea that communion is functional in cases where social support is received for the attempted behaviour change.

Hence, the earlier, often mixed findings regarding the effects of social support, especially those regarding its differential effects among women and men (Allgöwer et al., 2001; Sallis et al., 1992), as well as mixed findings on its effectiveness in interventions (Dombrowski et al., in press; Greaves et al., 2010) might be explained by interactions with gender role-related traits such as communion. Social support is crucial for some individuals, while others are less dependent on it. Although the present finding relates to naturally occurring social support, this might generalise to interventions that experimentally manipulate social support (e.g. Wing & Jeffery, 1999), and there is evidence that socially focused treatment might prove beneficial especially for communal individuals (John et al., 2008).

Textbox. Examples of the meaning of social support for GOAL participants.

The importance of social support is illustrated in the GOAL LIT participant interviews by Jallinoja and Pajari (unpublished data). The following women had gained weight, and they talk about interpersonal relationships:

> *"… my husband always has to have his gravy … he always says, 'Where's the gravy, don't we have gravy? It's not even food if we don't have gravy' … he's old-fashioned [laughs]"* "Venla", gained weight
>
> *"… there are those who don't see that there is any problem, like people who are naturally thin, who don't have any problems with eating, but … it's so sad that there is discouragement, especially covert discouragement …"* "Marja", gained weight

A successful participant reports supportive family behaviour:

> *"My daughter calls me very often. She has a commute of 11 kilometres and now she has started to walk to the office, and tells me, 'Come on, you too'. So I have someone to push me.* "Leena", lost weight

The effects of personality traits were partly dependent on social factors: not only the domain-specific psychosocial factors – in this case, social support – but also gender. Gender moderated the effects of agency on weight loss. A sex-atypical orientation seems to benefit both women and men. In men, agentic traits might signify an emphasised masculine gender identity, and as cultural masculine values undermine health promotion attempts (Courtenay, 2000; Gough, 2007), this is likely to hinder goal attainment. Furthermore, for women, social roles with caregiving and household maintenance demands might establish unfavourable conditions for the individual goal-oriented behaviour required for lifestyle change, but agentic traits such as assertiveness and independence help them to focus on their own needs and overcome social obstacles. In line with this reasoning, communal women, characterised by a high need for affiliation and focus on others' well-being, succeed when they are provided with high social support for lifestyle change, indicating person-environment interaction. Moreover, the Study I finding that increased planning seemed to be of greater benefit to women supports this interpretation.

This study is one of the first attempts to examine personality factors in the process of health behaviour change in a T2D prevention intervention. Other studies are needed with different personality factors related to health behaviours (de Bruijn, Kremers, van Mechelen, & Brug, 2005) as predictors of weight loss success or mediating and moderating factors.

5.2 Validity and reliability of the study

All substudies made use of the prospective longitudinal design of the GOAL Lifestyle Implementation Trial. The explicit modelling of dynamic psychological changes during an intervention and linking the changes to behaviour change has rarely been done to date. In Study IV, the initial change in self-efficacy was linked to a weight-loss timeframe of as long as three years. In many health behaviour intervention studies, the temporal distances of measurement points cover a much shorter time period – days or weeks. Other strengths of the study are the sound use of theory as the basis of the research problems and the analyses as well as the selection of novel research questions. For example, the mediation and moderation effects with regard to agency and communion have rarely been tested, although advancing and refining the theory requires establishing how and under which conditions certain factors disclose their effects. Finally, whereas many studies on individual health behaviour change interventions focus on *individual-level* factors, the present study also includes an *interpersonal-level* factor, social support as well as *sociodemographic* factors, gender and socioeconomic status. The combination of three levels of factors in the same study, in a long follow-up and a dynamic intervention design with a state-of-the-art statistical modelling method, is rare in current health psychology research. Next, selected issues pertaining to the reliability and validity of the study are discussed in more detail.

Representativeness of the sample. Some limitations of the sample might reduce the external validity of the study. As participants were self-selected into the study, they might not be representative of their respective socioeconomic class. On a related note, it is likely that individuals with more optimistic mindsets volunteered to participate more often than those who were more pessimistic. This could not be analysed in more detail because of missing information about those who declined to participate in the GOAL LIT. However, comparing the LOT-R scores's means (and standard deviations) with another Finnish study (Kivimäki et al., 2005) that examined 5007 municipality employees (Optimism = 2.78 (.61), and Pessimism = 1.53 (.57); GOAL LIT: 2.99 (.59), and 1.91 (.71); respectively) shows that the means are similar, although those of the GOAL LIT participants were higher in both, especially pessimism. However, there are no marked discrepancies from the comparison population. Furthermore, the gender distribution was not even, but this reflects the often-reported fact that men are less likely to use health care services. Due to the small sample size and potential sample selection, generalisations should be made cautiously and tentatively regarding men's results in Study I and IV. However, most background characteristics are similar to the general population (Fogelholm et al., 2006). The data represent a "real-world" situation and people who seek lifestyle counselling from primary health care, and thus the study has strong ecological validity. Furthermore, the study provides preliminary results concerning theoretically relevant questions that are to be later tested in larger samples.

Causality. A prospective longitudinal design could be applied to all variables and substudies except for the gender-role orientation variables agency and communion in Study IV. Entering the research group between the one- and three-year follow-ups to study gender differences in the GOAL LIT, I was interested in disentangling the topic also from the perspective of psychological gender, the measures for which had not been included at baseline. Agency and communion were thus measured in retrospect at T4. Therefore we cannot rule out a reverse causal pathway, e.g. reductions in weight causing changed, more agentic self-assessments, or that a third, unknown factor would have caused changes both in agency and weight. There is however good reason to expect that the trait estimates would have been the same if measured three years earlier at the baseline (Loehlin et al., 2005). These variables might also relate to differential dropout, but this cannot be checked. Nevertheless, the study can be considered an exploratory study investigating a new area with theory-based and justified questions, and new studies with a more robust design are needed to replicate these results.

Furthermore, Study I suffers from the prospect of an alternative causal pathway: the three-month change in self-efficacy and planning might also be *caused* by the changes in exercise behaviour. Most psychological variables are in fact also influenced by behaviours, in a reciprocal relationship (Bandura, 1997). In a post-hoc analysis of data with set data gathering points, and with research interest in the short-term adoption of exercise behaviour, one cannot go back in time to measure

psychological determinants temporally slightly prior to the behaviour, even if desired. Still, there is ample experimental evidence showing the causal effects of self-efficacy (Bandura, 1997, for a review) as well as planning (e.g. Luszczynska et al., 2006) on behaviours, supporting our assumptions concerning their direction. Furthermore, it is a relatively novel approach to study social cognitive changes as predictors of behaviour changes, and many of the existing studies only evaluate covariance structures of *simultaneous* changes instead of temporally subsequent ones (e.g. Rhodes & Pfaeffli, 2010; Scholz et al., 2009). Three of the four studies in this dissertation had temporal sequencing between the change predictors and outcomes.

Still, caution should be employed when interpreting causal sequences from the present analyses. In the absence of a randomised control group, one cannot rule out the possibility of natural and co-occurring changes. Even when using change scores to measure behaviour change, we do not have information on what would have been the naturally occurring development or behaviour change *without* the intervention. In order to make causal claims, the higher the level of design control, the better (e.g. Wu & Zumbo, 2008); not all of the four levels of control (observation, temporal precedence, manipulation, randomisation) are met in the present design. Causal claims about the effects of self-efficacy and planning on behaviour would require a control group that would ideally be randomly selected. For example, in Studies III and IV, changes in behaviour during the intervention might have led to (according to the principle of reciprocal causation) changes in both self-efficacy and waist circumference. Hence, instead of self-efficacy having a direct causal influence on waist change, they both might have a common cause: the behaviour. However, the control analysis in which changes in exercise were added as a predictor (Study IV) concluded that the effect of self-efficacy remained the same. Unfortunately, the lack of three-month data on the other important obesity-related behaviour – eating – prevents us from ruling out this alternative explanation.

However, as the causal influence of psychological determinants on behaviours has been established in numerous earlier experimental studies, the fact that similar results are achieved from an ecologically valid "real-world" setting, with temporally relatively distant measurements, should be regarded as valuable evidence for the external validity of the findings from experimental investigations. As all participants were subject to the same intervention programme, at least some part of the change – but definitely not all – can be attributed to the influence of intervention. Theory should be tested and refined both in the laboratory and the field (Crosby & Noar, 2010; Rothman, 2004); the intervention study at hand was indeed conducted in the field.

Statistical methods. The benefits of using structural equation modelling as the analytic method were numerous. For example, using SEM, I was able to explicitly test coefficients across the groups. Also, longitudinal confirmatory factor analyses allowed for reducing measurement error in latent variables and testing for their

invariance across times and groups. In this dissertation (Studies I–III), changes were modelled using the latent change score approach (McArdle & Nesselroade, 1994). An alternative to latent change score models is provided by change regression models (McArdle, 2009), which were used in Study IV. Additional analyses of the current data showed no marked differences between these approaches. On the whole, in this dissertation, the analytical method matched the dynamic nature of theoretical questions, which is not common in psychological research (Ferrer & McArdle, 2010). Finally, treatment of missing data was done with a state-of-the-art methodology (Graham, 2003; Graham, 2009; Schafer & Graham, 2002) in all substudies.

Measurement of physical activity by self-report. Measurement of physical activity may be done in a variety of ways. Self-report measures include self-reported questionnaire data, interview-administered measures and physical activity records and logs. Although self-report measures have been found to correlate highly with more objective performance measures (Sallis et al., 1996), this is not always the case: laziness and inability to report accurate behaviours increase the unreliability of behaviour self-reports. The most typical threats to the reliability and validity of self-reported PA measurement are social desirability biases and demand characteristics (Wilcox & Ainsworth, 2009). However, behaviour is the crucial outcome of interest in health psychology (Kaplan, 1990); therefore, behaviours have to be captured by some measurement. The present study employed physical activity logs. Participants were provided with a list of five activities, which varied by type (sport, chores, etc.) and intensity, as well as the alternative "other type of PA", and they were asked to record every 10-minute bout of PA for seven days. Compared to self-report questionnaires, PA logs are typically completed during or at the end of the day, hence lowering recall bias and thus enhancing reliability and validity (Wilcox & Ainsworth, 2009).

An advantage of the log that was used in the GOAL trial was that it included six different options for recording one's PA. Consequently, in the analyses, we were able to extract the higher-intensity PA, which was more likely to influence the desired outcomes (Laaksonen et al., 2005). Additionally, as higher-intensity activities are more accurately reported than lower-intensity activities (Sallis & Saelens, 2000), our solution to use higher-intensity vigorous exercise PA types is likely to have led to a more reliable and valid PA estimation in this sample.

A disadvantage is that the mere act of recording activities in a log could change actual behaviour patterns (French & Sutton, 2010; Wilcox & Ainsworth, 2009): after all, such self-monitoring of behaviour is one important behaviour change technique (Michie, Abraham et al., 2009). Other PA measurement techniques do not get around this problem: accelerometers and pedometers, worn on the person, are likely to increase the salience of activity (and demand characteristics) for the participants. However, as self-monitoring of exercise and diet behaviours were an explicit BCT

in the GOAL intervention for the total sample, the measurement does not bias the result in this respect.

Compared to self-reports, the more objective measures of physical activity are more costly and also suffer from some reliability-threatening drawbacks. For example, pedometer counts need to be recorded by the participant, and the instruments need to be used properly (Wilcox & Ainsworth, 2009); hence, the reliability and validity of these measurements are also dependent on participant compliance. Also, estimates of energy expenditure from heart rate may be affected by other factors, e.g. emotional stress or temperature (Heyward, 2010). Future studies will see assessment of physical activity by approaches combining more objective measures (e.g. accelerometers, geographic location sensors and heart rate monitoring) with self-reporting of context and purpose (Troiano, 2009).

To avoid the possibility of self-report biases, Studies III and IV contain an objective outcome measure, waist circumference. Changes in dietary and physical activity behaviour are assumed to materialise in changes of obesity (Steptoe et al., 2010). Waist circumference was preferred over BMI, since physical activity changes are likely to reduce abdominal obesity even in the absence of weight change (Ross et al., 2000).

Validity and reliability of the measures of the psychosocial constructs. Also social support was self-reported. A limitation of self-reported social support might be that it reflects the intra-individual tendency to perceive the availability of support in general rather than actual support. However, as this environmental aspect is measured as part of a behaviour change intervention and concerns specific situations and behaviour, it might more reliably reflect the actual behaviour of significant others (Schwarzer & Knoll, 2010; Uchino, 2009). Another limitation of the measure by Sallis and colleagues (1987) is that it contains items that may act as markers for physical activity, especially the item “exercised with you”. Ideally a measure of social support should not overlap with measurement of behaviour. However, social support has several aspects: in addition to for example emotional support such as verbal encouragement, social support also involves supportive behaviours on a more concrete level, such as performing the target behaviour together. (See also 5.4.) Hence, eliminating this aspect of support from the measure would also be problematic. Future studies might nevertheless enhance the validity of the measurement of social support by taking into account this potential overlap in the analyses.

The content validity of the barriers self-efficacy scale (Study II) to represent barriers in general might be questioned: the items tap mostly into *emotional* barriers, although the scale could also include items such as “even if my friends would want something else”, “even if I had to work”, “even if the weather would be an obstacle”, or “even if I had to babysit”. The participant should also be offered the possibility to indicate that particular items are not relevant to their life (Baldwin et al., 2006; Choi & Pak, 2005). However, in the literature some studies seem to pay

little attention to the theoretical definition and content of the self-efficacy concept in terms of measurement. Future studies should put more effort into operationalisations of the constructs and carefully planning the measurement instruments. It is difficult to build a body of evidence due to the changing, insufficient and overlapping definitions and names for different types of self-efficacy. Also, when distinguishing between self-efficacy in different phases of the behaviour change process, one must bear in mind that the clinical utility of a theoretical concept might not translate to utility in empirical research (Marlatt et al., 1995). More evidence for phase-specific effects with careful investigation of the operationalisation of the concepts should be accumulated.

Clinical significance and effect sizes should be taken into consideration when evaluating the results of scientific studies. In the current study, the effects – when found – were small to medium in magnitude. Cohen's f^2 is an estimate of the effect size in multiple regression analyses. For example, in Study IV, Model 3 explained only about 1% of the variance (R^2 = 9%) in waist circumference change by 12 months, yielding an effect size f^2 of 0.064, which can be considered small in magnitude. On the other hand, it would be unexpected to have a much larger amount of predicted variance with such a limited number of psychosocial variables, without controlling for many important known environmental, genetic, behavioural and other psychosocial correlates of weight change.

Examining the effect sizes on a more concrete level in Study IV (estimates from Model 3) reveals that an increase of 1 unit in self-efficacy would correspond to a reduction of 3.5 cm in waist circumference (unstandardised effect: -3.495). Hence, the most radical self-efficacy change possible (i.e. from "completely disagree" (1) to "completely agree" (4), 3 units) would indicate a change in waist circumference of 10.5 cm, in the absence of any other predictors. Examining the effect of the agency dimension of personality in a similar fashion, a 1-unit change in agency corresponds to the unstandardised path coefficient estimate on a waist circumference change of –1.90. This would mean that the benefits gained by a completely agentic woman (scoring highest on all items, 5) would be 4 × 1.90 greater than those of a completely non-agentic woman (scoring lowest, 1), resulting in a difference of 7.6 cm. What would the effect size of self-efficacy mean in terms of intervention objectives? If a 5% change in BMI (Hainer et al., 2008) would also apply as an objective to waist circumference, this would mean an average change goal would be 5.2 cm for a woman with the average waist circumference in the sample (102.9 cm). Such a change would be induced by a 1.5 unit change in health related self-efficacy. This signifies half of the scale range, and does not seem feasible. See also Chapter 5.1.2.

Missing constructs. Of course, targeting self-efficacy alone is not assumed to suffice in engendering a relevant change in behaviour: health psychological models assume multiple determinants for behaviours (see Chapter 1.2). For example, the HAPA (Schwarzer, 2008) postulates additional factors such as risk perception and outcome expectancies as distal determinants. These were also targeted in GOAL

LIT. Due to space considerations, thorough measures of several psychosocial constructs could not be included in the questionnaires. The present study might nonetheless have benefited from the possibility of including other psychological constructs in the models, which now included few predictors. This would have allowed investigating their complex interrelationships over time as well as including these partly covarying constructs in the predictive models. Moreover, one fruitful avenue would have been to study the effects of automatic and implicit processes in behaviour change (Wiers et al., 2010). Increasing evidence implies that habitual health behaviours can be changed or cued via explicit cognitive strategies (e.g. Orbell & Verplanken, 2010). Now, the intervention programme was planned based on HAPA, an essentially social cognitive model. Still, some emotional elements are implicitly included in the model; for example, self-efficacy is not only a cold cognition, but involves an emotional component. Future studies should attempt to disentangle the effects and interplay of automatic and conscious processes on health behaviour change at the same time (Wiers et al., 2010).

Other issues. Adherence to intervention protocol was not systematically assessed: it has been shown that delivery of the intervention by facilitators may differ greatly from the protocol (Michie, Hardeman et al., 2008). Moreover, participant adherence to intervention components was not monitored, although analysing the association between intervention adherence and the psychological mediation constructs could be fruitful: it might shed light on the effects of specific intervention components (e.g. specific homework, self-monitoring of eating). Estimating adherence to the planning component from the questionnaires indicated that only a small minority of the participants had not formed any action or coping plans (1.7%–9.6%).

Participants in the GOAL intervention were nested in groups and not independent observations although the present analyses treated them as such. Lack of power limited multilevel analyses. There is however evidence that some facilitator characteristics played a role in the weight loss results: the more intrinsically motivated the facilitators were in the intervention, the better the weight loss results in their group (Absetz, Yoshida, Hankonen, & Valve, 2008; Yoshida, Hankonen, & Absetz, 2006). Similar effects of group leaders, teachers and tutors are well-known (e.g. De Grave, Dolmans, & Van Der Vleuten, 1999) and should be studied more in the context of health interventions as well.

Socioeconomic responses to the intervention might be gender-specific, but unfortunately, the present study was not powered enough to carry out analyses stratified by gender. Many studies have found that the socioeconomic gradients in men's rates of mortality and morbidity are steeper and more consistent than those of women (MacIntyre & Hunt, 1997). Recent analyses of health policy concerning smoking have suggested that while high-SES men benefit from policies more than low-SES men, no socioeconomic differences can be found among women

(Helakorpi, Martelin et al., 2008). Domain and gender differences should be explored in future studies with larger samples.

Despite the limitations, the dissertation has many strengths. The studies extended previous research in several respects. First, I integrated the study of sociodemographic, personality and social cognition variables. Secondly, alternative theoretical models were explicitly contrasted and tested (Studies II and III). Third, dynamic changes in theoretical constructs were modelled instead of using only static variables. Fourth, as outcome variables, both behaviours and an objectively measured indicator of such behaviours were used. Fifth, an exceptionally long follow-up was employed, and it proved to be valuable in pointing out, for example, that all cross-sectionally observed associations do not translate into longitudinal associations and that changes in psychological factors can have prospective associations over many years. The research questions were novel and both theoretically and practically relevant, not only for public health and health promotion, but also for the social psychological theory of behaviour change, and I tested the questions with state-of-the-art statistical methodology in a highly ecologically valid sample and context.

5.3 Implications for clinical practice and public health

Socioeconomic inequalities in health remain a major public health problem in the Western countries and require action across a broad front rather than simple solutions (Marmot, 2006). The results of Study II imply that as long as equal access is guaranteed and all socioeconomic groups are well motivated to participate, individuals from different educational backgrounds can be expected to change their behaviour through similar psychosocial mechanisms. In other words, targeting self-efficacy and planning is equally efficacious in bringing about behaviour change regardless of SES. However, intervention facilitators should take into account that while those with lower SES might have difficulties in enhancing self-efficacy, particularly women with low SES are also likely to lack support in their exercise behaviours and may even be punished for them by their social environment (Hankonen et al., 2007). Additionally, although the key social cognitive determinants in the present study did not show different patterns across socioeconomic groups, a range of other health behaviour determinants that differ by SES (Burton, Turrell, & Oldenburg, 2003) should be taken into account when planning interventions.

A consequence of interactionism (personality – environment/situations) is that therapies and interventions should be tailored to the strengths and weaknesses conferred by traits (Boyle et al., 2008). In line with Study III, most evidence seems to point to the lack of effects of optimism/pessimism traits on weight change. Optimists and pessimists do not even seem to need differential strategies to enhance self-efficacy. The results of this study should encourage health professionals not to

give up on more pessimistic patients – such patients can also be successful in changing their lifestyle provided that their self-efficacy is increased. Improving self-efficacy even among dispositional pessimists helps them lose weight. This aspect of personality does not appear to impact chances of success, even indirectly.

The beneficial effect of agency on women's weight loss performance, demonstrated in Study IV, suggests some practical strategies for interventions. Even though personality traits are rarely seen as malleable (Loehlin et al., 2005), similar personal resources – agentic *behavioural skills* and patterns – can be strengthened. For example, teaching appropriate selfishness and an agentic "cognitive focus on getting the job done" (Bem, 1981, p. 18) for women in interventions might enable them to focus on their weight loss goal pursuit despite the unsupportive social environment. Furthermore, teaching effective strategies to elicit social support might be beneficial, especially for women high in communion.

While theory-based behaviour change interventions fare much better than those without theory (Peters et al., 2009; Webb et al., 2010) more elaborate understanding of the change mechanisms and processes of different subgroups should help create more effective, evidence-based interventions, and thereby also increase cost-effectiveness. It seems that women and men might differ in some contextual, cultural and dispositional prerequisites for health behaviour change; therefore, the interventions should be sensitive to these differences. However, overestimating gender differences should not lead to excessive tailoring by gender, compromising cost-effectiveness. As the effect sizes for the gender differences in this study were rather small, and little other empirical evidence of major gender differences exists, recommending gender-specific or targeted intervention programme planning is unwarranted, at least with regard to the variables investigated in the present study. The "gender similarity hypothesis" suggests that despite the popular belief regarding major differences between men and women, the genders are psychologically more similar than different (Hyde, 2005). Moreover, some of the gender differences can be accounted for by gender role-related personality traits rather than the biological sex. Furthermore, labelling one group, in this case women, as the less successful gender might have a negative impact on their self-efficacy and subsequent performance as the result of a mere social psychological phenomenon (Spencer, Steele, & Quinn, 1999).

Although both Finnish women and men are similarly at risk for diabetes (Peltonen et al., 2006), three out of four of the intervention participants were women. This reflects the fact that women generally make more frequent use of medical services than men do. The lower attendance rate for men implies that something needs to be done in order to attract more men. Earlier research has shown differing motivations and preferences among men for weight loss (Wolfe & Smith, 2002), and as the traditional masculine cultural values disagree with health values (Courtenay, 2000), the social marketing of lifestyle change might need an approach

that appeals to larger male audiences. Perhaps interventions carried out in the workplace setting might reach more men (Abraham & Graham-Rowe, 2009).

Change in self-efficacy proved to be a slightly stronger predictor of one-year reduction of waist circumference than the level of post-intervention self-efficacy, and baseline self-efficacy beliefs were of no importance (Study III). Its effects on waist circumference change prevailed even until three years (Study IV). Therefore, focusing on enhancing self-efficacy early on in interventions should be considered. If a programme fails to increase self-efficacy, perhaps continued monitoring of self-efficacy development during the intervention would enable identifying potential relapsers (Vallis & Bucher, 1986) and then targeting them with increased and additional intervention attempts.

5.4 Implications for research

Numerous suggestions for further research could be pointed out. Below, I outline eight ideas. Firstly, the important role of making high-quality and specific plans for behaviour change is gaining more and more evidence (Sniehotta, 2009). However, planning represents only one facet of self-regulation. To bridge the "plan-behaviour gap" (Sniehotta, 2009), there is a need for action control, comprised of being aware of one's standards, self-monitoring and self-regulatory effort (Sniehotta, Nagy, Scholz, & Schwarzer, 2006). In goal pursuit, it is also important to have tracking, feedback, evaluation and other control mechanisms (Maes & Karoly, 2005). In behaviour change related to physical activity, diet and obesity, evidence is accumulating pointing to the effectiveness of self-monitoring and other self-regulation techniques in weight loss (Linde, Jeffery, French, Pronk, & Boyle, 2005) and diet and physical activity interventions (Michie, Abraham et al., 2009). Self-regulation failure is also a topic in health behaviour (Hagger, Wood, Stiff, & Chatzisarantis, 2009). The relevance of individual trait differences in self-regulation (Tangney et al., 2004), their relationship to socioeconomic status as well as how other personality traits may influence self-regulation processes in health behaviour represent interesting novel questions.

Secondly, it should be noted that although some of the conclusions drawn are on a societal-structural level, concerning women's social role and position, the actual measures used in the present study are largely individual and psychological in nature. In future studies, more empirical measures of social environment, actual barriers and resources (e.g. built environment, time and financial constraints), and family role as well as status indicators should be included in order to confirm or falsify these conclusions. In addition, interpersonal interaction in groups and facilitator characteristics (Absetz, Yoshida et al., 2008) might also play a differing role depending on gender, socioeconomic status or personality.

Furthermore, this study did not distinguish between the types of social support provided by close others. However, social support can take many forms: on the one

hand directive and non-directive or autonomy-supportive (Fisher et al., 1997; Ryan & Deci, 2000), on the other hand informational, emotional and instrumental or tangible (Antonucci, 2001), all of which have different implications for behaviour. In future research, it might be fruitful to establish the role of the *type* of support: whether there are gender differences in the amount and effects of different types of support, and whether women (and men) high in communion benefit equally much from all types of social support. On the other hand, it might be interesting to include measures of *needs for affiliation*, which communal traits signify, when investigating the effects of social support: perhaps social support facilitates behaviour change more for those individuals who display high affiliative needs, e.g. highly communal individuals, especially when those needs are satisfied in a reciprocal manner.

A novel approach to inter-group and inter-individual differences in weight loss comes from a motivation psychology model (Ryan & Deci, 2000). Men and women have different kinds of weight-related problems; e.g. women are more often stigmatised because of their weight than men (Sarlio-Lahteenkorva, Rissanen, & Kaprio, 2000). Because of the different cultural positions of men and women, the motives behind their lifestyle change attempts may differ, and this in turn influences the subsequent cognitive paths to successful change. The fact that women report emotional or lifestyle triggers as a precursor of successful weight loss, while men give more medical reasons or claim that they "just decided to do it" (Klem, Wing, McGuire, Seagle, & Hill, 1997) may reflect differing autonomy in motivation. If women tend to be more externally motivated in their lifestyle change attempts, this influences the goal pursuit process (Ryan & Deci, 2000): autonomous – as opposed to external or controlled – motivation is related to successful adherence to exercise (Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997; Thøgersen-Ntoumani & Ntoumanis, 2006; Wilson, Blanchard, Nehl, & Baker, 2006). A gender difference in autonomous motivation in exercise might be reflected in the gender-specific motive patterns for exercise participation. Indeed, empirical evidence shows that body- or body shape-related motives, which are more common among women (Pingitore, Spring, & Garfield, 1997), are associated with worse psychological outcomes and worse adherence than enjoyment and competence motives, which are more common among men (Frederick & Ryan, 1993; Ryan et al., 1997; Sallis et al., 1999; Segar, Spruijt-Metz, & Nolen-Hoeksema, 2006). The type of motivation could provide interesting insights for the study of gender or SES in health behaviour.

There are few studies on how personality impacts processes and outcomes of health behaviour change interventions. However, whereas some aspects of personality (e.g. dispositional optimism) seem to be irrelevant for some health outcomes such as obesity, others (e.g. the Big Five traits) seem to be at least correlated with diet and physical activity behaviours (Rhodes & Smith, 2006), and agentic traits among women are related to weight change. Agency correlates positively with extraversion, conscientiousness, emotional stability and openness (Helgeson & Fritz, 2000; Lippa, 1995), implying interesting interrelations for future

studies. Whether personality traits moderate the impact of health interventions, and how, i.e. through which more proximal cognitive and emotional pathways, should be investigated more in prospective longitudinal settings in the future.

It has been proposed that men and women are more similar than different psychologically (Hyde, 2005), and the present study also underlines that there are many differences within the sexes (Emslie et al., 1999). As a sixth point I argue that investigating the biological sex alone in health-related phenomena merely scratches the surface and does little to explain the gender differences. The inclusion of psychological gender-role orientation in the present study was important in pointing out that the gender-related, between-women differences (in agency) play a role in weight change. Other researchers have also called for acknowledging within-gender heterogeneity (Emslie, Hunt, & Macintyre, 2002) and the importance of psychological gender (Spence & Buckner, 2000), and the findings of Study IV point to this need for further studies. Including such factors, which would potentially explain more about the mechanisms of simple gender-stratified health outcome statistics, might improve our understanding of gender differences in many health phenomena (*Exploring Concepts of Gender and Health*, 2003).

Seventh, although changes in self-efficacy and coping planning were similarly related to behaviour changes across gender and SES groups, other psychological constructs such as normative beliefs might show differential patterning, as discussed above. Furthermore, although *theoretical determinants* and behaviour are similarly related ("conceptual theory"), different *behaviour change techniques* (theoretical methods) to enhance them might be differentially effective in different demographic groups (cf. Albarracin et al., 2005). Are similar mechanisms effective in producing self-efficacy increases in both women and men as well as those with low and high SES? Only tentative reviews have appeared (Michie, Jochelson et al., 2009). As early increases have a marked impact on temporally distal maintenance, strategies to effectively and intensively enhance initial self-efficacy appear to be important. More "action theory" research is needed to identify behaviour change techniques that can best create dramatic changes in participants' self-perceptions of their capabilities. Such studies may be challenged by the fact that intervention contents are typically recommended to be modified to fit the target population (Bartholomew et al., 2006), and special needs for different groups of people such as men or those with low SES might be taken into account from the start.

Nevertheless, models predicting static levels of behaviour as well as studies of determinants of *behaviour* are ample; it is now important to keep developing the theory of behaviour *change* (Brug et al., 2005). Research is already setting out to define and estimate the efficacy of single behaviour techniques. So far, reviews have tended to link BCTs directly to intervention effects (e.g. Dombrowski et al., in press) or theoretical mediators to intervention effects (e.g. Rhodes & Pfaeffli, 2010), but linking BCTs to psychological theoretical mediators of behaviour change has been more rare (Ashford et al., 2010). However, such analysis of "action theory"

would prove useful to theory development, as it shows whether the assumed psychological factors mediate the effect of a specific technique. Such an aim sets high demands for implementation fidelity and other methodological considerations as well as careful theory-based design (e.g. Michie & Prestwich, 2010).

Finally, although there are no differences between men and women in the mortality consequences of obesity and lifestyle-related diseases, they are equally lethal for both (Singh-Manoux et al., 2008); however, the social consequences of obesity do differ between the genders. Antifat prejudice has more detrimental consequences for women compared to men (Lee, 1998; Wadden & Stunkard, 1985). For example, obese women suffer from income disadvantage compared to their male counterparts (Maranto & Stenoien, 2000; Sarlio-Lahteenkorva, Silventoinen, & Lahelma, 2004). In fact, prejudice and discrimination towards both obese men and obese women has increased in recent years to levels comparable with racism and ageism (Andreyeva, Puhl, & Brownell, 2008). Stigmatisation of the obese damages psychological and physical health, generates health inequalities and hampers intervention (Puhl & Heuer, 2010). This phenomenon generates interesting avenues for social psychological research in the health field: how does such prejudice interfere with obesity reduction attempts, e.g. in the context of interventions?

It must also be noted that out of the many important health behaviours, including alcohol use and smoking, this study focused only on physical activity and diet behaviours. The relationships between psychological constructs and other health behaviours might show gender- and SES-specific patterns as well as interplay with personality traits that differ from those found in the present study.

5.5 Concluding remarks

Kurt Lewin's "*There is nothing more practical than a good theory*" is a classic social psychological quotation that is still cited and accepted widely (e.g. Rothman, 2004). Unfortunately, there is ample anecdotal evidence showing that it is not easy to convince others of the usefulness of theory in medical practice (Suls, Luger, & Martin, 2010): health psychologists working in multidisciplinary teams know that theory is not a sexy word to bring up. Why is this the case? The lay meaning of theory may presume that theory is far removed from real-world concerns and how things actually work (Brug et al., 2005). In contrast, theories are ideally based on empirical evidence. They should be tested, supported and falsified, and theoretical principles refined or rejected constantly (Rothman, 2004), with feedback from theory-based interventions back to theory (Crosby & Noar, 2010) – ideally, in an experimental setting (Craig et al., 2008; Michie & Abraham, 2004). Although the present findings are limited by the correlational nature of the data, this is not an uncommon feature of findings in health psychology (Rothman & Salovey, 2007).

Theory has been said to be one of the most distinctive contributions that psychologists can bring to the health sciences and medical practice (Suls et al.,

2010), as theory represents accumulated evidence and provides an explanation for mechanisms of action, and is therefore helpful in guiding efforts in practice. For this to happen, more systematic research is also needed on how the health psychological evidence can be translated into the areas of practice (Kerner, Rimer, & Emmons, 2005), into the everyday professional routines to aid in health promotion. As health promotion essentially involves changing *behaviours*, such as physical activity and eating, counselling patients may greatly be benefited by the evidence base built in social and health psychology and behavioural medicine. This evidence base, in turn, should be built keeping in mind another quote by Lewin: *"If you want truly to understand something, try to change it.*"

6 Appendix

6.1 Measures for the psychosocial variables

Study I:

Adoption self-efficacy for exercise

I can manage to maintain my exercise regimen

- even if I need a long time to develop the necessary routines
- even if I have to try several times until it works
- even if I have to rethink my entire way of exercising
- even if I do not receive a great deal of support from others when making my first attempts
- even if I have to make a detailed exercising plan

Action planning for exercise

I have made a detailed plan regarding:

- when to exercise
- where to exercise
- how to exercise
- how often to exercise

Social support for physical activity (participation)

How often have people close to you (friends, family or relatives) done or said the following during the past three months:

- exercised with you
- gave you encouragement to stick with your exercise program
- changed their schedule so you could exercise together
- discussed exercise with you
- planned for exercise on recreational outings

Study II:

Barriers self-efficacy regarding healthy diet

How certain are you that you can overcome difficulties related to choosing and adhering to a healthy diet?

I can manage to stick to healthful foods

- even when I have worries and problems
- even if I feel depressed

- even if I feel tense
- even when I am tired
- even when I am busy

Barriers self-efficacy regarding exercise

How certain are you that you can overcome difficulties related to exercise?
I can manage to maintain my exercise regimen

- even when I have worries and problems
- even if I feel depressed
- even if I feel tense
- even when I am tired
- even when I am busy

Coping planning regarding diet

The following questions are related to planning eating habits:
I have made a detailed plan regarding

- what to do if something interferes with my plans
- how to cope with possible setbacks
- how to hold on to healthy eating habits even in difficult situations
- when to be especially alert in order to avoid/prevent relapse/setback

Coping planning regarding exercise

The following questions are related to planning exercise habits:
I have made a detailed plan regarding

- what to do if something interferes with my plans
- how to cope with possible setbacks
- how to hold on to healthy eating habits even in difficult situations
- when to be especially alert in order to avoid/prevent relapse/setback

Study III:

Dispositional optimism (LOT-R)

- In uncertain times, I usually expect the best.
- I'm always optimistic about my future.
- Overall, I expect more good things to happen to me than bad.

Dispositional pessimism (LOT-R)

- If something can go wrong for me, it will.
- I hardly ever expect things to go my way.
- I rarely count on good things happening to me.

Health-related self-efficacy

- I am able to stick to my decisions about a new, healthier lifestyle

- I can take health considerations into account, even when it causes discomfort or a need to give up other important things
- I can lead a healthy lifestyle, even when people around me are indifferent about health
- I can attend health screenings regularly even if it was a bother or the operations were inconvenient
- I can take health considerations into account when planning my life and making decisions
- I can resist temptations when I know they are bad for my health

Study IV

PAQ: items of bipolar characteristics, responses 1–5
e.g. "Not at all independent 1 2 3 4 5 Very independent"

Agency (PAQ)

- Independent
- Active
- Competitive
- Can make decisions easily
- Never gives up
- Very self-confident
- Feels very superior
- Stands up well under pressure

Communion (PAQ)

- Emotional
- Easy to devote self to others
- Gentle
- Helpful
- Kind
- Aware of others' feelings
- Understanding
- Warm

Social support for physical activity (participation)

Below you find a list of things that people might do or say to someone who tries to change their exercise and dietary habits into healthier ones. How often have people close to you (friends, family, or relatives) done or said the following during the past three months?

- exercised with you
- offered to exercise with you
- gave you helpful reminders to exercise ("Are you going to go jogging today?")
- gave you encouragement to stick with your exercise program
- changed their schedule so you could exercise together
- discussed exercise with you
- made positive comments about you for your exercise
- planned for exercise on recreational outings
- helped plan activities around you exercise
- asked you for ideas on how they can get more exercise
- talked about how much they like exercise

6.2 Descriptive statistics

Study I

Table 1. Observed means (*SD*).

	Women (n = 217)		Men (n = 88)	
	Baseline T1	Follow-up T2	Baseline T1	Follow-up T2
Self-efficacy	3.1 (.48)	3.2 (.50)	3.0 (.47)	3.1 (.49)
Action planning	2.6 (.76)	2.9 (.68)	2.4 (.71)	2.7 (.78)
Social support	2.6 (1.00)	2.7 (1.01)	2.8 (1.01)	2.9 (1.05)
Exercise	84.1 (113.7)	84.4 (118.2)	39.9 (79.3)	63.3 (111.6)
Change in self-efficacy		0.07 (.51)		0.04 (.50)
Change in planning		0.31 (.80)		0.25 (.89)

Table 2. Correlation matrix (N = 305).

	1	2	3	4	5	6	7	8	9	10
1. Self-efficacy T1	1									
2. Action planning T1	.38**	1								
3. Social support T1	.14*	.22**	1							
4. Exercise T1	.21*	.25**	.04	1						
5. Self-efficacy T2	.46**	.28**	.15**	.10	1					
6. Action planning T2	.22**	.37**	.20**	.08	.42**	1				
7. Social support T2	.02	.06	.63**	-.03	.14*	.25**	1			
8. Exercise T2	.01	.13*	.07	.27**	.14*	.20**	.14*	1		
9. Change in self-efficacy	-.49**	-.08	.02	-.10	.56*	.20**	.11*	.13*	1	
10. Change in planning	-.15**	-.59**	-.02	.04	.10	.54**	.16**	.05	.24**	1
11. Change in exercise	-.15**	-.09	.02	-.56***	.04	.11	.14*	.65**	.18**	.18**

Study II

Table 3. Observed means and standard deviations for study variables.

	Low SES (n = 108)		High SES (n = 165)	
	Baseline T1	Follow-up T2/3	Baseline T1	Follow-up T2/3
Coping self-efficacy	2.7 (.65)	2.7 (.65)	2.8 (.60)	2.9 (.59)**
Coping planning	2.0 (.73)	2.4 (.76)***	2.1 (.74)	2.4 (.71)***
Exercise, min/week	68.5 (109.7)	88.2 (146.3)	77.0 (110.7)	88.6 (127.1)
Dietary fat, %	30.2 (6.4)	28.8 (5.5)*	29.3 (6.0)	29.7 (6.2)
Change in exercise	-	19.7 (138.7)	-	11.6 (133.7)
Change in dietary fat	-	-1.45 (7.5)	-	0.38 (7.5)

* p <.05, ** p <.01, *** p < .001.

Means were compared using paired t-tests for baseline vs. follow-up within each SES group.

Study III

Table 4. Observed means (SD) for study variables (N = 320).

Waist circumference (cm)		Skewness	Kurtosis
T1	105.1 (12.0)	0.45	0.19
T3	103.5 (12.3)	0.38	0.12
T1-T3 change	-1.65 (5.2)	-0.49	2.42

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References

Abraham, C., & Graham-Rowe, E. (2009). Are worksite interventions effective in increasing physical activity? A systematic review and meta-analysis. *Health Psychology Review, 3*(1), 108-144.

Abraham, C., Kok, G., Schaalma, H. P., & Luszczynska, A. (in press). Health promotion. In *International Association of Applied Psychology: Handbook of Applied Psychology*.

Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology, 27*(3), 379-387.

Abraham, C., Sheeran, P., & Johnston, M. (1998). From health beliefs to self-regulation: Theoretical, advances in the psychology of action control. *Psychology & Health, 13*(4), 569-591.

Absetz, P., Hankonen, N., Valve, R., Oldenburg, B., Fogelholm, M., Talja, M., et al. (unpublished manuscript). Does socioeconomic status predict success in a lifestyle change intervention to prevent type 2 diabetes?

Absetz, P., Oldenburg, B., Hankonen, N., Valve, R., Heinonen, H., Nissinen, A., et al. (2009). Type 2 diabetes prevention in the "real world": Three-year results of the GOAL Implementation Trial. *Diabetes Care, 32*(8), 1418-1420.

Absetz, P., Valve, R., Oldenburg, B., Heinonen, H., Nissinen, A., Fogelholm, M., et al. (2007). Type 2 diabetes prevention in the "real world": One-year results of the GOAL Implementation Trial. *Diabetes Care, 30*(10), 2465-2470.

Absetz, P., Valve, R., Oldenburg, B., Heinonen, H., Nissinen, A., Fogelholm, M., et al. (2008). Outcomes of Diabetes Prevention Study partly achieved by lifestyle intervention. *Finnish Medical Journal, 63*, 2065–2070.

Absetz, P., Yoshida, S., Hankonen, N., & Valve, R. (2008). Ryhmänohjaajan roolin ja käsitysten yhteys ohjattavien onnistumiseen elintapamuutoksessa. [Facilitators' perceptions of group and their own role: Associations with group success in lifestyle change]. *Hoitotiede, 5*, 248-257.

Acheson, D. (1998). *Independent Inquiry into Inequalities in Health: Report*. London: HMSO.

Adams, C. H., & Sherer, M. (1985). Sex-role orientation and psychological adjustment: Implications for the masculinity model. *Sex Roles, 12*(11-12), 1211-1218.

Adams, J., & White, M. (2007). Are the stages of change socioeconomically distributed? A scoping review. *American Journal of Health Promotion, 21*(4), 237-247.

Adler, N. E., Boyce, W. T., Chesney, M. A., Cohen, S., Folkman, S., Kahn, R. L., et al. (1994). Socioeconomic status and health: The challenge of the gradient. *American Psychologist, 41*(1), 15-24.

Aiken, L. S., & West, S. G. (1991). Multiple regression: testing and interpreting interactions: SAGE.

Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes, 50*, 179 - 211.

Albarracín, D., Gillette, J. C., Earl, A. N., Glasman, L. R., Durantini, M. R., & Ho, M.-H. (2005). A Test of Major Assumptions About Behavior Change: A Comprehensive Look at the Effects of Passive and Active HIV-Prevention Interventions Since the Beginning of the Epidemic. *Psychological Bulletin, 131*(6), 856-897.

Allgöwer, A., Wardle, J., & Steptoe, A. (2001). Depressive symptoms, social support, and personal health behaviors in young men and women. *Health Psychology, 20*(3), 223-227.

American Diabetes Association. (2010). Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care, 33*(Supplement 1), S62-S69.

American Psychological Association: Task Force on Socioeconomic Status. (2007). *Report of the APA Task Force on Socioeconomic Status*. Washington, DC: American Psychological Association.

Andreyeva, T., Puhl, R. M., & Brownell, K. D. (2008). Changes in Perceived Weight Discrimination Among Americans, 1995-1996 Through 2004-2006. *Obesity, 16*(5), 1129-1134.

Annandale, E., & Hunt, K. (1990). Masculinity, femininity and sex: An exploration of their relative contribution to explaining gender differences in health. *Sociology of Health and Illness, 12*(1), 24-46.

Annesi, J. J. (2007). Relations of age with changes in self-efficacy and physical self-concept in preadolescents participating in a physical activity intervention during afterschool care. *Perceptual and Motor Skills, 105*(1), 221-226.

Antonucci, T. C. (2001). Social Support, Psychology of. In J. S. Neil & B. B. Paul (Eds.), *International Encyclopedia of the Social & Behavioral Sciences* (pp. 14465-14469). Oxford: Pergamon.

Araujo-Soares, V., McIntyre, T., MacLennan, G., & Sniehotta, F. F. (2009). Development and exploratory cluster-randomised opportunistic trial of a theory-based intervention to enhance physical activity among adolescents. *Psychology & Health, 24*(7), 805-822.

Arber, S. (2001). Gender and Physical Health. In N. Smelser, J. & P. B. Baltes (Eds.), *International Encyclopedia of the Social &Behavioral Sciences* (pp. 5960-5965). Oxford: Pergamon.

Armitage, C. (2003). The relationship between multidimensional health locus of control and perceived behavioural control: How are distal perceptions of control related to proximal perceptions of control? *Psychology & Health, 18*, 723-738.

Armitage, C. J. (2006). Evidence that implementation intentions promote transitions between the stages of change. *Journal of Consulting and Clinical Psychology, 74*(1), 141-151.

Armitage, C. J., & Conner, M. (2000). Social cognition models and health behaviour: A structured review. *Psychology & Health, 15*(2), 173.

Ashford, S., Edmunds, J., & French, D. P. (2010). What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review with meta-analysis. *British Journal of Health Psychology, 15* (Pt 2), 265-288.

Avendano, M., Kunst, A. E., Huisman, M., Lenthe, F. V., Bopp, M., Regidor, E., et al. (2006). Socioeconomic status and ischaemic heart disease mortality in 10 western European populations during the 1990s. *Heart, 92*, 461-467.

Bakan, D. (1966). *The duality of human existence*. Chicago: Rand McNally.

Baldwin, A. S., Rothman, A. J., Hertel, A. W., Linde, J. A., Jeffery, R. W., Finch, E. A., et al. (2006). Specifying the determinants of the initiation and maintenance of behavior change: An examination of self-efficacy, satisfaction, and smoking cessation. *Health Psychology, 25*(5), 626-634.

Ball, K., & Crawford, D. (2005). Socioeconomic status and weight change in adults: a review. *Social Science & Medicine, 60*(9), 1987-2010.

Bandalos, D. L., & Finney, S. J. (2001). Item parcelling issues in structural equation modelling. In G. A. Marcoulides & R. E. Shumaker (Eds.), *Advanced structural equation modelling: New developments and techniques* (pp. 269-296). Mahwah, NJ: Erlbaum.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review 84*(2), 191-215.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Upper Saddle River, NJ: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman & Co.

Bandura, A. (2004). Health Promotion by Social Cognitive Means. *Health Education and Behavior, 31*(2), 143-164.

Baranowski, T., Anderson, C., & Carmack, C. (1998). Mediating variable framework in physical activity interventions: How are we doing? how might we do better? *American Journal of Preventive Medicine, 15*(4), 266-297.

Bartholomew, L. K., Parcel, G. S., Kok, G., & Gottlieb, N. H. (2006). *Planning health promotion programs. An intervention mapping approach* (2. ed.). San Francisco: Jossey-Bass.

Bassoff, E. S., & Glass, G. V. (1982). The Relationship between Sex Roles and Mental Health: A Meta-Analysis of Twenty-Six Studies. *The Counseling Psychologist, 10*(4), 105-112.

Baum, J. R., & Locke, E. A. (2004). The Relationship of Entrepreneurial Traits, Skill, and Motivation to Subsequent Venture Growth. *Journal of Applied Psychology, 89*(4), 587-598.

Baumeister, R. F., & Vohs, K. D. (2004). *Handbook of self-regulation: Research, theory and applications.* New York: Guilford Press.

Bem, S. L. (1974). The measurement of psychological androgyny. *Journal of Consulting and Clinical Psychology, 42*, 155-162.

Benyamini, Y., & Raz, O. (2007). 'I Can Tell You If I'll Really Lose All That Weight': Dispositional and Situated Optimism as Predictors of Weight Loss Following a Group Intervention. *Journal of Applied Social Psychology, 37*(4), 844-861.

Block, J. P., He, Y., Zaslavsky, A. M., Ding, L., & Ayanian, J. Z. (2009). Psychosocial Stress and Change in Weight Among US Adults. *American Journal of Epidemiology*, kwp104.

Bogg, T., & Roberts, B. W. (2004). Conscientiousness and Health-Related Behaviors: A Meta-Analysis of the Leading Behavioral Contributors to Mortality. *Psychological Bulletin, 130*(6), 887-919.

Boniface, D. R., Cottee, M. J., Neal, D., & Skinner, A. (2001). Social and demographic factors predictive of change over seven years in CHD-related behaviours in men aged 18-49 years. *Public Health, 115*(4), 246-252.

Booth-Kewley, S., & Vickers Jr, R. R. (1994). Associations Between Major Domains of Personality and Health Behavior. *Journal of Personality, 62*(3), 281-298.

Boyle, G. J., Matthews, G., & Saklofske, D. H. (2008). Personality theories and models: An overview. In G. J. Boyle, G. Matthews & D. H. Saklofske (Eds.), *The SAGE Handbook of Personality Theory and Assessment* (pp. 1-29). London: SAGE.

Brahler, E., & Maier, H. (2001). Men's Health. In N. Smelser, J. & P. B. Baltes (Eds.), *International Encyclopedia of the Social and Behavioral Sciences* (pp. 9625-9628). Oxford: Pergamon.

Brems, C., & Johnson, M. E. (1989). Problem-Solving Appraisal and Coping Style: The Influence of Sex-Role Orientation and Gender. *Journal of Psychology, 123*(2), 187.

Bromberger, J. T., & Matthews, K. A. (1996). A "Feminine" Model of Vulnerability to Depressive Symptoms: A Longitudinal Investigation of Middle-Aged Women. *Journal of Personality and Social Psychology, 70*(3), 591-598.

Brug, J., Oenema, A., & Ferreira, I. (2005). Theory, evidence and Intervention Mapping to improve behavior nutrition and physical activity interventions. *International Journal of Behavioral Nutrition and Physical Activity, 2*(1), 2.

Buckworth, J., & Dishman, R. K. (2007). Exercise adherence. In G. Tenenbaum & R. C. Ecklund (Eds.), *Handbook of sports psychology (3rd ed.)*. Hoboken, NJ: John C. Wiley & Sons, Inc.

Bunde, J., & Suls, J. (2006). A Quantitative Analysis of the Relationship Between the Cook-Medley Hostility Scale and Traditional Coronary Artery Disease Risk Factors. *Health Psychology, 25*(4), 493-500.

Burton, N. W., Turrell, G., & Oldenburg, B. (2003). Participation in recreational physical activity: why do socioeconomic groups differ? *Health Education & Behavior, 30*(2), 225-244.

Campbell, M., Fitzpatrick, R., Haines, A., Kinmonth, A. L., Sandercock, P., Spiegelhalter, D., et al. (2000). Framework for design and evaluation of complex interventions to improve health. *BMJ, 321*(7262), 694-696.

Carver, C. S. (2007). Dispositional optimism. In *Health behavior constructs: Theory, measurement, and research: National Cancer Institute Website.* http://dccps.cancer.gov/brp/constructs/dispositional_optimism/index.html.

Carver, C. S., & Scheier, M. F. (1982). Control theory: A useful conceptual framework for personality-social, clinical and health psychology. *Psychological Bulletin, 92*, 111-135.

Carver, C. S., & Scheier, M. F. (1998). Control theory: A useful conceptual framework for personality-social, clinical and health psychology. *Psychological Bulletin, 92*, 111-135.

Carver, C. S., & Scheier, M. F. (1999). Themes and issues in the self-regulation of behaviour. In R. S. Wyer, Jr. (Ed.), *Perspectives on behavioral self-regulation*. Mahwah, NJ: Lawrence Erlbaum Associates.

Cavelaars, A. E., Kunst, A. E., Geurts, J. J., Crialesi, R., Grotvedt, L., Helmert, U., et al. (1998). Differences in self reported morbidity by educational level: a comparison of 11 western European countries. *Journal of Epidemiology and Community Health, 52*(4), 219-227.

Cerin, E., Barnett, A., & Baranowski, T. (2009). Testing Theories of Dietary Behavior Change in Youth Using the Mediating Variable Model with Intervention Programs. *Journal of Nutrition Education and Behavior, 41*(5), 309-318.

Chen, H.-T. (1990). *Theory-driven evaluations*. Newbury Park, CA: Sage Publications, Inc.

Cheng, C. (1999). Gender-role differences in susceptibility to the influence of support availability on depression. *Journal of Personality, 67*(3), 439-467.

Choi, B. C. K., & Pak, A. W. P. (2005). A Catalog of Biases in Questionnaires. *Preventing Chronic Disease, 2*(1), A13.

Choi, N. (2004). Sex Role Group Differences in Specific, Academic, and General Self-Efficacy. *Journal of Psychology, 138*(2), 149-159.

Clark, D. O., Patrick, D. L., Grembowski, D., & Durham, M. L. (1995). Socioeconomic status and exercise self-efficacy in late life. *Journal of Behavioral Medicine, 18*(4), 355-376.

Conner, M., & Armitage, C. J. (1998). The theory of planned behaviour: A review and avenues for further research. *Journal of Applied Social Psychology, 28*, 1430-1464.

Courtenay, W. H. (2000). Constructions of masculinity and their influence on men's well-being: a theory of gender and health. *Social Science and Medicine, 50*(10), 1385-1401.

Cozzarelli, C. (1993). Personality and self-efficacy as predictors of coping with abortion. *Journal of Personality and Social Psychology 65*, 1224-1236.

Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2008). Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ, 337*.

Crosby, R., & Noar, S. (2010). Theory development in health promotion: are we there yet? *Journal of Behavioral Medicine, 33*(4), 259-263.

Cutrona, C. E. (1996). *Social support in couples*. Thousand Oaks, CA: Sage.

Danoff-Burg, S., Mosher, C. E., & Grant, C. A. (2006). Relations of agentic and communal personality traits to health behavior and substance use among college students. *Personality and Individual Differences, 40*(2), 353-363.

Davidson, K. W., Goldstein, M., Kaplan, R. M., Knatterud, G. L., Orleans, C. T., Spring, B., et al. (2003). Evidence-Based Behavioral Medicine: What Is It and How Do We Achieve It? *Annals of Behavioral Medicine, 26*(3), 161-171.

de Bruijn, G.-J., Kremers, S. P. J., van Mechelen, W., & Brug, J. (2005). Is personality related to fruit and vegetable intake and physical activity in adolescents? *Health Education Research, 20*(6), 635-644.

De Grave, W. S., Dolmans, D. H. J. M., & Van Der Vleuten, C. P. M. (1999). Profiles of effective tutors in problem-based learning: scaffolding student learning. *Medical Education, 33*(12), 901-906.

Des Jarlais, D. C., Lyles, C., Crepaz, N., & the, T. G. (2004). Improving the Reporting Quality of Nonrandomized Evaluations of Behavioral and Public Health Interventions: The TREND Statement. *American Journal of Public Health, 94*(3), 361-366.

Despres, J.-P., & Lemieux, I. (2006). Abdominal obesity and metabolic syndrome. *Nature, 444*(7121), 881-887.

Dishman, R. K., Motl, R. W., Saunders, R., Felton, G., Ward, D. S., Dowda, M., et al. (2004). Self-efficacy partially mediates the effect of a school-based physical-activity intervention among adolescent girls. *Preventive Medicine, 38*(5), 628-636.

Dombrowski, S., Sniehotta, F. F., Avenell, A., Johnston, M., MacLennan, G., & Araújo-Soares, V. (in press). Identifying active ingredients in complex behavioural interventions for obese adults with obesity-related comorbidities or additional risk factors for co-morbidities: A systematic review. *Health Psychology Review*.

Donnelly, J. E., Smith, B., Jacobsen, D. J., Kirk, E., DuBose, K., Hyder, M., et al. (2004). The role of exercise for weight loss and maintenance. *Best Practice & Research Clinical Gastroenterology, 18*(6), 1009-1029.

Eccles, M., Grimshaw, J., Johnston, M., Steen, N., Pitts, N., Thomas, R., et al. (2007). Applying psychological theories to evidence-based clinical practice: Identifying factors predictive of managing upper respiratory tract infections without antibiotics. *Implementation Science, 2*(1), 26.

Emslie, C., Hunt, K., & Macintyre, S. (1999). Problematizing gender, work and health: the relationship between gender, occupational grade, working conditions and minor morbidity in full-time bank employees. *Social Science and Medicine, 48*(1), 33-48.

Emslie, C., Hunt, K., & Macintyre, S. (2002). How similar are the smoking and drinking habits of men and women in non-manual jobs? *European Journal of Public Health, 12*(1), 22-28.

Exploring Concepts of Gender and Health. (2003). Retrieved 21.3.2006, from http://www.hc-sc-gc.ca/english/women/exploringconcepts.htm

Ferrer, E., & McArdle, J. J. (2010). Longitudinal Modeling of Developmental Changes in Psychological Research. *Current Directions in Psychological Science, 19*(3), 149-154.

Fishbein, M., Triandis, H. C., Kanfer, F. H., Becker, M. H., Middlestadt, S. E., & Eichler, A. (2001). Factors influencing behavior and behavior change. In A. Baum, T. A. Revenson & J. E. Singer (Eds.), *Handbook of Health Psychology*. Mahwah, NJ: Lawrence Erlbaum Associates.

Fisher, E. B., La Greca, A. M., Greco, P., Arfken, C., & Schneiderman, N. (1997). Directive and Nondirective Social Support in Diabetes Management. *International Journal of Behavioral Medicine, 4*(2), 131 - 144.

Fogelholm, M., Valve, R., Absetz, P., Heinonen, H., Uutela, A., Patja, K., et al. (2006). Rural-urban differences in health and health behaviour: A baseline description of a community health-promotion programme for the elderly. *Scandinavian Journal of Public Health, 34*(6), 632-640.

Fontaine, K. R., & Cheskin, L. J. (1999). Optimism and obesity treatment outcomes. *Journal of Clinical Psychology, 55*(1), 141-143.

Franks, P., Chapman, B., Duberstein, P., & Jerant, A. (2009). Five factor model personality factors moderated the effects of an intervention to enhance chronic disease management self-efficacy. *British Journal of Health Psychology, 14*(3), 473-487.

Frederick, C. M., & Ryan, R. M. (1993). Differences in motivation for sport and exercise and their relations with participation and mental health. *Journal of Sport Behavior, 16*(3), 124-146.

Fredrickson, B. L. (2001). The Role of Positive Emotions in Positive Psychology : The Broaden-and-Build Theory of Positive Emotions. *American Psychologist, 56*(3), 218.

French, D. R., & Sutton, S. (2010). Reactivity of measurement in health psychology: How much of a problem is it? What can be done about it? *British Journal of Health Psychology, 15*(3), 453-468.

French, S. A., Jeffery, R. W., & Wing, R. R. (1994). Sex differences among participants in a weight-control program. *Addictive Behaviors, 19*(2), 147-158.

Fritz, H. L. (2000). Gender-linked personality traits predict mental health and functional status following a first coronary event. *Health Psychology, 19*(5), 420-428.

Fritz, H. L., & Helgeson, V. S. (1998). Distinctions of unmitigated communion from communion: Self-neglect and overinvolvement with others. *Journal of Personality and Social Psychology, 75*(1), 121-140.

Gardner, B., Whittington, C., McAteer, J., Eccles, M. P., & Michie, S. (2010). Using theory to synthesise evidence from behaviour change interventions: The example of audit and feedback. *Social Science and Medicine, 70*(10), 1618-1625.

Geers, A. L., Wellman, J. A., & Lassiter, G. D. (2009). Dispositonal optimism and engagement: The moderating effect of goal prioritization. *Journal of Personality and Social Psychology 96*(913-932).

Ghaed, S. G., & Gallo, L. C. (2006). Distinctions Among Agency, Communion, and Unmitigated Agency and Communion According to the Interpersonal Circumplex, Five-Factor Model, and Social-Emotional Correlates. *Journal of Personality Assessment, 86*(1), 77-88.

Gillies, C. L., Abrams, K. R., Lambert, P. C., Cooper, N. J., Sutton, A. J., Hsu, R. T., et al. (2007). Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: Systematic review and meta-analysis. *BMJ: British Medical Journal, 334*(7588), 1-10.

Giltay, E.-J., Geleijnse, J.-M., Zitman, F.-G., Hoekstra, T., & Schouten, E.-G. (2004). Dispositional optimism and all-cause and cardiovascular mortality in a prospective cohort of elderly dutch men and women. *Archives of General Psychiatry, 61*(11), 1126-1135.

Giltay, E. J., Geleijnse, J. M., Zitman, F. G., Buijsse, B., & Kromhout, D. (2007). Lifestyle and dietary correlates of dispositional optimism in men: The Zutphen Elderly Study. *Journal of Psychosomatic Research, 63*(5), 483-490.

Glasgow, R. E., Vogt, T. M., & Boles, S. M. (1999). Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *American Journal of Public Health, 89*(9), 1322-1327.

Godin, G., Sheeran, P., Conner, M., langer-Gravel, A., Gallani, M. C., B. J., & Nolin, B. (2010). Social structure, social cognition, and physical activity: A test of four models. *British Journal of Health Psychology, 15*, 79-95.

Goldman, D. P., & Smith, J. P. (2002). Can patient self-management help explain the SES health gradient? *Proceedings of the National Academy of Sciences of the United States of America, 99*(16), 10929-10934.

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist 54*(7), 493-503.

Gollwitzer, P. M., & Brandstätter, V. (1997). Implementation Intentions and Effective Goal Pursuit. *Journal of Personality and Social Psychology, 73*(1), 186.

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology, 38*, 69-119.

Gough, B. (2007). 'Real men don't diet': An analysis of contemporary newspaper representations of men, food and health. *Social Science & Medicine, 64*(2), 326-337

Govil, S. R., Weidner, G., Merritt-Worden, T., & Ornish, D. (2009). Socioeconomic Status and Improvements in Lifestyle, Coronary Risk Factors, and Quality of Life: The Multisite Cardiac Lifestyle Intervention Program. *American Journal of Public Health, 99*(7), 1263-1270.

Graham, J. W. (2003). Adding missing-data-relevant variables to FIML-based structural equation models. *Structural Equation Modeling, 10*, 80-100.

Graham, J. W. (2009). Missing Data Analysis: Making It Work in the Real World. *Annual Review of Psychology, 60*(1), 549-576.

Grandes, G., Sanchez, A., Torcal, J., Sanchez-Pinilla, R., Lizarraga, K., Serra, J., et al. (2008). Targeting physical activity promotion in general practice: Characteristics of inactive patients and willingness to change. *BMC Public Health, 8*(1), 172.

Greaves, C. J., Reddy, P., & Sheppard, K. (2010). Supporting behaviour change for diabetes prevention. In P. E. H. Schwarz, P. Reddy, C. J. Greaves, J. A. Dunbar & J. Schwarz (Eds.), *Diabetes Prevention in Practice*. Dresden: TUMAINI Institute for Prevention Management.

Green, L. W., & Kreuter, M. W. (2005). *Health program planning: An educational and ecological approach* (4. ed.). New York: McGraw-Hill.

Gurin, P., Gurin, G., & Morrison, B. M. (1978). Personal and ideological aspects of internal and external control. *Social Psychology, 41*(4), 275-296.

Gutiérrez-Doña, B., Lippke, S., Renner, B., Kwon, S., & Schwarzer, R. (2009). Self-Efficacy and Planning Predict Dietary Behaviors in Costa Rican and South Korean Women: Two Moderated Mediation Analyses. *Applied Psychology: Health & Well-Being, 1*(1), 91-104.

Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. L. D. (2009). The strength model of self-regulation failure and health-related behaviour. *Health Psychology Review, 3*(2), 208-238.

Hainer, V., Toplak, H., & Mitrakou, A. (2008). Treatment modalities of obesity. *Diabetes Care, 31*(Supplement 2), S269-S277.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis* (6. ed.). Upper Saddle River, NJ: Prentice Hall.

Hankonen, N., Absetz, P., Ghisletta, P., Renner, B., & Uutela, A. (2010). Gender differences in social cognitive determinants of exercise adoption. *Psychology & Health, 25*(1), 55 - 69.

Hankonen, N., Absetz, P., Haukkala, A., & Uutela, A. (2009). Socioeconomic status and psychosocial mechanisms of lifestyle change in a type 2 diabetes prevention trial. *Annals of Behavioral Medicine, 38*(2), 160-165.

Hankonen, N., Absetz, P., & Uutela, A. (2007). Psychosocial changes contributing to lifestyle improvement: Are there socioeconomic differences? *European Journal of Public Health, 17*(Suppl. 2), 169–170.

Hankonen, N., Vollmann, M., Renner, B., & Absetz, P. (2010). What is setting the stage for abdominal obesity reduction? A comparison between personality and health-related social cognitions. *Journal of Behavioral Medicine, 33*(5), 415-422.

Hardeman, W., Griffin, S., Johnston, M., Kinmonth, A. L., & Wareham, N. J. (2000). Interventions to prevent weight gain: a systematic review of psychological models and behaviour change methods. *International Journal of Obesity, 24*(2), 131-143.

Haskell, W. L., Lee, I. M., Pate, R. R., Powell, K. E., Blair, S. N., Franklin, B. A., et al. (2007). Physical Activity and Public Health: Updated Recommendation for Adults From the American College of Sports Medicine and the American Heart Association. *Circulation, 116*(9), 1081-1093.

Helakorpi, S., Laitalainen, E., & Uutela, A. (2010). *Health behaviour and health among the Finnish adult population, Spring 2009. National Institute for Health and Welfare (THL), Report 7/2010*. Helsinki.

Helakorpi, S., Martelin, T., Torppa, J., Vartiainen, E., Uutela, A., & Patja, K. (2008). Impact of the 1976 Tobacco Control Act in Finland on the proportion of ever daily smokers by socioeconomic status. *Preventive Medicine, 46*(4), 340-345.

Helakorpi, S., Prättälä, R., & Uutela, A. (2008). *Health Behaviour and Health among the Finnish Adult Population, Spring 2007*.

Helgeson, V. S. (1993). Implications of Agency and Communion for Patient and Spouse Adjustment to a First Coronary Event. *Journal of Personality and Social Psychology, 64*(5), 807-816.

Helgeson, V. S. (1994). Relation of agency and communion to well-being: Evidence and potential explanations. *Psychological Bulletin 116*(3), 412–428.

Helgeson, V. S., & Fritz, H. L. (1999). Unmitigated agency and unmitigated communion: Distinctions from agency and communion. *Journal of Research in Personality, 33*, 131-158.

Helgeson, V. S., & Fritz, H. L. (2000). The implications of unmitigated agency and unmitigated communion for domains of problem behavior. *Journal of Personality, 68*(6), 1031-1057.

Helgeson, V. S., & Lepore, S. J. (1997). Men's Adjustment to Prostate Cancer: The Role of Agency and Unmitigated Agency. *Sex Roles, 37*(3), 251-267.

Hepp, U., Spindler, A., & Milos, G. (2005). Eating disorder symptomatology and gender role orientation. *International Journal of Eating Disorders, 37*(3), 227-233.

Heyward, V. H. (2010). *Advanced Fitness Assessment and Exercise Prescription* (6th ed.). Champaign, IL: Human Kinetics.

Hibbard, J. H., & Pope, C. R. (1983). Gender roles, illness orientation and use of medical services. *Social Science and Medicine, 17*(3), 129-137.

Hirokawa, K., & Dohi, I. (2007). Agency and communion related to mental health in Japanese young adults *Sex Roles, 56*(7/8), 517-524.

Horn, J. L., & McArdle, J. J. (1992). A practical and theoretical guide to measurement invariance in aging research. *Experimental Aging Research, 18*, 117-144.

Huisman, M., Kunst, A. E., Bopp, M., Borgan, J.-K., Borrell, C., Costa, G., et al. (2005). Educational inequalities in cause-specific mortality in middle-aged and older men and women in eight western European populations. *The Lancet, 365*(9458), 493-500.

Hunt, K., & Annandale, E. (1993). Just the job? Is the relationship between health and domestic and paid work gender-specific? *Sociology of Health and Illness, 15*(5), 632-664.

Hunt, K., Lewars, H., Emslie, C., & Batty, G. D. (2007). Decreased risk of death from coronary heart disease amongst men with higher 'femininity' scores: a general population cohort study. *International Journal of Epidemiology, 36*(3), 612-620.

Hunter, M. S., & Rosairo, M. (2010). Gender, health and illness. In D. P. French, K. Vedhara, A. A. Kaptein & J. Weinman (Eds.), *Health Psychology*. Oxford: BPS Blackwell.

Hurley, J. R. (1998). Agency and communion as related to 'Big Five' self-representations. *Journal of Psychology, 132*(3), 337.

Huselid, R. F., & Cooper, M. L. (1994). Gender Roles as Mediators of Sex Differences in Expressions of Pathology. *Journal of Abnormal Psychology, 103*(4), 595-603.

Hyde, J. S. (2005). The gender similarities hypothesis. *American Psychologist, 60*(6), 581-592.

International Diabetes Federation. (2009). *IDF Diabetes Atlas*. Retrieved September 19, 2009, from http://www.diabetesatlas.org/

Ironson, G., Fletcher, M. A., Schneiderman, N., O'Cleirigh, C., Balbin, E., Stuetzle, R., et al. (2005). Dispositional optimism and the mechanisms by which it predicts slower disease progression in HIV: proactive behavior, avoidant coping, and depression. *Int J Behav Med, 12*(2), 86-97.

John, B., Alwyn, T., Hodgson, R. J., & Phillips, C. J. (2008). Gender-role orientation and alcohol treatment outcome. *Journal of Applied Social Psychology, 38*(8), 2179-2194.

Joseph, K. S. (1989). The Matthew effect in health development. *BMJ: British Medical Journal (International edition), 298*(6686), 1497-1498.

Kaplan, M. S., & Marks, G. (1995). Appraisal of health risks: the roles of masculinity, femininity, and sex. *Sociology of Health and Illness, 17*(2), 206-221.

Kaplan, R. M. (1990). Behavior as the central outcome in health care. *American Psychologist, 45*(11), 1211-1220.

Kelloniemi, H., Ek, E., & Laitinen, J. (2005). Optimism, dietary habits, body mass index and smoking among young Finnish adults. *Appetite, 45*(2), 169-176.

Kerner, J., Rimer, B., & Emmons, K. (2005). Dissemination research and research dissemination: how can we close the gap? *Health Psychology, 24*(5), 443.

Khaw, K.-T., Wareham, N., Bingham, S., Welch, A., Luben, R., & Day, N. (2008). Combined Impact of Health Behaviours and Mortality in Men and Women: The EPIC-Norfolk Prospective Population Study. *PLoS Med, 5*(1), e12.

Kivimäki, M., Helenius, H., Singh-Manoux, A., Vahtera, J., Elovainio, M., & Pentti, J. (2005). Optimism and pessimism as predictors of change in health after death or onset of severe illness in family. *Health Psychology, 24*(4), 413-421.

Klem, M. L., Wing, R. R., McGuire, M. T., Seagle, H. M., & Hill, J. O. (1997). A descriptive study of individuals successful at long-term maintenance of substantial weight loss. *Am J Clin Nutr, 66*(2), 239-246.

Knittle, K., Warner, L. M., Ziegelmann, J. P., Schüz, B., & Wurm, S. (2010). *Sources of Self-Efficacy for Exercise in Older Adults with Multiple Chronic Conditions*. Paper presented at the Conference of the European Health Psychology Society.

Knowler, W. C., Barrett-Connor, E., Fowler, S. E., Hamman, R. F., Lachin, J. M., Walker, E. A., et al. (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin.[see comment]. *New England Journal of Medicine, 346*(6), 393-403.

Kok, G., Gottlieb, N. H., Commers, M., & Smerecnik, C. (2008). The Ecological Approach in Health Promotion Programs: A Decade Later. *American Journal of Health Promotion, 22*(6), 437-442.

Koskinen, S., Martelin, T., Sainio, P., Heliövaara, M., Reunanen, A., & Lahelma, E. (2007). Pitkäaikaissairastavuus [Chronic disease prevalence]. In H. Palosuo, S. Koskinen, E. Lahelma, R. Prättälä, T. Martelin, A. Ostamo, I. Keskimäki, M. Sihto, K. Takala, E. Hyvönen & E. Linnanmäki (Eds.), *Terveyden eriarvoisuus Suomessa [Health inequalities in Finland]*. Helsinki: Ministry of Social Affairs and Health.

Krieger, N., Williams, D. R., & Moss, N. E. (1997). Measuring social class in US public health research: concepts, methodologies, and guidelines. *Annual Review of Public Health, 18*, 341-378.

Laaksonen, D. E., Lindström, J., Lakka, T. A., Eriksson, J. G., Niskanen, L., Wikstrom, K., et al. (2005). Physical activity in the prevention of type 2 diabetes: The Finnish Diabetes Prevention Study. *Diabetes, 54*(1), 158-165.

Laaksonen, M., Prattala, R., Helasoja, V., Uutela, A., & Lahelma, E. (2003). Income and health behaviours. Evidence from monitoring surveys among Finnish adults. *Journal of Epidemiology and Community Health, 57*(9), 711-717.

Laaksonen, M., Talala, K., Martelin, T., Rahkonen, O., Roos, E., Helakorpi, S., et al. (2007). Health behaviours as explanations for educational level differences in cardiovascular and all-cause mortality: a follow-up of 60 000 men and women over 23 years. *European Journal of Public Health, 18*(1), 38-43.

Lahelma, E., Martikainen, P., Rahkonen, O., & Silventoinen, K. (1999). Gender differences in illhealth in Finland: patterns, magnitude and change. *Social Science & Medicine, 48*(1), 7-19.

Lakerveld, J., Ijzelenberg, W., van Tulder, M., Hellemans, I., Rauwerda, J., van Rossum, A., et al. (2008). Motives for (not) participating in a lifestyle intervention trial. *BMC Medical Research Methodology, 8*(1), 17.

Lantz, P. M., House, J. S., Lepkowski, J. M., Williams, D. R., Mero, R. P., & Chen, J. (1998). Socioeconomic factors, health behaviors, and mortality: Results from a nationally representative prospective study of US adults. *Journal of the American Medical Association, 279*(21), 1703-1708.

Law, C., Power, C., Graham, H., & Merrick, D. (2007). Obesity and health inequalities. *Obesity reviews, 8*(s1), 19-22.

Lee, C. (1998). *Women's health: psychological and social perspectives*. Thousand Oaks: Sage.

Lee, S., Kuk, J. L., Davidson, L. E., Hudson, R., Kilpatrick, K., Graham, T. E., et al. (2005). Exercise without weight loss is an effective strategy for obesity reduction in obese individuals with and without Type 2 diabetes. *Journal of Applied Physiology, 99*(3), 1220-1225.

Lefkowitz, E. S., & Zeldow, P. B. (2006). Masculinity and Femininity Predict Optimal Mental Health: A Belated Test of the Androgyny Hypothesis. *Journal of Personality Assessment, 87*(1), 95-101.

Leventhal, H., Singer, R., & Jones, S. (1965). Effects of fear and specificity of recommendation upon attitudes and behavior. *Journal of Personality and Social Psychology 2*(1), 20-29.

Lewis, M. A., & Rook, K. S. (1999). Social control in personal relationships: Impact on health behaviors and psychological distress. *Health Psychology, 18*(1), 63-71.

Linde, J. A., Jeffery, R., French, S., Pronk, N., & Boyle, R. (2005). Self-weighing in weight gain prevention and weight loss trials. *Annals of Behavioral Medicine, 30*(3), 210-216.

Linde, J. A., Rothman, A. J., Baldwin, A. S., & Jeffery, R. W. (2006). The impact of self-efficacy on behavior change and weight change among overweight participants in a weight loss trial. *Health Psychology, 25*(3), 282-291.

Lindström, J., Ilanne-Parikka, P., Peltonen, M., Aunola, S., Eriksson, J. G., Hemiö, K., et al. (2006). Sustained reduction in the incidence of type 2 diabetes by lifestyle intervention: follow-up of the Finnish Diabetes Prevention Study. *Lancet, 368*(9548), 1673-1679.

Lindström, J., Neumann, A., Sheppard, K. E., Gilis-Januszewska, A., Greaves, C. J., Handke, U., et al. (2010). Take Action to Prevent Diabetes - The IMAGE Toolkit for the Prevention of Type 2 Diabetes in Europe. *Hormone and Metabolic Research, 42*(S 01), S37,S55.

Lindström, J., Peltonen, M., Eriksson, J. G., Louheranta, A., Fogelholm, M., & Uusitupa, M. (2006). High-fibre, low-fat diet predicts long-term weight loss and decreased type 2 diabetes risk: the Finnish Diabetes Prevention Study. *Diabetologia, 49*(5), 912-920.

Lindström, J., & Tuomilehto, J. (2010). The short history of diabetes prevention through lifestyle intervention. In P. E. H. Schwarz, P. Reddy, C. J. Greaves, J. A. Dunbar & J. Schwarz (Eds.), *Diabetes Prevention in Practice*. Dresden: TUMAINI Institute for Prevention Management.

Lippa, R. (1995). Gender-Related Individual Differences and Psychological Adjustment in Terms of the Big Five and Circumplex Models. *Journal of Personality and Social Psychology, 69*(6), 1184-1202.

Lippke, S., Ziegelmann, J. P., & Schwarzer, R. (2004). Behavioral intentions and action plans promote physical exercise: A longitudinal study with orthopedic rehabilitation patients. *Journal of Sport & Exercise Psychology, 26*(3), 470-483.

Loehlin, J. C., Jönsson, E. G., Gustavsson, J. P., Stallings, M. C., Gillespie, N. A., Wright, M. J., et al. (2005). Psychological masculinity-femininity via the gender diagnosticity approach: heritability and consistency across ages and populations. *Journal of Personality, 73*(5), 1295-1320.

Lott, B. (2002). Cognitive and behavioral distancing from the poor. *American Psychologist, 57*(2), 100-110.

Luszczynska, A. (2006). An implementation intentions intervention, the use of a planning strategy, and physical activity after myocardial infarction. *Social Science and Medicine, 62*(4), 900-908.

Luszczynska, A., Tryburcy, M., & Schwarzer, R. (2006). Improving fruit and vegetable consumption: a self-efficacy intervention compared with a combined self-efficacy and planning intervention. *Health Education Research, 22*(5), 630-638.

Macintyre, S. (1997). The black report and beyond what are the issues? *Social Science and Medicine, 44*(6), 723-745.

MacIntyre, S., & Hunt, K. (1997). Socio-economic Position, Gender and Health: How Do They Interact? *Journal of Health Psychology, 2*(3), 315-334.

Mackenbach, J. P., Kunst, A. E., Cavelaars, A. E. J. M., Groenhof, F., & Geurts, J. J. M. (1997). Socioeconomic inequalities in morbidity and mortality in western Europe. *The Lancet, 349*(9066), 1655-1659.

Maes, S., & Karoly, P. (2005). Self-regulation assessment and Intervention in physical health and Illness: A review. *Applied Psychology: An International Review, 54*(2), 267-299.

Maibach, E., Flora, J. A., & Nass, C. (1991). Changes in Self-Efficacy and Health Behavior in Response to a Minimal Contact Community Health Campaign. *Health Communication, 3*(1), 1.

Majer, J., Jason, L., & Olson, B. (2004). Optimism, Abstinence Self-Efficacy, and Self-Mastery: A Comparative Analysis of Cognitive Resources. *Assessment, 11*, 57-63.

Maranto, C. L., & Stenoien, A. F. (2000). Weight Discrimination: A Multidisciplinary Analysis. *Employee Responsibilities and Rights Journal, 12*(1), 9-24.

Marlatt, G. A., Baer, J. S., & Quigley, L. A. (1995). Self-efficacy and addictive behavior. In A. Bandura (Ed.), *Self-efficacy in changing societies* (pp. 289-315). New York: Cambridge University Press.

Marlatt, G. A., & George, W. H. (1998). Relapse prevention and the maintenance of optimal health. In S. A. Shumaker & E. B. Schron (Eds.), *The handbook of health behavior change* (pp. 33-58). NY, NY: Springer.

Marmot, M. G. (2006). Status Syndrome: A Challenge to Medicine. *JAMA, 295*(11), 1304-1307.

Martikainen, P., Blomgren, J., & Valkonen, T. (2007). Change in the total and independent effects of education and occupational social class on mortality: analyses of all Finnish men and women in the period 1971-2000. *Journal of Epidemiology and Community Health, 61*(6), 499-505.

Matsui, T., & Onglatco, M. L. (1991). Instrumentality, expressiveness, and self-efficacy in career activities among Japanese working women. *Journal of Vocational Behavior, 39*(2), 241-250.

McAdams, D. P., & Pals, J. L. (2006). A new big five: Fundamental principles tor an integrative science of personality. *American Psychologist 61*(3), 204-217.

McArdle, J. J. (2009). Latent variable modeling of differences and changes with longitudinal data. *Annual Review of Psychology, 60*(1), 577-605.

McArdle, J. J., & Nesselroade, J. R. (1994). Using multivariate data to structure developmental change. In S. H. Cohen & H. W. Reese (Eds.), *Life-span developmental psychology: Methodological contributions* (pp. 223-267). Hillsdale, NJ: Lawrence Erlbaum Associates.

Michie, S., & Abraham, C. (2004). Interventions to change health behaviours: Evidence-based or evidence-inspired? *Psychology & Health, 19*(1), 29-49.

Michie, S., Abraham, C., Whittington, C., McAteer, J., & Gupta, S. (2009). Effective Techniques in Healthy Eating and Physical Activity Interventions: A Meta-Regression. *Health Psychology, 28*(6), 690-701.

Michie, S., Ashford, S., Sniehotta, F. F., Dombrowski, S., Bishop, A., & French, D. P. (in press). A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours – The CALO-RE taxonomy. *Psychology & Health*.

Michie, S., Hardeman, W., Fanshawe, T., Prevost, A. T., Taylor, L., & Kinmonth, A. L. (2008). Investigating theoretical explanations for behaviour change: The case study of ProActive. *Psychology & Health, 23*(1), 25 - 39.

Michie, S., Jochelson, K., Markham, W. A., & Bridle, C. (2009). Low-income groups and behaviour change interventions: a review of intervention content, effectiveness and theoretical frameworks. *Journal of Epidemiology and Community Health, 63*(8), 610-622.

Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008). From Theory to Intervention: Mapping Theoretically Derived Behavioural Determinants to Behaviour Change Techniques. *Applied Psychology An International Review, 57*, 660-680.

Michie, S., & Prestwich, A. (2010). Are interventions theory-based? Development of a theory coding scheme. *Health Psychology, 29*(1), 1-8.

Michie, S., Rothman, A. J., & Sheeran, P. (2007). Current issues and new direction in Psychology and Health: Advancing the science of behavior change. *Psychology & Health, 22*(3), 249 - 253.

Milam, J. E., Richardson, J. L., Marks, G., Kemper, C. A., & McCutchan, A. J. (2004). The roles of dispositional optimism and pessimism in HIV disease progression. *Psychology and Health, 19*, 167-181.

Mildestvedt, T., & Meland, E. (2007). Examining the "Matthew Effect" on the motivation and ability to make lifestyle changes in 217 heart rehabilitation patients. *Scandinavian Journal of Public Health, 35*, 140-147.

Mischel, W. (1973). Toward a cognitive social learning reconceptualization of personality. *Psychological Review 80*(4), 252-283.

Mokdad, A. H., Marks, J. S., Stroup, D. F., & Gerberding, J. L. (2004). Actual Causes of Death in the United States, 2000. *JAMA, 291*(10), 1238-1245.

Molloy, G. J., Dixon, D., Hamer, M., & Sniehotta, F. F. (in press). Social support and physical activity: Does planning mediate this link? *British Journal of Health Psychology*.

Mosher, C. E., & Danoff-Burg, S. (2008). Agentic and communal personality traits: Relations to disordered eating behavior, body shape concern, and depressive symptoms. *Eating Behaviors, 9*(4), 497-500.

Motl, R. W., Dishman, R. K., Ward, D. S., Saunders, R. P., Dowda, M., Felton, G., et al. (2005). Comparison of Barriers Self-Efficacy and Perceived Behavioral Control for Explaining Physical Activity Across 1 Year Among Adolescent Girls. *Health Psychology, 24*(1), 106-111.

Mourier, A., Gautier, J. F., De Kerviler, E., Bigard, A. X., Villette, J. M., Garnier, J. P., et al. (1997). Mobilization of visceral adipose tissue related to the improvement in insulin sensitivity in response to physical training in NIDDM. Effects of branched-chain amino acid supplements. *Diabetes Care, 20*(3), 385-391.

Mulder, M., Ranchor, A. V., Sanderman, R., Bouma, J., & van den Heuvel, W. J. A. (1998). The stability of lifestyle behaviour. *International Journal of Epidemiology, 27*(2), 199-207.

Nabi, H., Kivimaki, M., Sabia, S., Dugravot, A., Lajnef, M., Marmot, M. G., et al. (2009). Hostility and Trajectories of Body Mass Index Over 19 Years: The Whitehall II Study. *American Journal of Epidemiology, 169*(3), 347-354.

Nezu, A. M., & Nezu, C. M. (1987). Psychological distress, problem solving, and coping reactions: Sex role differences. *Sex Roles, 16*(3), 205-214.

NICE. (2007). Behaviour change at population, community and individual levels (Public Health Guidance 6) [Electronic Version]. *NICE Public Health Guidance*, from http://www.nice.org.uk/PH006

Oldroyd, J., Burns, C., Lucas, P., Haikerwal, A., & Waters, E. (2008). The effectiveness of nutrition interventions on dietary outcomes by relative social disadvantage: a systematic review. *Journal of Epidemiology and Community Health, 62*(7), 573-579.

Orbell, S., & Verplanken, B. (2010). The automatic component of habit in health behavior: Habit as cue-contingent automaticity. *Health Psychology, 29*(4), 374-383.

Paulweber, B., Valensi, P., Lindström, J., Lalic, N. M., Greaves, C. J., McKee, M., et al. (2010). A European Evidence-Based Guideline for the Prevention of Type 2 Diabetes. *Hormone and Metabolic Research, 42*(S 01), S3-S36.

Peltonen, M., Korpi-Hyövälti, E., Oksa, H., Puolijoki, H., Saltevo, J., Vanhala, M., et al. (2006). Lihavuuden, diabeteksen ja muiden glukoosiaineenvaihdunnan häiriöiden esiintyvyys suomalaisessa aikuisväestössä - Dehkon 2D-hanke [Prevalence of obesity, type 2 diabetes, and other disturbances in glucose metabolism in Finland - The Fin-D2D survey]. *Suomen Lääkärilehti*(3), 163-170.

Peters, L., Kok, G., Ten Dam, G., Buijs, G., & Paulussen, T. (2009). Effective elements of school health promotion across behavioral domains: a systematic review of reviews. *BMC Public Health, 9*(1), 182.

Pingitore, R., Spring, B., & Garfield, D. (1997). Gender differences in body satisfaction. *Obesity Res, 5*(5), 402-409.

Piro, M., Zeldow, P. B., Knight, S. J., Mytko, J. J., & Gradishar, W. J. (2001). The Relationship Between Agentic and Communal Personality Traits and Psychosocial Adjustment to Breast Cancer. *Journal of Clinical Psychology in Medical Settings, 8*(4), 263-271.

Porr, C., Drummond, J., & Richter, S. (2006). Health literacy as an empowerment tool for low-income mothers. *Fam Community Health, 29*(4), 328-335.

Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion, 12*, 38 - 48.

Puhl, R. M., & Heuer, C. A. (2010). Obesity Stigma: Important Considerations for Public Health. *American Journal of Public Health, 100*(6), 1019-1028.

Racette, S. B., Evans, E. M., Weiss, E. P., Hagberg, J. M., & Holloszy, J. O. (2006). Abdominal adiposity is a stronger predictor of insulin resistance than fitness among 50-95 year olds. *Diabetes Care, 29*(3), 673-678.

Raphael, D. (2006). Social determinants of health: present status, unanswered questions, and future directions. *International Journal of Health Services, 36*(4), 651-677.

Rasmussen, H. N., Wrosch, C., Scheier, M. F., & Carver, C. S. (2006). Self-Regulation Processes and Health: The Importance of Optimism and Goal Adjustment. *Journal of Personality, 74*(6), 1721-1748.

Raykov, T. (1999). Are Simple Change Scores Obsolete? An Approach to Studying Correlates and Predictors of Change. *Applied Psychological Measurement, 23*(2), 120-126.

Reevy, G. M., & Maslach, C. (2001). Use of social support: gender and personality differences. *Sex Roles, 44*(7/8), 437-459.

Renner, B., Hankonen, N., Ghisletta, P., & Absetz, P. (2010). Psychological and Behavioral Changes in the Adoption and Maintenance of Physical Exercise. *submitted*.

Renner, B., Kwon, S., Yang, B.-H., Paik, K.-C., Kim, S. H., Roh, S., et al. (2008). Social-cognitive predictors of dietary behaviors in South Korean men and women. *International Journal of Behavioral Medicine, 15*(1), 4-13.

Renner, B., Spivak, Y., Kwon, S., & Schwarzer, R. (2007). Does age make a difference? Predicting physical activity of South Koreans. *Psychology and Aging, 22*(3), 482-493.

Resnicow, K., & Vaughan, R. (2006). A chaotic view of behavior change: a quantum leap for health promotion. *International Journal of Behavioral Nutrition and Physical Activity, 3*(1), 25.

Rhodes, R. E., & Pfaeffli, L. (2010). Mediators of physical activity behaviour change among adult non-clinical populations: a review update. *International Journal of Behavioral Nutrition and Physical Activity, 7*(1), 37.

Rhodes, R. E., & Plotnikoff, R. C. (2005). Can current physical activity act as a reasonable proxy measure of future physical activity? Evaluating cross-sectional and passive prospective designs with the use of social cognition models. *Preventive Medicine, 40*(5), 547-555.

Rhodes, R. E., & Smith, N. E. I. (2006). Personality correlates of physical activity: a review and meta-analysis. *British Journal of Sports Medicine, 40*(12), 958-965.

Robbins, A. S., Spence, J. T., & Clark, H. (1991). Psychological Determinants of Health and Performance: The Tangled Web of Desirable and Undesirable Characteristics. *Journal of Personality and Social Psychology, 61*(5), 755-765.

Robinson-Whelen, S., Kim, C., MacCallum, R. C., & Kiecolt-Glaser, J. K. (1997). Distinguishing optimism from pessimism in older adults: Is it more important to be optimistic or not to be pessimistic? *Journal of Personality and Social Psychology, 73*(6), 1345-1353.

Ross, C. E., & Wu, C.-l. (1995). The links between education and health. *American Sociological Review, 60*(5), 719-745.

Ross, R., Dagnone, D., Jones, P. J. H., Smith, H., Paddags, A., Hudson, R., et al. (2000). Reduction in Obesity and Related Comorbid Conditions after Diet-Induced Weight Loss or Exercise-Induced Weight Loss in Men. *Annals of Internal Medicine, 133*(2), 92-103.

Rothman, A. J. (2004). "Is there nothing more practical than a good theory?": Why innovations and advances in health behavior change will arise if interventions are used to test and refine theory. *International Journal of Behavioral Nutrition and Physical Activity, 1*(11).

Rothman, A. J., & Salovey, P. (2007). The reciprocal relation between principles and practice: Social psychology and health behavior. In A. Kruglanski & E. T. Higgins (Eds.), *Social psychology: Handbook of basic principles* (2nd ed., pp. 826-849). New York, NY: Guilford Press.

Roumen, C., Blaak, E. E., & Corpeleijn, E. (2009). Lifestyle intervention for prevention of diabetes: determinants of success for future implementation. *Nutrition Reviews, 67*(3), 132-146.

Ryan, R. M., & Deci, E. L. (2000). Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being. *American Psychologist, 55*(1), 68-78.

Ryan, R. M., Frederick, C. M., Lepes, D., Rubio, N., & Sheldon, K. M. (1997). Intrinsic motivation and exercise adherence. *International Journal of Sport Psychology, 28*(4), 335-354.

Räikkönen, K., & Matthews, K. A. (2008). Do Dispositional Pessimism and Optimism Predict Ambulatory Blood Pressure During Schooldays and Nights in Adolescents? *Journal of Personality, 76*(3), 605-630.

Sallis, J. F., Calfas, K., Alcaraz, J., Gehrman, C., & Johnson, M. (1999). Potential mediators of change in a physical activity promotion course for university students: Project grad. *Annals of Behavioral Medicine, 21*(2), 149-158.

Sallis, J. F., Grossman, R. M., Pinski, R. B., Patterson, T. L., & Nader, P. R. (1987). The development of scales to measure social support for diet and exercise behaviors. *Preventive Medicine, 16*(6), 825-836.

Sallis, J. F., Hovell, M. F., & Hofstetter, R. C. (1992). Predictors of adoption and maintenance of vigorous physical activity in men and women. *Preventive Medicine, 21*(2), 237-251.

Sallis, J. F., & Saelens, B. (2000). Assessment of physical activity by self-report: status, limitations, and future directions. *Research Quarterly for Exercise and Sport, 71*(2 Suppl), 1-14.

Sallis, J. F., Strikmiller, P. K., Harsha, D. W., Feldman, H. A., Ehlinger, S., Stone, E. J., et al. (1996). Validation of interviewer- and self-administered physical activity checklists for fifth grade students. *Medicine and science in sports and exercise, 28*(7), 840-851.

Sanfilipo, M. P. (1994). Masculinity, femininity, and subjective experiences of depression. *Journal of Clinical Psychology, 50*(2), 144-157.

Sarlio-Lahteenkorva, S., Rissanen, A., & Kaprio, J. (2000). A descriptive study of weight loss maintenance: 6 and 15 year follow-up of initially overweight adults. *International-Journal-of-Obesity, 24*(1), 116-125.

Sarlio-Lahteenkorva, S., Silventoinen, K., & Lahelma, E. (2004). Relative Weight and Income at Different Levels of Socioeconomic Status. *American Journal of Public Health, 94*(3), 468-472.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7*(2), 147-177.

Scheier, M. F., & Carver, C. S. (1985). Optimism, coping, and health: assessment and implications of generalized outcome expectancies. *Health Psychology, 4*(3), 219-247.

Scheier, M. F., & Carver, C. S. (2003). Self-regulatory Processes and Responses to Health Threats: Effects of Optimism on Well-being. In J. Suls & K. Wallston (Eds.), *Social Psychological Foundations of Health and Illness*. Malden, MA: Blackwell Publishing.

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing Optimism from Neuroticism (and Trait Anxiety, Self-Mastery, and Self-Esteem) - a Reevaluation of the Life Orientation Test. *Journal of Personality and Social Psychology, 67*(6), 1063-1078.

Schnoll, R., & Zimmerman, B. J. (2001). Self-regulation training enhances dietary self-efficacy and dietary fiber consumption. *Journal of the American Dietetic Association, 101*(9), 1006-1011.

Scholz, U., Nagy, G., Göhner, W., Luszczynska, A., & Kliegel, M. (2009). Changes in self-regulatory cognitions as predictors of changes in smoking and nutrition behaviour. *Psychology & Health*(1), 1 - 17.

Schroder, K. E. E., & Schwarzer, R. (2005). Habitual self-control and the management of health behavior among heart patients. *Social Science and Medicine, 60*(4), 859-875.

Schwarzer, R. (2008a). Modeling Health Behavior Change: How to Predict and Modify the Adoption and Maintenance of Health Behaviors. *Applied Psychology, 57*(1), 1-29.

Schwarzer, R. (2008b). Some Burning Issues in Research on Health Behavior Change. *Applied Psychology, 57*(1), 84-93.

Schwarzer, R., & Fuchs, R. (1996). Self-efficacy and Health Behaviours. In M. Conner & P. Norman (Eds.), *Predicting Health Behaviour* (pp. 163-196). Buckingham: Open University Press.

Schwarzer, R., & Knoll, N. (2010). Social support. In D. P. French, K. Vedhara, A. A. Kaptein & J. Weinman (Eds.), *Health Psychology* (2. ed.). Oxford: BPS Blackwell.

Schwarzer, R., & Luszczynska, A. (2007). Self-efficacy. In M. Gerrard & K. D. McCaul (Eds.), *Health behavior constructs: Theory, measurement, and research*: National Cancer Institute Website. <http://dccps.cancer.gov/brp/constructs/self-efficacy/index.html>.

Schwarzer, R., & Renner, B. (2000). Social-cognitive predictors of health behavior: action self-efficacy and coping self-efficacy. *Health Psychology, 19*(5), 487-495.

Schwarzer, R., Schüz, B., Ziegelmann, J. P., Lippke, S., Luszczynska, A., & Scholz, U. (2007). Adoption and maintenance of four health behaviors: theory-guided longitudinal studies on dental flossing, seat belt use, dietary behavior, and physical activity. *Annals of Behavioral Medicine, 33*(2), 156-166.

Segar, M., Spruijt-Metz, D., & Nolen-Hoeksema, S. (2006). Go Figure? Body-Shape Motives are Associated with Decreased Physical Activity Participation Among Midlife Women. *Sex Roles, 54*(3), 175-187.

Segerstrom, S. C., & Solberg Nes, L. (2006). When goals conflict but people prosper: The case of dispositional optimism. *Journal of Research in Personality, 40*(675-693).

Shaw, K., Gennat, H., O'Rourke, P., & Del Mar, C. (2006). Exercise for overweight or obesity. *Cochrane Database of Systematic Reviews*(4).

Sheeran, P., & Abraham, C. (2003). Mediator of moderators: Temporal stability of intention and the intention-behavior relation. *Personality and Social Psychology Bulletin, 29*, 205-215.

Shepperd, J. A., Maroto, J. J., & Pbert, L. A. (1996). Dispositional optimism as a predictor of health changes among cardiac patients. *Journal of Research in Personality, 30*(4), 517-534.

Shnek, Z. M., Irvine, J., Stewart, D., & Abbey, S. (2001). Psychological factors and depressive symptoms in ischemic heart disease. *Health Psychology, 20*(2), 141-145.

Singh-Manoux, A., Gueguen, A., Ferrie, J., Shipley, M., Martikainen, P., Bonenfant, S., et al. (2008). Gender Differences in the Association Between Morbidity and Mortality Among Middle-Aged Men and Women. *American Journal of Public Health, 98*(12), 2251-2257.

Skår, S., Sniehotta, F. F., Araújo-Soares, V., & Molloy, G. J. (2008). Prediction of Behaviour vs. Prediction of Behaviour change: The Role of Motivational Moderators in the Theory of Planned Behaviour. *Applied Psychology: An International Review., 57*(4), 609-627.

Smith, L. (2005). Psychotherapy, Classism, and the Poor: Conspicuous by Their Absence. *American Psychologist, 60*(7), 687-696.

Snibbe, A. C., & Markus, H. R. (2005). You Can't Always Get What You Want: Educational Attainment, Agency, and Choice. *Journal of Personality and Social Psychology, 88*(4), 703-720.

Sniehotta, F. F. (2009). Towards a theory of intentional behaviour change: Plans, planning, and self-regulation. *British Journal of Health Psychology, 14*(2), 261-273.

Sniehotta, F. F., & Aunger, R. (2010). Stage models of behaviour change. In D. P. French, K. Vedhara, A. A. Kaptein & J. Weinman (Eds.), *Health Psychology* (2. ed.). Oxford: BPS Blackwell.

Sniehotta, F. F., Nagy, G., Scholz, U., & Schwarzer, R. (2006). The role of action control in implementing intentions during the first weeks of behaviour change. *British Journal of Social Psychology, 45*(1), 87-106.

Sniehotta, F. F., Scholz, U., & Schwarzer, R. (2005). Bridging the intention-behaviour gap: Planning, self-efficacy, and action control in the adoption and maintenance of physical exercise. *Psychology & Health, 20*, 143-160.

Sniehotta, F. F., Schwarzer, R., Scholz, U., & Schüz, B. (2005). Action planning and coping planning for long-term lifestyle change: theory and assessment. *European Journal of Social Psychology, 35*(4), 565-576.

Solberg Nes, L., & Segerstrom, S. C. (2006). Dispositional optimism and coping: A meta-analytic review. *Personality and Social Psychology Review, 10*, 235-251.

Spence, J. T., & Buckner, C. E. (2000). Instrumental and expressive traits, trait stereotypes, and sexist attitudes. *Psychology of Women Quarterly, 24*(1), 44.

Spence, J. T., & Helmreich, R. L. (1978). *Masculinity and femininity: Their psychological dimensions, correlates and antecedents*. Austin: University of Texas Press.

Spence, J. T., Helmreich, R. L., & Stapp, J. (1973). The Personal Attributes Questionnaire: A Measure of sex-role stereotypes and masculinity-femininity. *JSAS Catalog of Selected Documents in Psychology, 4*, 43-44.

Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). Stereotype Threat and Women's Math Performance. *Journal of Experimental Social Psychology, 35*(1), 4-28.

Steptoe, A., Gardner, B., & Wardle, J. (2010). The role of behaviour in health. In D. P. French, K. Vedhara, A. A. Kaptein & J. Weinman (Eds.), *Health Psychology* (2 ed.). Oxford: BPS Blackwell.

Steptoe, A., Wright, C., Kunz-Ebrecht, S. R., & Iliffe, S. (2006). Dispositional optimism and health behaviour in community-dwelling older people: Associations with healthy ageing. *British Journal of Health Psychology, 11*(Pt 1), 71-84.

Stewart, S. T., Cutler, D. M., & Rosen, A. B. (2009). Forecasting the Effects of Obesity and Smoking on U.S. Life Expectancy. *New England Journal of Medicine, 361*(23), 2252-2260.

Strack, S., Carver, C. S., & Blaney, P. H. (1987). Predicting successful completion of an aftercare program following treatment for alcoholism: The role of dispositional optimism. *Journal of Personality and Social Psychology, 53*(3), 579-584.

Suls, J., Luger, T., & Martin, R. (2010). The biopsychosocial model and the use of theory in health psychology. In J. Suls, K. W. Davidson & R. M. Kaplan (Eds.), *Handbook of Health Psychology and Behavioral Medicine*.

Sutton, S. (2001). Health behavior: Psychosocial theories. In N. J. Smelser & P. B. Baltes (Eds.), *International Encyclopedia of the Social &Behavioral Sciences* (pp. 6499-6506). Oxford: Pergamon.

Sutton, S. (2004). Determinants of health-related behaviours: Theoretical and methodological issues. In S. Sutton, A. Baum & M. Johnston (Eds.), *The SAGE Handbook of Health Psychology*. London: SAGE.

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72*, 271-322.

Taylor, M. C., & Hall, J. A. (1982). Psychological androgyny: Theories, methods, and conclusions. *Psychological Bulletin 92*(2), 347-366.

Taylor, S., Kemeny, M., Aspinwall, L., Schneider, S., Rodriguez, R., & Herbert, M. (1992). Optimism, coping, psychological distress, and high-risk sexual behavior among men at risk for acquired immunodeficiency syndrome (AIDS). *Journal of Personality and Social Psychology 63*, 460-473.

Taylor, S. E., & Seeman, T. E. (1999). Psychosocial resources and the SES-health relationship. In N. E. Adler, M. Marmot, B. S. McEwen & J. Stewart (Eds.), *Socioeconomic status and health in industrial*

nations: Social, psychological, and biological pathways. (pp. 210-225). New York: New York Academy of Sciences.

Teixeira, P. J., Silva, M. N., Coutinho, S. R., Palmeira, A. L., Mata, J., Vieira, P. N., et al. (2010). Mediators of Weight Loss and Weight Loss Maintenance in Middle-aged Women. *Obesity, 18*(4), 725-735.

The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. (2003). Follow-up Report on the Diagnosis of Diabetes Mellitus. *Diabetes Care, 26*(11), 3160-3167.

Thøgersen-Ntoumani, C., & Ntoumanis, N. (2006). The role of self-determined motivation in the understanding of exercise-related behaviours, cognitions and physical self-evaluations. *Journal of Sports Sciences, 24*(4), 393 - 404.

Timothy, W. S., & Paula, G. W. (1992). Personality and Health: Advantages and Limitations of the Five-Factor Model. *Journal of Personality, 60*(2), 395-425.

Troiano, R. P. (2009). Can there be a single best measure of reported physical activity? *The American Journal of Clinical Nutrition, 89*(3), 736-737.

Trudeau, K. J., Danoff-Burg, S., Revenson, T. A., & Paget, S. A. (2003). Agency and Communion in People with Rheumatoid Arthritis. *Sex Roles, 49*(7), 303-311.

Tuomilehto, J., Lindstrom, J., Eriksson, J. G., Valle, T. T., Hamalainen, H., Ilanne-Parikka, P., et al. (2001). Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *New England Journal of Medicine, 344*(18), 1343-1350.

Uchino, B. N. (2009). Understanding the Links Between Social Support and Physical Health: A Lifespan Perspective With Emphasis on the Separability of Perceived and Received Support. *Perspectives on Psychological Science, 4*, 236-255.

Uutela, A., Hankonen, N., & Absetz, P. (2009). *Can women maintain elevated level of physical activity long term and is it related to their level of education? 36 month results from the Finnish GOAL Trial.* Paper presented at the Conference of Society of Behavioral Medicine.

Uutela, A., Valve, R., Talja, M., Absetz, P., Nissinen, A., & Fogelholm, M. (2004). Health psychological theory in promoting population health in Päijät-Häme, Finland: first steps toward a type 2 diabetes prevention study. *Journal of Health Psychology, 9*(1), 73-84.

Wadden, T. A., Brownell, K. D., & Foster, G. D. (2002). Obesity: Responding to the global epidemic. *Journal of Consulting and Clinical Psychology, 70*(3), 510-525.

Wadden, T. A., & Stunkard, A. J. (1985). Social and Psychological Consequences of Obesity. *Annals of Internal Medicine, 103*(6 Part 2), 1062-1067.

Waldrop, D., Lightsey, O., Ethington, C., Woemmel, C., & Coke, A. (2001). Self-efficacy, optimism, health competence, and recovery from orthopedic surgery. *Journal of Counseling Psychology, 48*, 233-238.

Vallis, T. M., & Bucher, B. (1986). Self-efficacy as a predictor of behavior change: Interaction with type of training for pain tolerance. *Cognitive Therapy and Research, 10*(1), 79-94.

van den Bree, M. B. M., Przybeck, T. R., & Robert Cloninger, C. (2006). Diet and personality: Associations in a population-based sample. *Appetite, 46*(2), 177-188.

Van Gundy, K., Schieman, S., Kelley, M. S., & Rebellon, C. J. (2005). Gender role orientations and alcohol use among Moscow and Toronto adults. *Social Science and Medicine, 61*(11), 2317-2330.

Warburton, D. E. R., Nicol, C. W., & Bredin, S. S. D. (2006). Health benefits of physical activity: the evidence. *CMAJ, 174*(6), 801-809.

Ward, L. C., Thorn, B. E., Clements, K. L., Dixon, K. E., & Sanford, S. D. (2006). Measurement of Agency, Communion, and Emotional Vulnerability With the Personal Attributes Questionnaire. *Journal of Personality Assessment, 86*(2), 206-216.

Wardle, J., & Steptoe, A. (2003). Socioeconomic differences in attitudes and beliefs about healthy lifestyles. *Journal of Epidemiology and Community Health, 57*(6), 440-443.

Webb, L. T., Joseph, J., Yardley, L., & Michie, S. (2010). Using the Internet to Promote Health Behavior Change: A Systematic Review and Meta-analysis of the Impact of Theoretical Basis, Use of Behavior Change Techniques, and Mode of Delivery on Efficacy. *Journal of Medical Internet Research, 12*(1), e4.

Wee, H.-L., Cheung, Y.-B., Li, S.-C., Fong, K.-Y., & Thumboo, J. (2005). The impact of diabetes mellitus and other chronic medical conditions on health-related Quality of Life: Is the whole greater than the sum of its parts? *Health and Quality of Life Outcomes, 3*(1), 2.

Weinstein, N. D. (2007). Misleading tests of health behavior theories. *Annals of Behavioral Medicine, 33*(1), 1-10.

Weinstein, N. D., Rothman, A. J., & Sutton, S. R. (1998). Stage theories of health behavior: conceptual and methodological issues. *Health Psychol, 17*(3), 290-299.

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

Verplanken, B., & Faes, S. (1999). Good intentions, bad habits, and effects of forming implementation intentions on healthy eating. *European Journal of Social Psychology, 29*(5-6), 591-604.

Whitley, B. E. J. (1983). Sex role orientation and self-esteem: a critical meta-analytic review. *Journal of Personality and Social Psychology 44*(4), 765-778.

Victora, C. G., Vaughan, J. P., Barros, F. C., Silva, A. C., & Tomasi, E. (2000). Explaining trends in inequities: evidence from Brazilian child health studies. *The Lancet, 356*(9235), 1093-1098.

Wiedemann, A. U., Richert, J., & Koring, M. (2010). Action plans: Effects of experimentally manipulated number of plans and plan recall. *Psychology & Health, 25*, 98-99.

Wiers, R. W., Houben, K., Roefs, A., Jong, P. d., Hofmann, W., & Stacy, A. W. (2010). Implicit Cognition in Health Psychology. Why Common Sense Goes Out the Window. In B. Gawronski & B. K. Payne (Eds.), *Handbook of Implicit Social Cognition: Measurement, Theory, and Applications*: The Guilford Press.

Wiggins, J. S. (1991). Agency and communion as conceptual coordinates for the understanding and measurement of interpersonal behavior. In D. Cicchetti & W. M. Grove (Eds.), *Thinking Clearly about Psychology*: University of Minnesota Press.

Wikström, K., Peltonen, M., Eriksson, J. G., Aunola, S., Ilanne-Parikka, P., Keinänen-Kiukaanniemi, S., et al. (2009). Educational attainment and effectiveness of lifestyle intervention in the Finnish Diabetes Prevention Study. *Diabetes Research and Clinical Practice, 86*(1), e1-e5.

Wilcox, S., & Ainsworth, B. E. (2009). The measurement of physical activity. In S. A. Shumaker, J. K. Ockene & K. A. Riekert (Eds.), *The handbook of health behavior change*. New York: Springer Publishing Company, LLC.

Williams, D., & Dunsiger, S. (2007). Suggestions for testing health behavior theories: Implications for mediator analysis. *Annals of Behavioral Medicine, 34*(2), 223-223.

Williams, P. G., Smith, T. W., & Cribbet, M. R. (2008). Personality and health: Current evidence, potential mechanisms, and future directions. In G. J. Boyle, G. Matthews & D. H. Saklofske (Eds.), *The SAGE Handbook of Personality Theory and Assessment* (pp. 635-658). London: SAGE Publications Ltd.

Wilson, P. M., Blanchard, C. M., Nehl, E., & Baker, F. (2006). Predicting physical activity and outcome expectations in cancer survivors: an application of Self-Determination Theory. *Psycho-Oncology, 15*(7), 567-578.

Wing, R. R., & Jeffery, R. W. (1999). Benefits of recruiting participants with friends and increasing social support for weight loss and maintenance. *Journal of Consulting and Clinical Psychology, 67*(1), 132-138.

Winkleby, M. A., Fortmann, S. P., & Barrett, D. C. (1990). Social class disparities in risk factors for disease: Eight-year prevalence patterns by level of education. *Preventive Medicine, 19*(1), 1-12.

Wolfe, B. L., & Smith, J. E. (2002). Different strokes for different folks: why overweight men do not seek weight loss treatment. *Eating Disorders: The Journal of Treatment & Prevention, 10*(2), 115 - 124.

Wu, A. D., & Zumbo, B. D. (2008). Understanding and Using Mediators and Moderators. *Social Indicators Research: An International Interdisciplinary Journal for Quality of Life Measurement, 87*, 367-392.

Yoshida, S., Hankonen, N., & Absetz, P. (2006). Facilitators' self-fulfillment predicts successful weight change in life-style counseling program. *International Journal of Behavioral Medicine, 13*, 292.